

Paper Reference	Last Name	First Name	Speakers Paper Title	Speakers Theme Description	Session Description
FP001	Renfree	Kevin	Closed Treatment of Metacarpal and Proximal Palanx Fractures with a 'Cobra' Cast	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP002	Grigorescu	Dan Ovidiu	The Versatility of the K-Wire Osteosynthesis in the Metacarpal and Phalanx Fractures	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP003	Salazard	Bruno	A New Technique for Treatment of Phalangeal Neck Fractures in Children.	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP004	Lee	Young Ho	Modification of the Extension Block Kirschner Wire Technique for Mallet Finger Fractures: Two Extension Block Pins Method	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP005	Khalid	Mohamed	Where and When Does Length Matter? Regional Variations in Pull-out Strength of Uni-cortical VS Bi-cortical Screws in Proximal Phalanges - A Cadaveric Study	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP006	Jhamb	Alok	Sometimes Screwing Just Isn't Enough - Biomechanics of Plates and Screws in Metacarpal Fractures	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP007	Omokawa	Shohei	Low Profile Titanium Plate Fixation for the Treatment of Unstable Periarticular Finger Fractures	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP008	Langer	Martin	New Plate for Intra-Operative Correction of Malrotation of Metacarpals and Proximal Phalanges	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP009	Varitimidis	Sokratis	Fractures of Metacarpals: Evaluation of Results after Treatment with ORIF or a Mini External Fixator	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP010	Segmüller	Helen E.	Nonsurgical Treatment of Mallet Finger Fractures Involving More Than One Third of the Joint Surface: Results and Literature Review	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP011	Crowley	Bríd	Paediatric Mallet Injuries – A Three Year Review	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP012	Giddins	Grey Edward Bence	Closed Corrective Osteotomies for Phalangeal Malalignment	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 1 - Phalangeal and Metacarpal Fractures 1
FP013	Hussey	Alan	Long Term Outcome of the Wrap-Around Flap in Thumb Reconstruction	Surgery - Free Tissue Transfer	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP014	Dowd	Michael	The Segmueller Neurovascular Island Flap in Fingertip Injuries	Surgery - Soft Tissue Cover	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP015	Murata	Keiichi	Reconstruction of Finger and Thumb Pulp Using Hemipulp Flap	Surgery - Free Tissue Transfer	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP016	Chung	Duke Whan	Procedure for Failed Replantation of the Thumb	Surgery - Soft Tissue Cover	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP017	Senda	Hiroya	Reconstruction of Fingertip with Reverse Dorsal Digital Island Flap	Surgery - Soft Tissue Cover	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP018	O'Boyle	Ciaran	Tendency For Development of Valgus Deviation of the Second Toe Metatarsophalangeal Joint: A Possible Cause of Instability of the Reconstructed Thumb after Free Toe-To-Thumb Transfer?	Surgery - Free Tissue Transfer	Free Paper Session 2 - Microsurgery: Thumb Reconstruction

FP019	Fang	Yousheng	Compound Flap from Great Toe and Vascularized Joint of Second Toe for Post-traumatic Thumb Reconstruction at the Level of Proximal Metacarpal Bone	Surgery - Mutilating Hand Injuries	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP020	Kubitskiy	Alexander	Microsurgical Reconstruction of the Thumb After Complete or Partial Loss	Surgery - Free Tissue Transfer	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP021	Barbary	Stephane	Toe to Hand Transplantation in Traumatic Thumb Reconstruction: A Review of 98 Cases	Surgery - Free Tissue Transfer	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP022	Méndez	Manuel	Thumb Reconstruction with Toe Transfer Technique	Surgery - Free Tissue Transfer	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP023	Garofano	Alberto	Post-Traumatic Bone Lengthening of the Thumb	Surgery - Mutilating Hand Injuries	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP024	Solomons	Michael	Osseo-Integrated Finger Prostheses	Surgery - Mutilating Hand Injuries	Free Paper Session 2 - Microsurgery: Thumb Reconstruction
FP025	Massoumi	Mas G.	Interposition Arthroplasty of the D.I.P. Joint of the Fingers and I.P. Joint of the Thumbs	Surgery - Degenerative Joint Disease	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP026	Merle	Michel	Use of Heterodox Headless Cannulated Compressive Screw for Distal Interphalangeal Joint Arthrodesis in Digits: Clinical Evaluation of 24 Cases.	Surgery - Degenerative Joint Disease	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP027	Mathoulin	Christophe	"DIGITAL" Finger Joints Implants for PIP and MCP Reconstruction : Preliminary Report about 25 cases	Surgery - Degenerative Joint Disease	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP028	Mathoulin	Christophe	Pyrocarbon Interposition Implant for Treatment of Scapho Trapezio Trapezoid (STT) Arthritis with Arthroscopic Assistance	Surgery - Degenerative Joint Disease	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP029	Roux	Jean-Luc	Four Corner Arthrodesis- The Advantages of Radiopaque Circular Plate Fixation	Surgery - Fractures Of The Radius	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP030	Biraima	Angelo	Carpal Arthrodesis With The Limited Wrist Fusion Plate (Hub Cap)	Surgery - Degenerative Joint Disease	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP031	Olandersson	Sofia	Ultrasonograph Assessment and Force Measurement of M. Extensor Digitorum Communis in Rheumatoid Arthritis (RA) and Healthy Controls	Surgery - Rheumatoid Hand	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP032	Arimitsu	Sayuri	Kinematics of the Midcarpal Joint in Rheumatoid Wrists: A Three-Dimensional Motion Analysis	Surgery - Rheumatoid Hand	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP033	Lo	Che-Yuen	Osteochondral Grafting Of The Metacarpophalangeal Joint in Rheumatoid Arthritis	Surgery - Rheumatoid Hand	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP034	Bogoch	Earl	NeuFlex and Swanson Metacarpophalangeal Implants for Rheumatoid Arthritis: A Prospective Controlled Clinical Trial	Surgery - Rheumatoid Hand	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP035	Cooney	William	Total Wrist Replacement. A Resurfacing Arthroplasty	Surgery - Rheumatoid Hand	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP036	Sollerman	Christer	One-Year Results From an Ongoing Multi-Center Study of the Avanta Total Wrist-Implant	Surgery - Rheumatoid Hand	Free Paper Session 3 - Degenerative Joint Disease/ Rheumatoid Arthritis
FP037	Sakano	Hiroaki	Non-Bridging External Fixation for Unstable Fractures of the Distal Radius	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1

FP038	Tobe	Masahiro	Minimally Invasive Plate Osteosynthesis for Distal Radius Fractures	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP039	Jakubietz	Michael G.	Is Bone Augmentation Required for Fractures of the Distal Radius? Results of a Prospective, Randomized Clinical Study to Evaluate the Benefits of Bone Augmentation of the Dorsal Comminution Zone in High Grade Distal Intraarticular Radius Fractures	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP040	Kopylov	Philippe	Two Kinds of Fast and Slowly Resorbable and Injectable Bone Substitutes used in Osteotomies for Malunion of the Distal Radius	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP041	Ross	Mark	Variable Angle Locked Volar Plating in Distal Radius Fractures	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP042	Wheen	Douglas	Assembling the Jigsaw: Osteo-Plastic Fixation of the Distal Radius	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP043	Ruggiero	Gustavo Mantovani	The Volar Approach for Fractures of the Distal Radius: 100 Patients Analysis	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP044	Anand	Sambandam	Closed Reduction and Open Fixation of Distal Radius Fracture. An Innovative Method using Chinese Finger Trap Traction	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP045	Beumer	Annechien	Early Prognostic Factors for a Bad Outcome in Non-osteoporotic Distal Radius Fractures	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP046	Evers	Bernd	Plate Removal After Forearm Fracture Repair: To Do or Not to Do?	Surgery - Fractures Of The Radius	Free Paper Session 4 - Distal Radial Fractures 1
FP047	Nachemson	Ann, Kerstin	Children With Surgically Corrected Hand Deformities and Upper Limb Deficiencies: Self-concept and Psychological Well-being	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP048	Furniss	Dominic	The Characterisation of Causative Mutations in an Unselected Cohort of 203 Patients with Congenital Limb Malformations Requiring Reconstructive Surgery	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP049	Molenaar	Ties	Normative Grip Strength Data on JAMAR Dynamometer in Young Children	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP050	Decramer	Arne	Normal Thumb Length in Children	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP051	Zuidam	Michiel	The Length of the First Metacarpal in the Treatment of Triphalangeal Thumb	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP052	Smith	Paul	Index Finger Pollicisation: Factors Affecting Outcome	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP053	Schmidt	Manfred	Long Term Results After Surgical Correction Of Radius Dysplasia	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP054	Pajardi	Giorgio Eugenio	Hand and Wrist Treatment of Arthrogryptic Patient	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP055	Yoshida	Kiyoshi	Bone Growth of the Ulna after Lengthening in Radial Club Hands	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP056	Shibata	Minoru	Iliac Bone with Apophysis Grafting to Donor Site of Toe Phalanx Transfer to Short Digits with Defective Phalanx of the Hand	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP057	Cooney	William	Duplication of the Thumb. Review of Ten Years Experience and Surgical Approach of Combination of Parts	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP058	Aydin	H. Utkan	Reconstruction Algorithm for Congenital Hand Contractures	Surgery - Congenital	Free Paper Session 5 - Congenital 1
FP059	Gschwind	Claudia	FCR Tendonitis and Radial Sided Wrist Pain	Surgery - Other Wrist Conditions	Free Paper Session 6 - Basal Thumb Joint OA 1
FP060	Stahl	Shalom	Osteoarthritis Of Trapeziometacarpal (TM) Joint	Surgery - Thumb Basal Joint OA	Free Paper Session 6 - Basal Thumb Joint OA 1
FP061	Paul	Pereira	Osteoarthritis of the Carpometacarpal Joint of the Thumb: Simple Total Trapeziectomy Arthroscopically Assisted	Surgery - Thumb Basal Joint OA	Free Paper Session 6 - Basal Thumb Joint OA 1
FP062	Renfree	Kevin	Clinical Results of the Thompson Abductor Pollicis Longus Suspensionplasty	Surgery - Thumb Basal Joint OA	Free Paper Session 6 - Basal Thumb Joint OA 1

FP063	Sakai	Naotaka	Interposition Arthroplasty Using Trapezium Tendon Ball for Osteoarthritis of the Carpometacarpal Joint of the Thumb	Surgery - Thumb Basal Joint OA	Free Paper Session 6 - Basal Thumb Joint OA 1
FP064	Sturzenegger	Michael	The Painful TMC-joint Of The Thumb Treated By A Modified Brunelli - APL Capsuloplasty	Surgery - Thumb Basal Joint OA	Free Paper Session 6 - Basal Thumb Joint OA 1
FP065	Dubert	Thierry	Use of the Entire Flexor Carpi Radialis Tendon for Basal Thumb Ligament Reconstruction Interposition Arthroplasty	Surgery - Degenerative Joint Disease	Free Paper Session 6 - Basal Thumb Joint OA 1
FP066	Naidu	Sanjiv	Full Thickness FCR Harvest for LRTI Alters Wrist Kinetics	Surgery - Thumb Basal Joint OA	Free Paper Session 6 - Basal Thumb Joint OA 1
FP067	Panunzi	Andrea	Key-Points About Trapezectomy and Suspensionplasty for Thumb Basal Joint Arthrosis After Twenty-Years Experience and Four Hundred Patients Operated	Surgery - Thumb Basal Joint OA	Free Paper Session 6 - Basal Thumb Joint OA 1
FP068	Regnard	Pierre-Jean	ELEKTRA Prosthesis to Treat Painful Osteoarthritis of CMC Joint of the Thumb. 290 Cases	Surgery - Degenerative Joint Disease	Free Paper Session 6 - Basal Thumb Joint OA 1
FP069	Jupiter	Jesse	Multiple Isolated Neurofibromas of the Hand and Upper Extremity	Surgery - Tumours	Free Paper Session 7 - Tumours
FP070	Sawada	Tomokazu	The Relationship Between Pre-Operative Clinical Findings, Operative Findings and Postoperative Neurological Complications in Schwannomas	Surgery - Tumours	Free Paper Session 7 - Tumours
FP071	Langer	Martin	Surgical Treatment of Ollier's Disease of the Hand in Children	Surgery - Tumours	Free Paper Session 7 - Tumours
FP072	Salazard	Bruno	Hand and Wrist Giant Melanocytic Nevi in Children.	Surgery - Tumours	Free Paper Session 7 - Tumours
FP073	Crowley	Bríd	Ganglion Cysts of the Hand and Wrist in a Paediatric Population	Surgery - Tumours	Free Paper Session 7 - Tumours
FP074	Yajima	Hiroshi	Treatment of Interosseous Ganglion and Bone Cyst of the Carpal Bone with Injectable Calcium Phosphate Bone Cement	Surgery - Tumours	Free Paper Session 7 - Tumours
FP075	Kaleli	Tufan	Tumours of the Finger	Surgery - Tumours	Free Paper Session 7 - Tumours
FP076	Kitagawa	Yasuyuki	Lipoma of the Finger with Large Bone Erosion	Surgery - Tumours	Free Paper Session 7 - Tumours
FP077	Cohen-Kashi	Kambiz Jacob	A Unique Surgical Approach for Mucous Cyst Resection – Curvilinear Incision from the Eponychial Fold to the Distal Interphalangeal Joint	Surgery - Tumours	Free Paper Session 7 - Tumours
FP078	Kim	Jin Young	Multiple Hereditary Osteochondromatosis Causing Limitation of the Forearm Rotation	Surgery - Dupuytren's	Free Paper Session 7 - Tumours
FP079	Mohd Kasim	Kamil	Replantation Service in a Malaysian Public Hospital	Surgery - Replantation	Free Paper Session 8 - Microsurgery: Replantation
FP080	Yam	Andrew	Single Finger Distal Amputation - Replant or Terminalize?: Comparison of Costs and Functional Outcome	Surgery - Replantation	Free Paper Session 8 - Microsurgery: Replantation
FP081	Haugstvedt	Jan-Ragnar	Bone Growth After Replantation of Fingers in Children	Surgery - Replantation	Free Paper Session 8 - Microsurgery: Replantation
FP082	Berger	Alfred Karl	Long-term Results After Upper Major Limb Replantation	Surgery - Replantation	Free Paper Session 8 - Microsurgery: Replantation
FP083	Tos	Pierluigi	Long Term Results After Major Upper Limb Replantation : Critical Analysis of 38 Cases	Surgery - Replantation	Free Paper Session 8 - Microsurgery: Replantation
FP084	Eo	SuRak	Successful Composite Graft Using Ice-Cooling and PGE1 injection in Fingertip Amputation	Surgery - Soft Tissue Cover	Free Paper Session 8 - Microsurgery: Replantation
FP085	Narushima	Mitsunaga	Intravascular Stenting Ivaa Method for Safe and Accurate Replantation	Surgery - Replantation	Free Paper Session 8 - Microsurgery: Replantation
FP086	Jaeger	Marcos R.O.	Preservation of Muscle Bulk: A New Model to Assess Heterotopically Transplanted Muscle	Surgery - Free Tissue Transfer	Free Paper Session 8 - Microsurgery: Replantation
FP087	Sabapathy	Raja	Functional Outcome of Emergency Proximal Row Carpectomy(PRC) in Replantation and Revascularisation at the Level of the Wrist	Surgery - Replantation	Free Paper Session 8 - Microsurgery: Replantation

FP088	Love	Robert	A Case of Triple Macroplattation: Out of the Media Spotlight to 2 Years Postoperative. Was It a Success?	Surgery - Replantation	Free Paper Session 8 - Microsurgery: Replantation
FP089	Pereira	Eduardo	Ulnar Side Wrist Pain on Tennis Player: Diagnostic and Treatment	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP090	Beard	Anthony	Magic Angle Effect Can Help Decipher the Mystery of ECU Tendon Pathology and Ulnocarpal Wrist Pain	Surgery - Other Wrist Conditions	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP091	Cameiro	Ronaldo	Pain in the Ulnar Side of the Wrist Caused by Erosion of the Floor of the 6th Dorsal Compartment	Surgery - Other Wrist Conditions	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP092	Golubev	Igor	Stability and Congruity of DRUJ as a Key to it: Injury Type Classification	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP093	Maki	Yutaka	Reconstruction for Voluntary Palmar Dislocation of the Distal Radioulnar Joint: A New Surgical Technique	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP094	Manikowski	Wladyslaw	Arthroscopic Treatment of TFCC Lesions	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP095	Nakamura	Toshiyasu	Reconstruction of the TFCC Using ECU Half Slip and Interference Screw - A New Technique	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP096	Lluch	Alex	Brachialis Tenotomy for the Treatment of Ulna Stump Instability After Sauvè-Kapandji Procedure	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP097	Giannoulis	Filippos	Failed Darrach Procedure: An Allograft Solution	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP098	Nygaard	Marianne	Ulnar Shortening - A Biomechanical Evaluation of the Fractional Load Changes in the Wrist Joints	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP099	Kopylov	Philippe	A New Concept in the Treatment of Distal Radio-Ulnar Joint (DRUJ) with an Implant that Respects the Ulna Head and the Length of the Ulna	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP100	Cooney	William	Prosthetic Replacement of the Distal Ulna. Experience in 35 Patients with 2 Year Followup	Surgery - Distal Radioulnar Joint	Free Paper Session 9 - Distal Radio-Ulnar Joint
FP101	Singh	Bijayendra	Natural History of Carpal Tunnel Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP102	Southgate	Jeremy	Carpal Tunnel Syndrome In The Elderly:Long Term Follow Up After Surgical Decompression.	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP103	Yoshida	Aya	Relationship Between Age and Postoperative Recovery of Abductor Pollicis Brevis Muscle Strength in Carpal Tunnel Syndrome Patients	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP104	Watts	Adam	Are There Gender Differences In Outcome Following Open Carpal Tunnel Decompression?	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP105	Seo	Jae Sung	Surgical Treatment of Carpal Tunnel Syndrome using the Knifelight - Compared with Open Carpal Tunnel Release	Surgery - Chronic Regional Pain Syndrome	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP106	Hinzpeter	Daniel	Bilateral Carpal Tunnel, Simultaneous Release	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP107	Jenkins	Nelson	Endoscopic Carpal Tunnel Release in Post Traumatic Compressive Neuropathies of the Median Nerve	Surgery - Fractures Of The Radius	Free Paper Session 10 - Nerve Compression: Median Nerve 1

FP108	Lluch	Alberto	Flexor Retinaculum Reconstruction After CTS Release. Long Term Review Of 248 Cases	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP109	Field	Jeremy	A Double Blind Randomised Controlled Study Comparing The Infiltration Of Warm -v- Refrigerated Local Anaesthetic (1% Lidocaine With Adrenaline 1:200,000) Prior To Open Carpal Tunnel Release	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP110	Anderson	George A.	Patterns of Hand use Activities as Risk Factors for Carpal Tunnel Syndrome in Indian Patients	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP111	Neumann	Axel	Long Term Results Following Endoscopic Carpal Tunnel Release (ECTR) in Agee Technique	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP112	Berntsson	Lilian	For Fast Return of Grip Strength After Open Carpal Tunnel Release Minimize the Days of Sick Leave	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 10 - Nerve Compression: Median Nerve 1
FP113	Braga Silva	Jefferson	A Prospective Randomized Study Comparing Homodigital Island Flaps and the Reversed Flow Homodigital Flap on Reconstruction of the Finger Pulp	Surgery - Soft Tissue Cover	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP114	Gahankari	Dilip	New Classification Of Neuro-Vascular Island Flaps For Digital Reconstruction: New Technique Of Neuro-Vascular Island Flaps For Dorsal Finger Defects Is Presented.	Surgery - Soft Tissue Cover	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP115	Gahankari	Dilip	Neuro-Vascular Island Flaps for Digital Reconstruction	Surgery - Soft Tissue Cover	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP116	Lee	Young Ho	Innervated Reverse Digital Artery Island Flap for a Large Pulp Defect by Bilateral Neuroorrhaphy using the Direct Small Branches of the Digital Nerve	Surgery - Soft Tissue Cover	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP117	Orhun	Emre	Square Thenar Flap for Digital Tip Injuries	Surgery - Soft Tissue Cover	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP118	Saffar	Philippe	Vascularized Skin-Bone Island Flap for Treatment of Claw-Nail Deformity	Surgery - Soft Tissue Cover	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP119	Kuroshima	Nagatsugu	Half Big Toe-Nail Flaps with a Pedicle of Sub-millimetre Vessels	Surgery - Free Tissue Transfer	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP120	Lee	Dong Chul	Finger Tip Coverage With Partial Medial Second Toe Pulp Free Flap With a Short Pedicle	Surgery - Free Tissue Transfer	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP121	Kong	Byeong Seon	Arterialized Venous Free Flap Using the Thenar Region for the Reconstruction of Pulp Defects of the Fingers	Surgery - Free Tissue Transfer	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP122	Kong	Byeong Seon	The First Web Space Free Flap of the Foot to Reconstruct the Pulp of the Fingers	Surgery - Free Tissue Transfer	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP123	Somia	Naveen	Simultaneous Venous and Soft Tissue Reconstruction in Ring Avulsion Injuries using the Venous Island Conduit Flap	Surgery - Soft Tissue Cover	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP124	Chung	Duke Whan	Joint Reconstruction with Free Vascularized Osteochondral Transplantation	Surgery - Free Tissue Transfer	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP125	Rider	Mark	An Evolution in Flexor Tendon Repair	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1
FP126	Chong	Alphonsus	Mesenchymal Stem Cells Increases Tendon Healing Rate after Primary Repair in Rabbits	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1

FP127	Kim	Jong B	An ex vivo biomechanical study to determine the optimal tendon bite length to achieve maximum tensile strength following flexor tendon repair	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1
FP128	Walbeehm	Erik	Two Times Two is Not Always Four in Flexor Tendon Surgery	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1
FP129	Buendia	Luis Antonio	A Comparative Biomechanical Study of Traction Resistance Among Hand Tendon Suturing Techniques	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1
FP130	Mass	Daniel	Temporal Augmentation of Flexor Tendon Healing Mediated by BMP13 in a Rabbit Model	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1
FP131	Tarallo	Luigi	Spiral CT with 3D Volume Rendering of Flexor Tendons of the Hand: Technique, Normal Anatomy and Tendons Ruptures	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1
FP132	Lalonde	Don	The Wide Awake Approach to Flexor Tendon Repair	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1
FP133	Stavrev	Vladimir	Clinical Results After Two-staged Reconstruction of the Flexor Tendons	Surgery - Tendon Injury / Repair	Free Paper Session 12 - Flexor Tendon Injury: Research & Repair 1
FP134	Jorgsholm	Peter	Incidence of Scaphoid Fractures in Malmö; Comparison Between the 1950's, 1990's and 2000's	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP135	Jorgsholm	Peter	MRI in Suspected Scaphoid Fractures Reveals Many Other Carpal Fractures and CT Scan is Inferior to MRI in the Diagnosis of Suspected Scaphoid Fracture	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP136	Adachi	Keisuke	A New Technique for Imaging Longitudinal Computed Tomography of the Scaphoid	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP137	Makino	Masaharu	Persistent Nonunion of the Scaphoid after Failed Bone Graft - Salvaged by the Vascularised Second Metacarpal Base Bone Graft	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP138	Jarrett	Paul	A Biomechanical Comparison in Human Cadavers Between Scaphoid Fracture Fixation and Grafting with Iliac Bone Versus Distal Radial Bone	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP139	Braga Silva	Jefferson	Prospective Randomized Study Comparing Vascularized Distal Radial Bone Graft and Iliac Crest Bone Graft In Scaphoid Nonunion	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP140	Latendresse	Kim	Successful Treatment Of Complicated Nonunions Of The Scaphoid With A Vascularized Bone Graft: Surgery for Proximal Pole Nonunions And Revision After Failed Initial Surgery.	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP141	Lanzetta	Marco	Scaphocapitate Arthrodesis in the Treatment of Scaphoid Nonunion with Proximal Pole Avascular Necrosis	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP142	Choudry	Qaisar	Adaptive Proximal Scaphoid Implant (APSI) – A Case Series	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 13 - Scaphoid 1
FP143	Shin	Robert	Prospective Randomized Trial of Injection of Dexamethasone Versus Triamcinolone for Idiopathic Trigger Finger	Surgery - Tendon Injury / Repair	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger Digits
FP144	Schwarz	Martin	Learning Percutaneous Trigger Finger Release	Surgery - Tendon Injury / Repair	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger Digits
FP145	Lee	Young-Keun	Ten trigger fingers in an adult man	Surgery - Tendon Injury / Repair	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger Digits
FP146	Orozim	Zdenko	Is Percutaneous Trigger Thumb Release Really Dangerous?	Surgery - Tendon Injury / Repair	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger

					Digits
FP147	Monsivais	Jose	Psychological Profile of a Group of Chronic Limb Pain Patients in a Hand Surgery Clinic	Surgery - Chronic Regional Pain Syndrome	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger Digits
FP148	Monsivais	Jose	An Alternate Nociceptive Drive: The Role of Afferent-Efferent Proprioceptive System in the Maintenance of Chronic Pain States	Surgery - Chronic Regional Pain Syndrome	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger Digits
FP149	Zyluk	Andrzej	Treatment of an Early Complex Regional Pain Syndrome Type 1: A Longitudinal Study of the Effectiveness of "Szczecin" Protocol	Surgery - Chronic Regional Pain Syndrome	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger Digits
FP150	Takahara	Masatoshi	Various Disorders Similar To Complex Regional Pain Syndrome (CRPS) Type I	Surgery - Chronic Regional Pain Syndrome	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger Digits
FP151	Chen	Desong	Cervical Nerve Root Compression - One Cause for Intractable Lateral Elbow Pain	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 14 - Complex Regional Pain Syndrome/ Trigger Digits
FP152	Nanchahal	Jagdeep	Normal Dermal Fibroblasts Modulate Dupuytren's Cord Cells	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1
FP153	Owers	Kate	Oxidative Stress, AT Protein and Dupuytren's	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1
FP154	Smarrelli	Davide	Identification of a Marker of Clinical Activity in Dupuytren's Disease: Role of Smooth Alpha Actin.	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1
FP155	Georgescu	Alexandru	Indications and Limits of Dupuytren Disease Percutaneous Needle Treatment	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1
FP156	Badalamente	Marie	Long-term Efficacy of Injectable Mixed Collagenase for Dupuytren's Contracture: Recurrence Rates Within 2 Years in Phase 3 Clinical Trials	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1
FP157	Dias	Joseph	Does Dermofasciectomy Prevent Recurrent Contracture after Dupuytren's Contracture Surgery: A Prospective Randomised Trial	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1
FP158	Dubert	Thierry	Ulnar Reversed Island Flap as a Salvage Procedure in Severe Dupuytren's Contracture: About Three Cases	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1
FP159	Gozzard	Charles	Does Post-Operative Hand Elevation Reduce Hand Swelling?	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1
FP160	Langer	Martin	112 Cases of Ledderhose's Disease	Surgery - Dupuytren's	Free Paper Session 15 - Dupuytren's Disease 1

Paper Reference	Last Name	First Name	Speakers Paper Title	Speakers Theme Description	Session Description
FP161	Husain	Sajid Husain	Decompression of Ulnar and Median Nerve in Leprosy Can Prevent the Occurrence Of the Deformities-A Retrospective Study of 400 Hundred Cases	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP162	Jeon	In-Ho	Simple Decompression of the Ulnar Nerve in the Cubital Tunnel Syndrome with Minimal Skin Incision.	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP163	Baek	Goo Hyun	Radiological Analysis of the Cubital Tunnel	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP164	Fukumoto	Keizo	Cubital Tunnel Syndrome in Young Generation	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP165	Hoffmann	Reimer	Multifocal Compression of the Ulnar Nerve in Cubital Tunnel Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP166	Hoffmann	Reimer	Endoscopic Management of Cubital Tunnel Syndrome – Long Term Results	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP167	Thornton	Daniel	10 Year Experience of Subcutaneous Anterior Transposition of the Ulnar Nerve for Cubital Tunnel Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP168	Saito	Hidehiko	Transposition of the FCU Humeral Head to Secure Anterior Translocation of the Ulnar Nerve for Cubital Tunnel Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP169	Boico	Morel	Combined Snapping of Ulnar Nerve and Medial Head of Triceps Muscle	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 16 - Nerve Compression: Ulnar Nerve
FP170	Morita	Kozo	Indication of Non-bridging External Fixation for Distal Radius Fractures: A Review of Delayed Union Fractures	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP171	Kapandji	Adalbert	A New External Non-Bridging Fixator Mini-Radius	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP172	Casaletto	John	Distal Radius Fracture Osteosynthesis – Volar or Dorsal?	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP173	Krimmer	Hermann	Multidirectional Fixed-Angle Plate Fixation of Unstable Distal Radial Fractures Based on a New Locking Principle	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP174	Carneiro	Ronaldo	Severe Distal Radius Fractures in the Elderly Treated with Low Profile Dorsal Plates and Bone Allografts	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP175	Dubert	Thierry	Dorsal Fixed-Angle Plate Fixation of Distal Radius Fractures in Extension : About 26 Cases	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP176	Mudgal	Chaitanya	Combined Fractures of the Distal Radius and Scaphoid	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP177	Hinzpeter	Daniel	Distal Radius Osteotomy with Tricalcium Phosphate Ceramic Bone Graft Substitute	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP178	Beumer	Annechien	A Biomechanical Comparison of Two Plating Techniques for Distal Radius Fractures	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2

FP179	Tarallo	Luigi	The Treatment of Articular Fractures of the Distal Radius Using LCP Plate	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP180	Sirin	Evrin	Midterm Results of Patients with Distal Radius Intraarticular Fractures Treated with Volar Locking Plates	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP181	Page	Richard	Complex Unstable Distal Radial Fracture Management with Locking Plates and Injectable Bone Graft	Surgery - Fractures Of The Radius	Free Paper Session 17 - Distal Radial Fractures 2
FP182	Engin	Murat Sinan	The T-Approximator: A New Design to Avoid Pressure-Related Endothelial Damage in Microsurgical Procedures	Surgery - Free Tissue Transfer	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP183	Cho	Alvaro	Impact of Fibrin Adhesive Application in Microvascular Anastomosis: A Comparative Experimental Study	Surgery - Free Tissue Transfer	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP184	Dowd	Michael	The Effects of L-arginine on Intimal Hyperplasia and Patency in Cold-Stored Rabbit Arterial Allografts	Surgery - Free Tissue Transfer	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP185	Jakubietz	Rafael G.	Aging and the Ideal Aesthetic of the Hand. Results of a Study to Evaluate Aging of the Male and Female Hand in the Caucasian Population	Surgery - Soft Tissue Cover	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP186	Zhang	Cheng-Gang	Anatomical Study and Clinical Application of Anatomic Snuffbox Flap	Surgery - Free Tissue Transfer	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP187	Behan	Felix	The Keystone Flap in Hand Surgery	Surgery - Soft Tissue Cover	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP188	Balakrishnan	Govindasamy	Newer Flaps and Indications in Upper Limb Burn Scar Contractures	Surgery - Soft Tissue Cover	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP189	Abela	Christopher	Architectural Scrutiny of Dorsal Cutaneous Flap Design in the Hand and Digits	Surgery - Soft Tissue Cover	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP190	Adani	Roberto	Dorsal Hand Reconstruction: An Algorithm of Treatment	Surgery - Soft Tissue Cover	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP191	Lloyd	Mark Sheldon	Immediate Reconstruction of Large Composite Dorsal Finger Defects Using the Reverse Extended Cross Finger Flap (RECF)	Surgery - Soft Tissue Cover	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP192	Fontaine	Christian	Anatomical Bases of the 2nd Toe Composite Dorsal Flap for Simultaneous Cutaneous and Tendinous Reconstruction of the Dorsal Aspect of the Fingers	Surgery - Mutilating Hand Injuries	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP193	Hiemer	Robert	Results after Degloving Injury of the Hand	Surgery - Mutilating Hand Injuries	Free Paper Session 18 - Microsurgery: Flaps in the Hand and Upper Limb 1
FP194	Langer	Martin	History of Tendon Suture Techniques	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP195	Tang	Jin Bo	Certain Tension During Tendon Suturing Favors Gap Resistance of the Repairs	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP196	Cao	Yi	Biomechanical Analysis of Four-Strand Suture Methods with Three Different Configurations for Tendon Repair	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP197	Cao	Yi	Remarkable Decreases in the Strength of Repaired Tendons Gliding Over A2 Pulley: A Biomechanical Study in a Chicken Model	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2

FP198	Wong	Jason	Three Dimensional Models for the Investigation of Flexor Tendon Healing and Repair in the Mouse	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP199	Wong	Jason	The Longterm Fate of the Suture Induced Acellular Zones in Tendon Repair	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP200	Stewart	David	Flexion of the Digits by the Vincula Breve	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP201	Hanson	Richard	A Mechanical Study of Different Suture Materials used in Flexor Tendon Repairs; In Relation to the Type of Knot used and Number of Throws	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP202	Sullivan	Paul	Inverting Epitendonous Suture Repair	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP203	Nietosvaara	Aarno Y	Active Mobilization Programme After Flexor Tendon Repair In Children	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP204	Mattar Junior	Rames	Comparative Clinical Study Between Conventional Flexor Tenolysis in Zone II and Tenolysis With Intra-Operative Wake-Up Technique	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP205	Belmahi	Amin	The Protection of the Flexor Tendon Graft in Zone 2 with a Cleft Silicone Tube: Results at 4 years about 16 cases	Surgery - Tendon Injury / Repair	Free Paper Session 19 - Flexor Tendon Injury: Research and Repair 2
FP206	Hagert	Elisabet	Immunohistochemical Analysis of Wrist Ligament Innervation and Structural Composition Reveal Differences in Sensory and Biomechanical Wrist Functions	Surgery - Other Wrist Conditions	Free Paper Session 20 - Wrist Instability
FP207	McLean	James	Influence of Lunate Type on Scaphoid Kinematics	Surgery - Other Wrist Conditions	Free Paper Session 20 - Wrist Instability
FP208	Werner	Frederick	The Role of the Dorsal Radiocarpal and Dorsal Intercarpal Ligaments in Stabilizing the Scaphoid and Lunate	Surgery - Carpal Instability	Free Paper Session 20 - Wrist Instability
FP209	Couzens	Greg	Ultrasound in the Assessment of Dynamic Scaphoid Instability	Surgery - Carpal Instability	Free Paper Session 20 - Wrist Instability
FP210	Pilny	Jaroslav	Results of Treatment of the Dynamic Scapholunate Carpal Instability	Surgery - Carpal Instability	Free Paper Session 20 - Wrist Instability
FP211	Trail	Ian Alexander	Results of Tri-Ligament Tenodesis: A Modified Brunelli Procedure in the Management of Scapholunate Instability	Surgery - Carpal Instability	Free Paper Session 20 - Wrist Instability
FP212	Putnam	Matthew	Reconstruction of scapholunate instability	Surgery - Degenerative Joint Disease	Free Paper Session 20 - Wrist Instability
FP213	Werner	Frederick	Wrist Instability is Controlled by Wrist Geometry	Surgery - Carpal Instability	Free Paper Session 20 - Wrist Instability
FP214	Allieu	Yves	Adaptative Carpal Malalignments and Pyrocarbon Intracarpal Implants	Surgery - Carpal Instability	Free Paper Session 20 - Wrist Instability
FP215	Hara	Yuinori	Cervical Lateral Tilting in Brachial Plexus Injury	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 21 - Brachial Plexus 1
FP216	TAJIRI	Yasuhito	Intercostal Nerves Transfer to Restore Elbow Flexion in C5,6 or C5-7 Brachial Plexus Injury	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 21 - Brachial Plexus 1
FP217	Jaeger	Marcos R.O.	End-to-Side Versus End-to-End Ulnar Nerve Transfer In Upper Trunk Brachial Plexus Lesions	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 21 - Brachial Plexus 1
FP218	Zhao	Xin	Selective Neurotisation of the Deltoid for Treatment of Brachial Plexus Palsy--An Anatomic Study and Case Reports	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 21 - Brachial Plexus 1
FP219	Okazaki	Masato	Outcome Of Axillary Nerve Injuries Treated With Nerve Grafts	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 21 - Brachial Plexus 1
FP220	Wongtrakul	Saichol	End-to-Side Neuroorrhaphy to Restore Shoulder Flexion in C5-7 Root Injuries: A Preliminary Report	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 21 - Brachial Plexus 1

FP221	Lao	Jie	Long-Term Outcome Of Contralateral C7 Nerve Transfer	Surgery - Degenerative Joint Disease	Free Paper Session 21 - Brachial Plexus 1
FP222	Bengtson	Keith	Brachial Plexus Reconstruction Outcome Measures	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 21 - Brachial Plexus 1
FP223	Wong	Eugene	What is the Role of Shoulder Fusion in Complete Brachial Plexus Injuries?	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 21 - Brachial Plexus 1
FP224	Fairbank	Sian	Surgical Management of Kimer's Deformity: Review and Case Series	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP225	Abe	Muneaki	Mobilisation of Congenital Radioulnar Synostosis with Interposition of Pedicled Local Fat Graft	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP226	Jeong	Jae-Hoon	Complications of Distraction Lengthening in the Hand	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP227	Romanowski	Leszek	Lengthening in Upper Extremity Congenital Deformities	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP228	Smith	Paul	Management of Apert's Acrosyndactyly	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP229	Pajardi	Giorgio Eugenio	Management of Epidermolysis Bullosa	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP230	Fatemi	Mohammad Javad	Microsurgical Dissection of Neurovascular Structure and Transverse Segmental Resection in the Treatment of Macroductyly	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP231	Baek	Goo Hyun	Natural History of the Congenital Trigger Thumb	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP232	Thomsen	Niels	Correction of Madelung's Deformity with Callus Distraction Technique Using a New Multiplanar External Fixator.)	Surgery - Congenital	Free Paper Session 22 - Congenital 2
FP233	Thomsen	Niels	Vibrotactile Sense and Hand Symptoms in Men with Long-term Type 2 Diabetes, Impaired and Normal Glucose Tolerance	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General
FP234	Boland	Robert	Riche-Cannieu Anastomosis In A Family	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General
FP235	Ryhänen	Jorma	The Diagnostic Utility of a New Handheld Nerve Conduction Device in Carpal Tunnel Syndrome: A Multicenter Study	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General
FP236	Kanatani	Takako	The Usefulness of Distal Motor Latency Measurement After Palmar Stimulation of the Median Nerve for Assessment of Severe Carpal Tunnel Syndrome with Absence of Motor Response	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General
FP237	Weigel	Gerlinde	Thoracic Outlet Syndrome: Objective Criteria to Indicate Surgery	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General
FP238	Gray	Anne	Suprascapular Neuropathy. Management and Outcome of 25 Surgical Suprascapular Entrapments.	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General
FP239	Chen	Desong	Anatomical Study and Clinical Observation of Thoracic Outlet Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General
FP240	Omura	Takao	Hourglass-Like Constrictions of the Anterior Interosseous Nerve	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General
FP241	Rossello	Mario Igor	Carpal Tunnel and Cubital Tunnel in HNPP: Diagnosis and Treatment Strategy	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 23 - Nerve Compression: General

FP242	De Mourgues	Philippe	Stem Fixation of the MOPYC Radial Head Prosthesis	Surgery - Degenerative Joint Disease	Free Paper Session 24 - Elbow Injury and Disease
FP243	Giannoulis	Filippos	Single Incision Repair with Suture Anchors for Treatment of Distal Biceps Tendon Rupture: A 59 Cases Follow Up	Surgery - Tendon Injury / Repair	Free Paper Session 24 - Elbow Injury and Disease
FP244	Chang	MoonJong	Surgical Treatment of Post-traumatic Flexion Limitation of the Elbow	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 24 - Elbow Injury and Disease
FP245	Girsch	Werner	Elbow Reconstruction Using Dynamic External Fixation	Surgery - Congenital	Free Paper Session 24 - Elbow Injury and Disease
FP246	Kim	Byung Sung	Hinged Elbow Fixation for Instability Following Complex Elbow Injuries	Surgery - Fractures Of The Radius	Free Paper Session 24 - Elbow Injury and Disease
FP247	Rhyou	In Hyeok	Early Stabilization With Collateral Ligament Repair In Dislocation Of The Elbow Joint May Acquire Valgus Stability And Improve Functional Results	Surgery - Other Wrist Conditions	Free Paper Session 24 - Elbow Injury and Disease
FP248	Jeon	In-Ho	Early Operative Stabilization and Mobilization for Unstable Elbow Dislocations	Surgery - Other Wrist Conditions	Free Paper Session 24 - Elbow Injury and Disease
FP249	Jeon	In-Ho	Osteoarthritis of the Elbow with Ulnar Neuropathy; Outerbridge-Kashiwagi Procedure through Posteromedial Approach	Surgery - Degenerative Joint Disease	Free Paper Session 24 - Elbow Injury and Disease
FP250	Van Hoonacker	Petrus M M D J	Revision Total Elbow Arthroplasty: Preliminary Results	Surgery - Degenerative Joint Disease	Free Paper Session 24 - Elbow Injury and Disease
FP251	Li	Zong-Ming	Regulation of PIP Joint Stiffness by Intrinsic Muscles via MCP Joint position	Therapy - Splinting The PIP Joint	Free Paper Session 25 - The PIP Joint
FP252	Somia	Naveen	The Importance of the Volar Recess in PIP Joint Stiffness - An Anatomical and Clinical Study with a 7 Year Follow Up	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 25 - The PIP Joint
FP253	Garofano	Alberto	The Treatment of Post-Traumatic Flexion Stiffness of the Long Fingers with a New External Fixation System	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 25 - The PIP Joint
FP254	Shimada	Kozo	Two-Stage Reconstruction of Finger Extension for Chronic Flexion Deformity of the Finger	Surgery - Tendon Injury / Repair	Free Paper Session 25 - The PIP Joint
FP255	FitzPatrick	Jennifer	Management of the Central Extensor Tendon in the Surgical Approach for Exposure of the Proximal Interphalangeal Joint: A Biomechanical Study	Surgery - Tendon Injury / Repair	Free Paper Session 25 - The PIP Joint
FP256	Choi	Soo Joong	Treatment of Severe Post-traumatic Extension Contracture of the Metacarpophalangeal Joints of the Hand by Arthrolysis	Surgery - Degenerative Joint Disease	Free Paper Session 25 - The PIP Joint
FP257	Glasgow	Celeste	Which Splint? Dynamic versus Static Progressive Mobilizing Splinting	Therapy - Splinting The PIP Joint	Free Paper Session 25 - The PIP Joint
FP258	Nancoo	Tamara	Severe Dupuytren's Contracture Treated By A Two Stage Technique: A Pilot Study	Surgery - Dupuytren's	Free Paper Session 25 - The PIP Joint
FP259	Rose	Robyn-Lee	The Use of CMMS (Casting Motion to Mobilise Stiffness) to Regain Digital Flexion Following Dupuytren's Fasciectomy	Surgery - Dupuytren's	Free Paper Session 25 - The PIP Joint
FP260	Schultz-Johnson	Karen Sarah	Prioritizing Extension Following Injury About the PIP Joint	Therapy - Splinting The PIP Joint	Free Paper Session 25 - The PIP Joint
FP261	Curtis	Christine	Validity of the Active Movement Scale: An Evaluative Tool for Infants With Obstetrical Brachial Plexus Palsy	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP262	Curtis	Christine	The Development Of A Multimedia Teaching Aid For The Active Movement Scale: An Evaluative Tool For Infants And Children With Obstetrical Brachial Plexus Palsy	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP263	Hosseinian	Mohammad Ali	Evaluated Limb Shortening In Obstetrical Brachial Plexus Palsy	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP264	Bahm	Jörg	Value of Neuropathological Examination in Brachial Plexus Surgery	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy

FP265	Clarke	Howard	Final Results of Grafting versus Neurolysis in Obstetrical Brachial Plexus Palsy	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP266	Vijayasekaran	Vijith	Long Term Results of Patients with Obstetric Brachial Plexus Palsy Undergoing Primary Brachial Plexus Reconstruction at or Later than 12 Months of Age. A Retrospective Review	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP267	Bahm	Jörg	Rationale and Technique for Suprascapular Nerve Neurotisation in Severe Obstetric Brachial Plexus Palsy	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP268	Gousheh	Jamal	What Can Be Performed for the Treatment of Old, Permanent Brachial Plexus Palsy.	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP269	Hierner	Robert	Further Experience With The Use Of Botulinum Toxin Type A In the Treatment Of Obstetrical Brachial Plexus Lesions	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP270	Johnstone	Bruce	Botulinum Toxin A in Obstetric Brachial Plexus Palsy	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 26 - Brachial Plexus Birth Palsy
FP271	Walbeehm	Erik	Influence of Core Suture Geometry on Tendon Deformation and Gap Formation in Porcine Flexor Tendons	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP272	Cao	Yi	Differences in Resistance to Motion of the Repaired Flexor Tendons at Different Parts of Digital Flexion	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP273	Cao	Yi	Changes in Resistance to Tendon Motion after Commencement of Digital Mobilization at Different Days	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP274	Ikegami	Hiroyasu	Ruptures of the Flexor Tendon in Athletes	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP275	Dowd	Michael	Results of Immediate Re-repair of Flexor Tendon Repairs in Zones 1 and 2 Which Have Ruptured	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP276	Brunelli	Giorgio	One-Stage Flexor Tendon Reconstruction Using Brunelli Active Tendon Implant: Results At 5 Years	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP277	Gong	Hyun Sik	The Effect of Muscle Length and Excursion on Myostatic Contracture. A Study in Rabbit Soleus Muscles	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP278	Tuzuner	Serdar	Effects of Botulinum Toxin Type-A Injection on Tendon Surgery: Biomechanical Test Results in Rabbits	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP279	Zolotov	Alexander	The Treatment of the Chronic "Mallet Finger"	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP280	Ecker	Jeffrey Oscar	Primary Extensor Grafting in the Region of the Metacarpophalangeal Joints (zone 5)	Surgery - Tendon Injury / Repair	Free Paper Session 27 - Tendon Injury: Research and Repair
FP281	Breden	Frédéric	Intermediate Results of Synthetic Anchovy Interposition using PLA after Total-Trapeziectomy in the Treatment of Basal Osteoarthritis of the Thumb	Surgery - Thumb Basal Joint OA	Free Paper Session 28 - Basal Thumb Joint OA 2
FP282	Carneiro	Ronaldo	Base of the Thumb Arthroplasty with Suspension: A Double Blind Prospective Comparison of Two Techniques	Surgery - Thumb Basal Joint OA	Free Paper Session 28 - Basal Thumb Joint OA 2
FP283	Lluch	Alberto	Early Postoperative Mobilization of Trapezium Silicone Implants	Surgery - Thumb Basal Joint OA	Free Paper Session 28 - Basal Thumb Joint OA 2
FP284	Wallwork	Nicholas	Review Following OrthosphereTN Spheric Interpositional Arthroplasty for the Treatment of Thumb Basal Joint Arthritis	Surgery - Degenerative Joint Disease	Free Paper Session 28 - Basal Thumb Joint OA 2
FP285	Allieu	Yves	Resurfacing Prostheses for Trapeziometacarpal Osteoarthritis: Preliminary Results	Surgery - Thumb Basal Joint OA	Free Paper Session 28 - Basal Thumb Joint OA 2
FP286	Naidu	Sanjiv	Finite Element Analysis and Clinical Outcome of Titanium Basal Joint Hemiarthroplasty	Surgery - Degenerative Joint Disease	Free Paper Session 28 - Basal Thumb Joint OA 2
FP287	Page	Richard	Anatomic Pyrocarbon Metacarpal Hemiarthroplasty in Thumb CMC Osteoarthritis	Surgery - Thumb Basal Joint OA	Free Paper Session 28 - Basal Thumb Joint OA 2

FP288	Stockmans	Filip	Treatment of Symptomatic CMC Instability by Combined Closing Wedge Extension Osteotomy of Metacarpal I and Opening Wedge Osteotomy of the Trapezium Using the Metacarpal Wedge	Surgery - Thumb Basal Joint OA	Free Paper Session 28 - Basal Thumb Joint OA 2
FP289	Norman	Della Rosa	Comparison of Bioreplaceable Joint Prosthesis with Trapeziectomy and AbLP Arthroplasty in the Treatment of the Osteoarthritis at the CMCj Level. A Randomised Parallel Groups Study in Adult Subjects.	Surgery - Thumb Basal Joint OA	Free Paper Session 28 - Basal Thumb Joint OA 2
FP290	Edmunds	Ian	The Surgical Management of Basal Thumb Arthritis: A Cochrane Systematic Review	Surgery - Thumb Basal Joint OA	Free Paper Session 28 - Basal Thumb Joint OA 2
FP291	Della Rosa	Norman	Update on Assessment of Spasticity at the Upper Limb	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP292	VanHeest	Ann	Motion Lab Analysis of the Upper Extremity in Spastic Hemiplegia Due to Cerebral Palsy	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP293	Pajardi	Giorgio Eugenio	Therapeutic Approach to Upper Limb Spasticity in Different Age Groups	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP294	Johnstone	Bruce	Botulinum Toxin A in the Upper Limb in Cerebral Palsy	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP295	Kreulen	Mick	Manual Dexterity and Movement Patterns of the Upper Limb in Cerebral Palsy Before and After Corrective Surgery: A Prospective Clinical Outcome Study	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP296	Sakellarides	Harilaos	Treatment of the Cerebral Palsy Hand	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP297	Hjorth Jensen	Claus	Upper Extremity Surgery in Cerebral Palsy	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP298	Saeed	Waseem	Upper Limb Spasticity Surgery and the Wrist. A Review of Results In Leeds UK	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP299	Van Loon	Jan	Extensor Pollicis Longus Rerouting for Thumb-in-Palm Deformity in Cerebral Palsy	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP300	Ozkan	Turker	Brachioradialis Re-Routing Supinatorplasty for the Surgical Correction of Forearm Pronation in Cerebral Palsy	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 29 - Spasticity
FP301	Ferreres	Angel	Vascular Anatomy of the 4th dorsal interosseous Space: Multidetector-Row Computed Tomography Finding and Anatomic Correlation	Surgery - Soft Tissue Cover	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP302	Ferreres	Angel	Vascular Anatomy Of The 4th Dorsal Interosseous Space: Anatomical Dissection.	Surgery - Soft Tissue Cover	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP303	Georgescu	Alexandru	Metacarpal Flaps without Sacrificing the Dorsal Metacarpal Artery	Surgery - Soft Tissue Cover	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP304	Langer	Martin	Proximal Perforator Flap of Second Metacarpal Artery	Surgery - Soft Tissue Cover	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP305	Durrani	Shakeel	Retrograde Flow Posterior Interosseous Flaps for Soft Tissue Coverage of the Hand - A Meta Analysis	Surgery - Soft Tissue Cover	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP306	Bifani	Alejandro	Posterior Interosseous Flap in Hand Defect Reconstruction	Surgery - Soft Tissue Cover	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP307	Cheng	Tai-Ju	Reconstruction of the First Web Space by Using the Free Arterialized Venous Flap - An Alternative to Conventional Free Cutaneous Flaps	Surgery - Free Tissue Transfer	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2

FP308	Zhang	Gao Meng	Anatomy of the Anterior Supramalleolar Flap and its Clinical Application in Hand Surgery	Surgery - Free Tissue Transfer	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP309	Thomson	Suzanne	Upper Limb Function After the Extended Latissimus Dorsi Flap	Surgery - Soft Tissue Cover	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP310	Kong	Byeong Seon	Soft Tissue Reconstruction of Extremities Using the Anteromedial Thigh Perforator Free Flap	Surgery - Free Tissue Transfer	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP311	Jakubietz	Rafael G.	Lower Extremity Free Perforator Flap Soft Tissue Coverage for Large Defects of the Distal Upper Extremity	Surgery - Free Tissue Transfer	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP312	Tang	Jin Bo	Medial Sural Artery Perforator Flaps for Reconstruction of Soft Tissue Defects in the Hand	Surgery - Soft Tissue Cover	Free Paper Session 30 - Microsurgery: Flaps in the Hand and Upper Limb 2
FP313	Mee	Sarah	Comparison of the Pins and Rubber Traction System Against the Modified Banjo Frame for Complex Intra-articular Fractures of the Proximal Interphalangeal Joint	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP314	Pelissier	Philippe	Dynamic External Fixation for Digital Articular Fractures	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP315	Orozim	Zdenko	Results After Static and Dynamic Treatment of Hyperextensive Volar Plate Avulsions of the Proximal Interphalangeal Joint of the Finger	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP316	Southgate	Jeremy	Fractures Around The PIP Joint. Treatment With Dynamic Traction.	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP317	Campbell	Doug	Depressed Articular Fractures Of The Proximal Interphalangeal Joint – Treatment Using A Novel Combination Of Functional Surgical Approach, Internal Fixation And Local Bone Graft.	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP318	Biddulph	Sydney Lionel	A Phalangeal Plate for Fracture-Dislocation of the PIP Joint	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP319	Ikeda	Masayoshi	Treatment of Dorsal Fracture Dislocation of the Proximal Interphalangeal Joint Using Low-Profile Mini-Plate	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP320	Shin	Hyun-Dae	Treatment of Unstable Dorsal Proximal Interphalangeal Fracture/Dislocation Using a Hemi-Hamate Resurfacing Arthroplasty	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP321	Chuter	Graham	Ulnar Collateral Ligament Repair of the Thumb Metacarpal-Phalangeal Joint: A Ten Year Experience of a Dedicated Service.	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP322	Kömürcü	Mahmut	Handgun Injuries of The Metacarpal and Proximal Phalangeal Fractures: Early Definitive Treatment	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP323	Crowley	Bríd	Ulnar Carpometacarpal Joint Injuries - A Prospective Clinical Study of Injury Patterns, Aetiology and Outcome	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP324	Jeong	Changhoon	Fracture and Dislocation of the Fourth and Fifth Carpometacarpal Joints	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 31 - Phalangeal and Metacarpal Fractures 2
FP325	Field	Jeremy	Scaphoid Bone Bruise - Probably Not the Precursor of Asymptomatic Non-union of the Scaphoid	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP326	Bindra	Randy	Microstructure and Implant Fixation within the Scaphoid: A Micro-CT cadaveric Study	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2

FP327	Andrade	Francisco	Scaphoid Fractures: Protocol of Treatment	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP328	Liverneaux	Philippe André René	Kirschner Wire Placement in Scaphoid Bones using Fluoroscopic Navigation: A Cadaver Study Comparing Conventional Techniques with Navigation	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP329	Verstreken	Frederik	Percutaneous Transtrapezial Fixation of Acute Scaphoid Fractures	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP330	Inoue	Goro	Percutaneous Screw Fixation for Scaphoid Fractures	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP331	Sommerkamp	Greg	Scaphoid AARIF: Arthroscopic Assisted Reduction and Internal Fixation with the Herbert-Whipple System	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP332	Puskas	Brian	Mini-Open Dorsal Approach For Fixation Of Scaphoid Waist Fractures	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP333	Tanaka	Juichi	Minimum Invasive Surgery for Scaphoid Fracture Using DTJ Screw	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP334	Ya'ish	Feras	A New Composite Bioresorbable Compression Screw for Scaphoid Fracture Fixation	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP335	Goddard	Nicholas	Acute Volar Percutaneous Scaphoid Fixation: 10 Years Experience	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP336	Dias	Joseph	8 year Clinical and Radiological Outcome of Non-Operative Versus Operative Management of Acute Scaphoid Fractures : Prospective Randomised Trial	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 32 - Scaphoid 2
FP337	Atroshi	Isam	Intensive Keyboard Use is Associated With Lower Prevalence of Carpal Tunnel Syndrome Among Working-age Persons: Results From a Population-based Study	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 33 - Nerve Compression: Median Nerve 2
FP338	Burke	Frank	Community based management of Carpal Tunnel Syndrome in the United Kingdom: Year 1 of a Primary Care Hand Therapy Clinic.	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 33 - Nerve Compression: Median Nerve 2
FP339	Atroshi	Isam	The SF-6D Health Utility Index is a Valid Measure for Use in Cost Effectiveness Studies in Carpal Tunnel Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 33 - Nerve Compression: Median Nerve 2
FP340	Hems	Timothy	Evaluation of a Diagnostic Questionnaire and Scoring System for Carpal Tunnel Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 33 - Nerve Compression: Median Nerve 2
FP341	Slattery	Philip	4,444 Modified Chow Endoscopic Carpal Tunnel Release- Immediate Complications and Techniques to Avoid Them	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 33 - Nerve Compression: Median Nerve 2
FP342	Wyatt	Michael	Early Return to Work Following Open Carpal Tunnel Decompression	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 33 - Nerve Compression: Median Nerve 2
FP343	Pelissier	Philippe	The Synovial Flap for Recurrence of Carpal Tunnel Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 33 - Nerve Compression: Median Nerve 2
FP344	Hiemer	Robert	Results of Ulno-dorsal Fascia Flap According to BECKER/GILBERT After Intrafascicular Neurolysis for Recurrent Carpal Tunnel Syndrome	Surgery - Nerve Injuries / Repair	Free Paper Session 33 - Nerve Compression: Median Nerve 2
FP345	Jeong	Changhoon	Modified Camitz Opponensplasty Using Transverse Carpal Ligament Pulley in Patient with Carpal Tunnel Syndrome	Surgery - Nerve Compression Syndromes & Tissue Degeneration	Free Paper Session 33 - Nerve Compression: Median Nerve 2

Paper Reference	Last Name	First Name	Speakers Paper Title	Speakers Theme Description	Session Description
FP346	Miller	Mary-Clare	The Role of Membrane-type 1 Matrix Metalloproteinase (MT1-MMP) in Rheumatoid Arthritis	Surgery - Rheumatoid Hand	Free Paper Session 34 - Rheumatoid Arthritis
FP347	Jones	Neil F.	Evolution of Surgery for Scleroderma of the Hand	Surgery - Rheumatoid Hand	Free Paper Session 34 - Rheumatoid Arthritis
FP348	Hussey	Alan	Efficacy of Magnetic Resonance Angiography of the Hand in Management of Patients with Scleroderma	Surgery - Rheumatoid Hand	Free Paper Session 34 - Rheumatoid Arthritis
FP349	Jakubietz	Michael G.	Scleroderma in the Hand and its Surgical Approach	Surgery - Rheumatoid Hand	Free Paper Session 34 - Rheumatoid Arthritis
FP350	Trail	Ian Alexander	Seventeen-Year Survivorship Analysis of Silastic Metacarpophalangeal Joint Replacement	Surgery - Rheumatoid Hand	Free Paper Session 34 - Rheumatoid Arthritis
FP351	Cooney	William	Finger Joint Replacement of the Metacarpal Phalangeal Joint Using a Resurfacing Implant. Experience in 40 Patients	Surgery - Rheumatoid Hand	Free Paper Session 34 - Rheumatoid Arthritis
FP352	Giddins	Grey Edward Bence	In-Vitro Testing Of MCP Implants With Varying Ulnar Deviation	Surgery - Rheumatoid Hand	Free Paper Session 34 - Rheumatoid Arthritis
FP353	Brindley	Stephen	Universal 2 Total Wrist Arthroplasty: Early results	Surgery - Other Wrist Conditions	Free Paper Session 34 - Rheumatoid Arthritis
FP354	Chochole	Martin	Total Wrist Arthroplasty in Rheumatoid and Osteoarthritis: Comparison of Outcomes	Surgery - Rheumatoid Hand	Free Paper Session 34 - Rheumatoid Arthritis
FP355	Coombs	Christopher	Brachial Artery Thrombosis in Infants: An Algorithm for Limb Salvage	Surgery - Replantation	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP356	Georgescu	Alexandru	Microsurgical Reconstruction of Complex Defects of the Upper Limb	Surgery - Mutilating Hand Injuries	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP357	Adani	Roberto	Post-Traumatic Bone Defects of the Upper Extremity: Treatment with VFG	Surgery - Free Tissue Transfer	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP358	Jupiter	Jesse	A Comparison of Vascularized Fibular Graft for Segmental Loss of the Humerus and Femur--Technical Questions and Outcomes	Surgery - Free Tissue Transfer	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP359	Tos	Pierluigi	Free Vascularized Fibular Graft in the Treatment of Severe Osteomyelitis of the Forearm	Surgery - Free Tissue Transfer	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP360	Chung	Duke Whan	Lengthening of Digits with External Fixator Callostasis	Surgery - Mutilating Hand Injuries	Free Paper Session 11 - Microsurgery: Finger Reconstruction
FP361	Rath	Santosh	Severe Civilian Blast Injuries to the Hand: Classification of Injury for Predicting Functional Outcome and Intervention	Surgery - Mutilating Hand Injuries	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP362	Schmidt	Ralf	Mutilating Hand Injuries Due to Circular Saws. A Review of 124 Patients treated between 2000 and 2004	Surgery - Mutilating Hand Injuries	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP363	Armstrong	James	Financial and Social Costs Resulting from Hand Injuries due to 'Skil' Saws	Surgery - Mutilating Hand Injuries	Free Paper Session 35 - Microsurgery: Mutilating Injuries and Bone Transfer
FP373	Schofield	Michel Mary Elizabeth	Trends in Hand Injuries in Ontario, Canada Workers' Compensation Claimants Between 1996 and 2003	Surgery - Hand Fractures (Phalangeal & Metacarpal)	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand
FP374	Cumming	William	Australian Orthopaedic Activities Overseas	Surgery - Chronic Regional Pain Syndrome	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand
FP375	Buntine	John	Mycobacterium Ulcerans Limb Infections and Resulting Deformities	Surgey - Septic Hand	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand

FP376	Kaji	Yoshio	Efficacy of Oral Minocycline and Hyperthermic Treatment for a Mycobacterium marinum Infection in the Hand	Surgey - Septic Hand	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand
FP377	Mandl	Irena	Atypical Mycobacterial Infections of the Hand and Wrist: Diagnostic and Therapeutic Considerations	Surgey - Septic Hand	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand
FP378	Sullivan	Paul	The Efficacy of Peri-operative Skin Preparation of the Hand	Surgey - Septic Hand	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand
FP379	Barton	Richard	Upper Limb Morbidity as a Direct Result of IVDU	Surgey - Septic Hand	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand
FP380	Incoll	Ian	The Effect of Skin Preparation Techniques for Hand Surgery on Bacterial Counts, Comparing Sterile Swab or Non-Sterile Plastic Bag Preparation	Surgey - Septic Hand	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand
FP381	Zyluk	Andrzej	Severe Infections within the Upper Limb: an Analysis of the Causes and Results of the Treatment	Surgey - Septic Hand	Free Paper Session 37 - Hand Surgery Services/ The Septic Hand
FP382	Hussey	Alan	The Source and Pattem of Motor Collateral Sprouting and Nerve Regeneration in End-to-Side Nerve Repair of Nerve to Medial Gastrocnemius in the Rat	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP383	Schmidhammer	Robert	Terminal end-to-side Coaptation to Transfer Nerve Fibers from an Innervated Terminal Motor Branch to the Terminal Branch of a Denervated Synergistic Muscle: An Experimental Study with Baboons	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP384	Smit	Xander	Recovery of Neurophysiological and Functional Features with Time after Rat Sciatic Nerve Repair: The Dissimilarities	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP385	Xiong	Ge	Transplanted Embryonic Spinal Tissue in Severed Rat Sciatic Nerves Promotes Motor Nerve Regeneration	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP386	Mattar Junior	Rames	Extra Cellular Matrix Modification Increases Peripheral Nerve Regeneration	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP387	Wang	Huan	Digital Video Motion Analysis For Measurement of Upper Limb Nerve Function	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP388	Ho	Emily	Evaluation of the Sensory Deficit after Sural Nerve Harvesting in Pediatric Patients	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP389	Braga Silva	Jefferson	Comparative Study on the Utilization of the Empty Silicone Tubbing Versus With Bone Marrow Mesenchymal Cells in the Repair of the Median and Ulnar Gaps at the Level of the Forearm	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP390	Hwang	So-Min	Arterialized Venous Sural Nerve Graft for Coexisting Injury of Ulnar Artery & Nerve by Arc Burn at Wrist	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP391	Smarrelli	Davide	Correlation Between Clinical Outcome and Electromyography's Results After Ulnar And Median Nerve Repair. Our Experience.	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP392	Schreuders	Ton	Outcome of Muscle Strength in Patients with Ulnar and Median Nerve Injury	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP393	Kamrani	Reza-Shahryar	Two Stage Nerve Graft, Clinical Application	Surgery - Nerve Injuries / Repair	Free Paper Session 38 - Nerve Injury: Research and Repair 1
FP394	Kazuki	Kenichi	Minimum Invasive Palmar Plating for Fractures of the Distal Radius	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP395	Jakubietz	Rafael G.	1 Year Results Comparing Palmar, Angle-Stable Plate Osteosynthesis And Dorsal Plate Osteosynthesis In High Grade Intraarticular Fractures Of The Distal Radius.	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3

FP396	Rigo	Istvan Zoltan	Mechanical Comparison of Fixed Angle Locking Volar Plate and K-wire Fixation of Distal Radius Fractures	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP397	Nelson	Cory O.	Biomechanical Evaluation of Volar Locking Plates for Distal Radius Fractures	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP398	Wong	Eugene	Locked Distal Radius Plating for Comminuted Intraarticular Distal Radial Fractures	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP399	Melsom	David	Intercarpal Ligament Injuries in Distal radial Fractures	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP400	Orbay	Jorge	Distal Radius Fractures and Concomitant Ulnar Styloid Fractures	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP401	Lubahn	John	Coralline Hydroxyapatite: A Bone Graft Alternative in Distal Radius Osteotomy	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP402	Jupiter	Jesse	Prospective Randomized Comparison of Early vs. Late Wrist Mobilization After Volar Plate Fixation of Distal Radius Fractures	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP403	Jupiter	Jesse	Distal Radius Osteotomy in the Older Age Patient Using Angular Stable Implants and Norian Bone Cement	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP404	Campbell	Doug	Day Case Osteotomy For Malunited Distal Radial Fractures Using Bone Substitute	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP405	Murase	Tsuyoshi	Three Dimensional Corrective Osteotomy for Malunited Forearm Fractures Using Custom-Made Osteotomy Template	Surgery - Fractures Of The Radius	Free Paper Session 39 - Distal Radial Fractures 3
FP406	Khalid	Mohamed	Are Patients with Normal MRI and X-Rays After Wrist Injury Asymptomatic	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 40 - Carpal Injuries
FP407	Kim	Byung Sung	Value of Post-Arthrography Computed Tomography in Wrist Ligament Injuries	Surgery - Other Wrist Conditions	Free Paper Session 40 - Carpal Injuries
FP408	Olazabal	Alfredo	Wrist Arthroscopy: Therapeutic Resource or Technological Toy?	Surgery - Other Wrist Conditions	Free Paper Session 40 - Carpal Injuries
FP409	Packer	Greg	Early Experience with the InnerVue - a New Era in Wrist Arthroscopy	Surgery - Other Wrist Conditions	Free Paper Session 40 - Carpal Injuries
FP410	Brunelli	Giorgio	Carpal Instability and the Role of Scapho-Trapezoid Pillar as Stabilizer of the Carpus and Spacer Between Radius and Metacarpus	Surgery - Carpal Instability	Free Paper Session 40 - Carpal Injuries
FP411	Magdiev	Djamalutdin	Distraction Technique for Treatment of Injuries and Diseases of Carpal Bones	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 40 - Carpal Injuries
FP412	Apergis	Emmanuel	Comparison Between Lesser and Greater Arc Injuries of the Wrist	Surgery - Other Wrist Conditions	Free Paper Session 40 - Carpal Injuries
FP413	Kömürcü	Mahmut	Early And Delayed Treatment of Dorsal Transscaphoid Perilunate Fracture Dislocations.	Surgery - Carpal Instability	Free Paper Session 40 - Carpal Injuries
FP414	Takase	Katsumi	Traumatic Mechanisms and Therapeutic Results of the Perilunate Injuries	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 40 - Carpal Injuries
FP415	Mudgal	Chaitanya	Perilunate Fracture-Dislocations of the Wrist: Comparison of Temporary Screw vs. Kirschner Wire Fixation	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 40 - Carpal Injuries
FP416	Irisawa	Taro	Treatment of Trans-Scaphoid Perilunate Dislocations	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 40 - Carpal Injuries
FP417	Fong	Sin Tak Benjamin	Minimally Invasive Approach to Transcaphoid Perilunate Dislocation	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 40 - Carpal Injuries
FP418	Pathmanathan	V.	Arm Transplantation for Congenital Absence of the Hand	Surgery - Hand Transplantation	Free Paper Session 41 - Microsurgery : Transplantation
FP419	Zamfirescu	Dragos	Sentinel Skin Allograft - A Reliable Marker for Monitoring of Limb Transplant Rejection	Surgery - Hand Transplantation	Free Paper Session 41 - Microsurgery : Transplantation

FP420	Lanzetta	Marco	Importance of Strict Patient Compliance in Hand Transplantation	Surgery - Hand Transplantation	Free Paper Session 41 - Microsurgery : Transplantation
FP421	Adani	Roberto	The Use of Allograft in Reconstructive Surgery of the Hand	Surgery - Hand Transplantation	Free Paper Session 41 - Microsurgery : Transplantation
FP422	Kanatani	Takako	Long-Term Acceptance of Fully MHC-Mismatched Limb Allografts After a Short Course of Anti-AB-T Cell Receptor Monoclonal Antibody and FK506	Surgery - Hand Transplantation	Free Paper Session 41 - Microsurgery : Transplantation
FP423	MacDermid	Joy	Validation Of Scales Used To Assess Pain And Disability In Arthritis	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP424	Armstrong	James	Digital Mucous Cysts and their Surgical Management	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP425	Merle	Michel	Lateral Approach for Proximal Interphalangeal Joint Arthroplasty: Clinical Evaluation of 51 Cases	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP426	Sokolow	Constantin	A New PIP Joint Osseointegrated Prosthesis - IPP2. Presentation and Results with Mean 5-Year Follow-Up	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP427	Kopylov	Philippe	Pyrocarbon PIP Ascension® Prosthesis. 3 years Results	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP428	Johnstone	Bruce	Proximal Interphalangeal Joint Arthroplasty – A 10 Year Experience	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP429	Sotereanos	Dean	A New Technique for the Thumb Carpometacarpal Joint Arthroplasty: Flexor Carpi Radialis Sparing Human Allograft	Surgery - Thumb Basal Joint OA	Free Paper Session 42 - Degenerative Joint Disease
FP430	Kwon	Bong Cheol	Proximal Row Carpectomy with Capsular Interposition - A minimum 2 year Follow Up Study	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP431	Pagnotta	Alessia	Clinical and CT Evaluation of Four-Corner Arthrodesis With Spider Circular Plate in the Treatment of SLAC/SNAC Wrist	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP432	Ross	Mark	Four Corner Fusion Using Circular (Spider) Plate	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP433	Nagle	Daniel	Conversion Rate of Intercarpal Arthrodesis to Wrist Pan-Arthrodesis	Surgery - Degenerative Joint Disease	Free Paper Session 42 - Degenerative Joint Disease
FP434	Felderhoff	Joachim	Findings of Multicenter Study into a Novel Ceramic Wrist Joint Prosthesis (MBW)®	Surgery - Other Wrist Conditions	Free Paper Session 42 - Degenerative Joint Disease
FP435	Kim	Byung Sung	Arthroscopic Reduction and Percutaneous Fixation of Scaphoid Fracture and Nonunion	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP436	Trail	Ian Alexander	Scaphoid Non-Union: The Factors Effecting Outcome After Non-Vascular Bone Grafting and Internal Fixation	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP437	Kurimoto	Shigeru	Asymptomatic Scaphoid Nonunion	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP438	Goddard	Nicholas	Percutaneous Grafting and Fixation for Selected Scaphoid Non-Union	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP439	Kitsis	Christos	Mini-Acutrak Screw Fixation In A Consecutive Series of 46 Scaphoid Non-unions	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP440	Kim	Jin Sam	Treatment of the undisplaced scaphoid nonunion by a pure cancellous chip bone graft and K-wire fixation	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP441	Gotani	Hiroyuki	Treatment of Scaphoid Pseudoarthrosis with Vascularized Bone Graft from Volar Aspect of the Radius	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP442	Naam	Nash	Long Term Clinical Outcome of Vasculaized Pedicled Bone Graft for Scaphoid Nonunion.	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3

FP443	Bifani	Alejandro	Vascularized Bone Grafts in Scaphoid Nonunion	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP444	McNab	Ian	Vascularised Bone Grafts for Scaphoid Non-Union	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 43 - Scaphoid 3
FP445	Mathoulin	Christophe	Arthroscopic Replacement of Necrosis of the Proximal Pole of the Scaphoid by a Partial, Pyrolytic Carbon, Scaphoid Implant	Surgery - Degenerative Joint Disease	Free Paper Session 43 - Scaphoid 3
FP446	Pereira	Pedro	Adaptative Proximal Scaphoid Implant (APSI) in the Treatment of Proximal Scaphoid Pseudarthrosis	Surgery - Carpal Instability	Free Paper Session 43 - Scaphoid 3
FP447	Hansson	Thomas	Activation of the Primary Somatosensory Cortex during Stereoscopic Observation of Tactile Stimulation of the Hand	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP448	Lee	Joo-Yup	Differentiation of Bone Marrow Stromal Cells into Schwann Cells in Adult Rats	Surgery - Tumours	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP449	Sinis	Nektarios	Tissue Engineering for the Peripheral Nervous System: An Experimental Study of Different Materials in Rats	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP450	Móricz	Otto	Study of the Peripheral Motor Re-Innervation of the Sciatic Plexus on Rabbits After Surgical Lesion	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP451	Janssen	Wilhelmus	Quantitative Evaluation of Sensory Loss in Charcot-Marie-Tooth Disease	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP452	Ñhoulovskaya	Irina	Modern Ultrasound Diagnostics of the Periferal Nerves Lesions of the Upper Extremity	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP453	Ya'ish	Feras	Temperature Strips; A Reliable Objective Diagnostic Tool In Peripheral Nerve Injuries	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP454	Jaquet	Jean-Bart	Cold Intolerance in Upper Extremity Nerve Injury Patients	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP455	Jupiter	Jesse	Comparison of Complete Transposition vs. Partial Release and Protection of the Ulnar Nerve during ORIF of a Distal Humerus Fracture	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP456	Rider	Mark	Is Splintage Necessary Following Digital Nerve Repair?	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP457	Zhang	Zijie	Preventing Neuroma Formation by Molecular Neurosurgical Approach	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP458	Braga Silva	Jefferson	Bone Marrow Mesenchymal Stem Cells and Platelet-Enriched Plasma are Capable of Repair and Functional Recover of the Peripheral Nerve.	Surgery - Nerve Injuries / Repair	Free Paper Session 44 - Nerve Injury: Research and Repair 2
FP459	Lim	Aymeric Yutang	Intramuscular Innervation of Upper-limb Skeletal Muscles: Classification and Clinical Applications	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP460	Fridén	Jan	Passive Muscle-Tendon Amplitude does not Reflect Skeletal Muscle Functional Excursion	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP461	Ponten	Eva	Intraoperative Measurement of Muscle Properties Reveal Relationship Between Contracture Formation and Muscle Remodeling	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP462	Lalonde	Don	Patient Participation in Getting the tension Right in Tendon Transfers and Tendon Grafting with the Wide Awake Approach	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP463	Rath	Santosh	Half FPL 'Lasso' to A1 Pulley For Dynamic Metacarpophalangeal Joint Stabilization for 'Z' Deformity of Thumb & Froment's Sign Correction in Irreversible Ulnar / Median-Ulnar Nerve Paralysis.	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer

FP464	Rath	Santosh	Immediate Active Mobilization Versus Immobilization for Opposition Tendon Transfer in the Hand	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP465	Srinivasan	Hariharan	Landsmeer's Model Helps Develop Corrective Procedures for Paralytic Claw-fingers	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP466	Belmahi	Amin	Restoration of Thumb's Opposition by a Local Muscular Transfer	Surgery - Nerve Injuries / Repair	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP467	Lanzetta	Marco	Reconstruction of Radial Nerve Palsy: a New Technique	Surgery - Nerve Injuries / Repair	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP468	Berger	Alfred Karl	The Steindler Flexorplasty- Current Concept Review and Personal Refinement	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP469	Fridén	Jan	Reconstruction of Active Palmar Thumb Abduction In Tetraplegia	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP470	Cizmar	Igor	Reconstruction in the Upper Extremity in the Tetraplegic Patients - a Review after 5 Years.	Surgery - Paralysis / Spasticity Tendon Transfers	Free Paper Session 45 - Tetraplegia, Paralysis and Tendon Transfer
FP471	Lubahn	John	Immunohistochemical Evidence of Nerve Growth Factor in Dupuytren's Diseased Palmar Fascia	Surgery - Dupuytren's	Free Paper Session 46 - Dupuytren's Disease 2
FP472	Abe	Yoshihiro	Dupuytren's Disease Following Acute Injury in the Ipsilateral Upper Limb in Japanese Patients; Is It 'False, or Non-Dupuytren's Palmar Fascial Disease'?	Surgery - Dupuytren's	Free Paper Session 46 - Dupuytren's Disease 2
FP473	Stahl	Shalom	Dupuytren's Contracture In Women	Surgery - Dupuytren's	Free Paper Session 46 - Dupuytren's Disease 2
FP474	Kebrle	Radek	Distally Based U - Flap for Progressive Dupuytren 's Surgery	Surgery - Dupuytren's	Free Paper Session 46 - Dupuytren's Disease 2
FP475	Pelissier	Philippe	The Palmar Intermetacarpal Flap in Dupuytren's Contracture	Surgery - Dupuytren's	Free Paper Session 46 - Dupuytren's Disease 2
FP476	Snelling	Andrew	Dupuytren's Disease: 5 Year Outcomes of Segmental Aponeurectomy, Fasciectomy and Dermofasciectomy	Surgery - Dupuytren's	Free Paper Session 46 - Dupuytren's Disease 2
FP477	Terrill	Patricia	Iontophoresis with Dexamethasone in Volar Hands Scars	Surgery - Dupuytren's	Free Paper Session 46 - Dupuytren's Disease 2
FP478	Salazard	Bruno	The 'Bilhaut-Cloquet' Technique for Treatment of Thumb Duplication.	Surgery - Congenital	Free Paper Session 47 - Congenital 3
FP479	Ogino	Toshihiko	Ulnar Cleft Hand Without Finger Defect	Surgery - Congenital	Free Paper Session 47 - Congenital 3
FP480	Arumugam	Manohar	Long term follow up of composite nonvascularised toe phalanx transfers for aphyalangia	Surgery - Congenital	Free Paper Session 47 - Congenital 3
FP481	Czarnecki	Piotr	Nonvascularised Middle Toe Phalanx Transfer in the Treatment of Hand Symbrachydactyly	Surgery - Congenital	Free Paper Session 47 - Congenital 3
FP482	Miyawaki	Takeshi	Upper Extremity in Apert Syndrome	Surgery - Congenital	Free Paper Session 47 - Congenital 3
FP483	Owers	Kate	Lunate Trabecular Structure - Risk Factors for Kienbock's Disease	Surgery - Other Wrist Conditions	Free Paper Session 48 - Kienbocks Disease
FP484	Ribak	Samuel	The Importance of Wrist Arthroscopy for Staging and Treatment of Kienböck's Disease	Surgery - Other Wrist Conditions	Free Paper Session 48 - Kienbocks Disease
FP485	Sood	Aman	Effect of Distal Scaphoid and Triquetrum Excision on Radioscapholunate Arthrodesis: A Cadaveric Study	Surgery - Other Wrist Conditions	Free Paper Session 48 - Kienbocks Disease
FP486	Lee	Jaesung	Triscaphe Fusion in the Treatment of Stage IIIb Kienbock Disease -Comparison of Lunate Preservation and Excision-	Surgery - Other Wrist Conditions	Free Paper Session 48 - Kienbocks Disease

FP487	Canela	Pedro	Lunaroplasthy with Cement for the Treatment of Advanced Kienbock Disease	Surgery - Other Wrist Conditions	Free Paper Session 48 - Kienbocks Disease
FP488	Lanzetta	Marco	Scaphocapitate Arthrodesis in the Treatment of Stage IIIB and IV Kienbock's Disease	Surgery - Carpal Instability	Free Paper Session 48 - Kienbocks Disease
FP489	Takase	Katsumi	The Long Term Follow-up of Modified Graner Procedure for the Patients with Advanced Kienbock Disease	Surgery - Scaphoid & Other Carpal Fractures	Free Paper Session 48 - Kienbocks Disease
FP490	Zhang	Cheng-Gang	C7 Nerve Double Neurotisation in the Treatment of Total Brachial Plexus Avulsion Injury: An Experimental Study in Rats	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 49 - Brachial Plexus 2
FP491	Hu	Shao Nan	Tracing the Spinal Segmental Origination of the Brachialis Branch of Musculocutaneous Nerve: An Electrophysiological Study and Case Report	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 49 - Brachial Plexus 2
FP492	Monsivais	Jose	Sensory Recovery Correlates with Post-operative Pain Improvement in Brachial Plexus Injuries	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 49 - Brachial Plexus 2
FP493	Berger	Alfred Karl	Long-term Results After Contralateral C7-Transfer In Adult Brachial Plexus Lesions	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 49 - Brachial Plexus 2
FP494	Wiper	Jonathan	Functioning Free Gracilis Transfer for Elbow Flexion: The Leeds Experience	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 49 - Brachial Plexus 2
FP495	Sakellarides	Harilaos	Brachial Plexus Injuries - Treatment and Neurotization for Total Paralysis	Surgery - Brachial Plexus Injuries And OBPP	Free Paper Session 49 - Brachial Plexus 2
FP496	Ghahremani	Shamsollah	Pectoralis Major Transplantation to Restore of Elbow Flexion in War Injured Paralytic Patients	Surgery - Nerve Injuries / Repair	Free Paper Session 49 - Brachial Plexus 2



FP001

Closed treatment of metacarpal and proximal phalanx fractures with a "Cobra" cast

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Open treatment of metacarpal and proximal phalangeal fractures can be associated with significant complications. Closed reduction of angular or rotational deformities can usually be accomplished after a local block, followed by immobilization. The author has been using a "cobra" cast which maintains the MCPJ's in maximal flexion and the interphalangeal joints free which prevents stiffness, joint contractures, and maintains fracture reduction.

26 adults were treated during a 2 year period. 10 were female, and 16 male with an average age of 44. Diagnosis' included: metacarpal neck (small finger=5; other=2), shaft (9), base (5), and proximal phalanx (11). An average of 6.2 days elapsed between injury and casting. 12/26 patients required a closed reduction for significant angulation or rotational deformity. Average pre-reduction sagittal angulation was 34 degrees volar apex for proximal phalangeal and 35 degrees dorsal apex for metacarpal fractures. Angulation in the coronal plane averaged 21 degrees. Average length of immobilization was 26 days. Full extension was regained except for 7 digits with an average 18 degree extensor lag at MCPJ (if patient with 3 digits involved and CRPS eliminated, only 4 digits with average 9 degrees lag), and 6 digits with an average extensor lag of 7 degrees at the PIPJ. Full flexion was achieved except for 7 digits with an average 68 degrees at the MCPJ and 7 digits with an average of 81 degrees at the PIPJ. All fractures healed with a final average angulation in the sagittal plane of 9.1 degrees and 5.4 degrees in the coronal plane. Complications occurred in 3 patients (12%): 2 cases of CRPS which resolved after treatment, and one patient with a loss of reduction requiring ORIF. This technique is cost effective, allows functional use of the hand during immobilization which results in excellent motion after fracture healing is complete.



FP002

The versatility of the K-wire osteosynthesis in the metacarpal and phalanx fractures

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Introduction: Even the osteosynthesis in hand's bones fractures is well coded, due especially to the modern materials, when these are missing, or in uncommon clinical forms, the K-wire osteosynthesis remains an elective method in spite of the relative instability of the bone fragments.

Aims: The discussion of the multiple possibilities to perform this osteosynthesis method.

Materials and method: The study had been done on 330 cases of fractures owing to 298 patients surgically treated between 2003-2005. First of all, it was done a statistical analysis concerning the repartition by sex, age, gravity, dominant hand, rays of the hand, continuity of the skin coverage and dislocation in the fracture centers. Second, it was analyzed the surgical techniques. It was performed many kind of K-wire osteosynthesis: a) 2 wires in X, in V, in parallel, in secant arch; b) one wire c) multiple wires d) other methods K- wire assisted.

Discussion: In 98% of cases was obtained a good reduction (under radiographic control) with good and excellent functional recovery, only in 2% of cases was necessary a reintervention.

Conclusion: The K-wire osteosynthesis is a versatile method and remains an important option to obtain good quality results.



FP003

A new technique for treatment of phalangeal neck fractures in children

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Introduction: Phalangeal transversal neck fractures are rare, specific of the young children hands. The purpose of this study is to evaluate this type of fracture and to propose a new technique for displaced fractures.

Patients and Method: Between 1999 and 2006, 47 children (3 months- 14 years old) were treated for 51 phalangeal neck fracture. Patients were followed up for a mean of 19 months. For 7 displaced fractures we used a new technique with an intrafocal percutaneous pinning ("Kapandji-like method").

Results: The fifth finger was affected in 23 cases. The proximal phalanx was more commonly involved (27/51). Open wound fractures were noted in 5 cases. Fractures were primary displaced in 13 cases and there was a secondary displacement in 5 cases (seen at the first week control). Surgery was necessary for 17 cases and we used the "Kapandji-like method" for 7 closed fractures. Fractures treated orthopedically gave good results. Open fractures gave poor results. Fractures treated by our technique gave very good results.

Discussion: Closed reduction and percutaneous treatment of these fractures give the best functional result. We propose a technical improvement of percutaneous synthesis with intrafocal pinning.



FP004

Modification of the extension block Kirschner wire technique for mallet finger fractures: Two extension block pins method

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The purpose of this report presents a modification of the extension block Kirschner wire technique that is used for closed reduction of displaced mallet finger fractures. Twenty-one mallet finger fractures of the distal phalanx treated with this modification were included in this prospective study.

To prevent the rotation of the fracture fragment of the distal phalanx, we routinely used the two extension block pins, which was then maintained with transarticular fixation. The indications for this technique were presence of a large bone fragment (mallet finger fractures involving more than one-third of the articular surface), and volar subluxation or the loss of joint congruity of the distal interphalangeal joint. The following parameters were assessed: time to union; range of motion; associated complication; and the established outcome criteria graded as excellent, good, fair or poor.

The average patient age was 25 years and the average joint surface involvement was 38%. All the fractures were united, and average time to fracture union was 6 weeks. The average follow-up was 10 months. Congruous and satisfactory joint surfaces were present in all patients. The average flexion of the distal interphalangeal joint was 79° and the average extension loss was 3°. There was no major complication and there were 3 minor complications. No pin tract infection and migration of the pins was occurred in this series. According to the Crawford classification there were 57% excellent, 33% good, 10% fair and no poor results.

This modification prevented the rotation of the fracture fragment of the distal phalanx on operative field when compared with the original method. The results of this study showed that the two extension block pins method resulted in anatomic and secure fracture union with a minimal morbidity and has good functional outcome. We believe that this modified technique, when properly applied, produces satisfactory results.



FP005

Where and when does length matter? Regional variations in pull-out strength of uni-cortical vs bi-cortical screws in proximal phalanges – A cadaveric study

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Background: The use of uni-cortical screws in the fixation of proximal phalangeal fractures is advantageous because it avoids damage to the flexor apparatus. We studied the pull-out strength of uni-cortical as compared to bi-cortical screws.

Methods: 40 proximal phalanges from 4 pairs of hands were harvested. Dorso-ventral and medio-lateral drill holes using a 1.4 mm drill were made 3 mm from the articular margin proximally and distally and at the midpoint of the shaft. Self tapping 1.7 mm screws (Stryker Osteosynthesis) bi-cortical screws were inserted into one and uni-cortical screws into the other of the paired phalanges. The specimens were then mounted on a jig consisting of a trap to hold the bone and a bracket underneath the screw head to pull it out. A universal testing machine (Instron) was used to measure the pull-out strength.

Results: Dorso-ventrally, the ratio of uni-cortical/bi-cortical screw pull-out strength for the proximal metaphysis varied from 12.5% for little finger to 37% for the thumb (average 23%, SD=8.67), mid-diaphysis from 46% for ring finger to 89% for index finger (average 69, SD=18.05), and distal metaphysis from 29% for ring finger to 67% for little finger (average 46, SD=12.72).

Medio-laterally, the respective ratios for the proximal metaphysis varied from 46% for little and ring fingers to 76% for middle finger (average 60, SD=12.62), for mid-diaphysis the ratios varied from 53% for little finger to 91% for middle finger (73, SD=14.48), and for distal metaphysis the ratios varied from 26% for index to 68% for middle finger (average 46, SD=14.71).

Conclusions: 1. Marked regional variations in the pull-out strength exist for uni-cortical screws with proximal metaphysis being the weakest. Additional screws and or locking plates may provide adequate stability at the proximal metaphysis

2. Pull-out strength differs depending upon the direction of screw placement mediolaterally



FP006

Sometimes screwing just isn't enough– Biomechanics of plates and screws in metacarpal fractures

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Oblique and spiral fractures of the metacarpals are relatively common. Lag screws provide good stability provided it is a fracture biomechanically suitable for this kind of fixation. When the fracture pattern is too short, lever arm forces are much higher at the fracture site leading to failure of fixation. In this circumstance a plate provides better fixation. A plate, however, is bulkier and more intrusive to extensor tendon glide. Maximal strength with the least amount of metal fixation is the ideal, however the cut-off to determine this has not been classified.

The aim of this study was to assess the relative percentage length of the fracture to the metacarpal length and width of the bone and at which point a plate should be applied compared to lag screws alone.

Sixteen cadaveric metacarpal bones were harvested and osteotomized in an oblique fashion involving 30%, 40%, 50%, and 60% of the length. The metacarpals were DEXA scanned to confirm porosity. In groups of four, two were fixed using a 2.0mm Synthes Hand modular set using lag screws only and two fixed using lag screws and dorsal plating. The metacarpals were then statically stressed to failure using 3 point bending at 2mm/minute using the 858 Bionix MTS testing machine. The results show that there was no statistical difference in porosity between groups. Peak load and stiffness of the lag screws increased with increasing obliquity. We conclude that a plate should be added to short oblique fractures. This does not take into account different fracture patterns (eg butterfly, comminution) and further investigation is required into whether the oblique length at which lag screws alone can be used changes when the fracture is spiral or comminution.



FP007

Low profile titanium plate fixation for the treatment of unstable periarticular finger fractures

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The purpose of this study is to review our experience with low profile titanium plate system for the treatment of unstable peri-articular fractures of the finger. 63 consecutive peri-articular finger fractures with a comminution and displacement were treated with a mini titanium plate. There were 41 male and 22 female patients, and the average age was 34 years (range, 14 to 63 years). There were 8 to the phalanx of the thumb (IP joint), 7 to the metacarpus of the thumb (CM joint), 15 to the phalanx of the digit (PIP joint), 27 to the proximal phalanx/metacarpus of the digit (MCP joint) and 6 to the middle phalanx of the digit (DIP joint). 15 fractures were open, and of these 8 had significant soft tissue injury which involved neurovascular injury in 4 and extensor tendon injury in 6 cases. Location of plate was lateral in 40, dorsal in 12 and volar in 1. The average duration from injury to surgery was 8 days (range, 2 to 40 days), and average follow-up period was 30 months. Bone union was successfully achieved in all patients with an average period of 3.8 months. There were no malunions or osteoarthritic changes in the injured finger. Final range of total active motion was excellent (%TAM>0.85) for 33; good (0.70-0.84) for 23, fair (0.50-0.69) for 5, and poor (<0.49) for 2. Postoperative complication occurred in three patients, which included a fracture re-displacement in two and a collapse of the condylar head due to bone necrosis in one. Postoperative grip and pinch strength averaged 83 and 71 % compared to the contralateral side. Plate was removed in 30, and simultaneous tenolysis and joint release was performed in 20 to obtain better joint movement. Acquired range of motion by this salvage surgery averaged 30 degrees. Despite technical demands in plating for comminuted finger fractures, low profile titanium plate system provides rigid fixation of unstable peri-articular fractures of the finger and permits postoperative early range of motion exercise.



FP008

New plate for intra-operative correction of malrotation of metacarpals and proximal phalanges

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Complex fractures in the joint area of the metacarpophalangeal joint and oblique fractures have a high risk for malrotation. Rotational deformity is poorly tolerated. More than 5 degrees of malrotation may cause overlapping of fingers during flexion. It is nearly impossible to correct an osteosynthesis of a metacarpal or proximal phalanx fracture because screws and pins had to be replaced only 0.5 millimeter or 1 mm away from the former position. In 2002 we developed a plate for easy intraoperative correction of malrotation. Different types of plates were tested in laboratory for the best position of the transverse gliding hole.

After fixation of the joint bearing part of the fractured bone with 2.0 mm locking screws a cortical screw is inserted into the transverse gliding hole. The rotation can be corrected within seconds as often as necessary until the perfect rotation is achieved. In operation the fine tuning of the rotation took no longer than 40 seconds in 10 patients. The cortical screws in the transverse gliding holes allowed to correct malrotations up to 18 degrees to both radial and ulnar side (36 degrees complete). When the perfect position is achieved the remaining screws are inserted.

This plate is a very useful supplementing of the existing systems for acute fractures and correction osteotomies.



FP009

Fractures of metacarpals : Evaluation of results after treatment with ORIF or a mini external fixator

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Introduction: The purpose of this study is to evaluate retrospectively the results after treatment of metacarpal fractures in two groups that were treated with internal fixation with plates and screws or with external fixation.

Material and Methods : 110 fractures were treated from 2000 to 2005 either with open reduction and internal fixation or with the application of an external fixator. 68 fractures were treated with open reduction and internal fixation and 42 with external fixation. Indications for ORIF included transverse, oblique, spiral fractures without extensive injury to soft tissues and very low profile plates and screws were used. External fixation was used in fractures with extensive comminution and injury to soft tissues, fractures with bone defects or infection.

Results: Mean follow-up was 32 months for the group treated with ORIF and 22 months for the group treated with external fixator. The external fixation device was removed after a mean of 33 days. In this group 28 patients had good or excellent results while 6 patients with severe combined injuries had poor results. In the group of patients with ORIF 48 of the 55 patients had good or excellent results. For the ex-fix group 33 of the 41 patients had excellent or good results. For evaluation of hand function the DASH score was 6 (0 to 15) for the ORIF group and 4 (0 to 36) for the external fixation group.

Discussion -Conclusion : Following the appropriate indications and techniques both methods were proved very efficient in the treatment of metacarpal fractures. Active mobilization is achieved early with both methods. The external fixator can be used in more severe injuries and in contaminated fractures but its cost is higher. The surgeon must be familiar with the safe paths in the hand in order to avoid injury to tendons or nerves and vessels.



FP010

Nonsurgical treatment of mallet finger fractures involving more than one third of the joint surface: Results and literature review

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Operative stabilisation of mallet finger fractures is often recommendend in cases with more than one-third of the articular surface involved (Bendre AA, 2005). We consider in most cases conservative treatment to be successful and certainly causing less complications and costs (Wehbé MA and Schneider LH, 1984; Kalainov DM, 2005).

We present the results of 10 consecutive patients with nonsurgical treatment. The patients had bony mallet injuries involving one-third to two-thirds of the articular surface. Initially the fractures showed 1 to 3 mm displacement, palmar subluxation was not present. Treatment consisted in splinting with a dorsal aluminium splint for 6 weeks, followed by intermittent splinting for another two weeks. Night splinting continued for a total of 3 months.

Functional results at 8 months follow-up are very good with a persistent extensor lag of maximally 5 degrees and reduced flexion in the DIP joint of not more than 10 degrees. Radiological results show a surprisingly good remodelling of the joint surface with anatomical joint congruency and no secondary palmar subluxation. Patient satisfaction is high, the only complaint being the slight thickening of the joint.

Comparison with available literature on surgical treatment indicates that there is good reason not to operate (Stern PJ and Kastrup BS, 1988; Bischoff R, 1994).

Our findings support the conclusion of Wehbé and Schneider from 1984 that most mallet finger fractures can be treated conservatively - regardless the size and amount of displacement of the bone fragment.



FP011

Paediatric mallet injuries – A three year review

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Aim of study: Aetiology, treatment and outcome following mallet injury have been well documented in the adult population. Our study aimed to look at mallet injury in children, examining aetiology, patterns of injury, treatment and outcome.

Method: Retrospective review of notes and X-rays between 1998 and 2001 of children presenting with mallet injuries, including those with associated fractures.

Results: 34 male and 15 female children aged 15 months to 16 years. The middle finger was most commonly injured. Direct trauma during sport was the most frequent cause of injury. There were 9 open and 20 (40.8%) closed fractures. Three fracture patterns were identified. 69% of the injuries were treated conservatively with a mean period of splintage of 6.4 wks and 5 complications (10.2%). 31% underwent surgery with 2 complications (4.1%).

Conclusion: Despite differing mechanisms of injury, the majority of mallet deformities in children can be treated conservatively, with satisfactory functional outcome in the most cases.



FP013

Long term outcome of the wrap-around flap in thumb reconstruction

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The advantage of the wrap-around technique is that it allows for optimal reconstruction of the distal thumb, but minimises the effect of harvesting a significant component of a sometimes uncompromising donor site. We present the long term outcome of patients who underwent this procedure under the care of the original author of the technique.

Between 1977 and 2001, 52 patients had wrap-around flap reconstructions. The records of fifty of these patients were available for review. The aetiology of the thumb defect was trauma in 93% of cases. The majority of patients underwent the wrap-around flap as a means of secondary reconstruction to optimise function.

Of the 50 procedures reviewed, ten patients suffered arterial compromise post-operatively, of which 3 were successfully salvaged. Three of the patients with a failed flap presented with vascular compromise between 5 days and 4 weeks after surgery. Two patients had secondary skin grafting of the thumb for partial skin necrosis, and a further two patients required grafting to the donor wound.

Twenty five of the patients who underwent a successful flap transfer responded to a DASH questionnaire. The average interval between reconstruction and the questionnaire was 10.9 years. All patients were satisfied with the procedure, with 68% rating it as a complete success. Almost 70% reported normal or near normal sensation in the thumb. Only one patient reported poor function of the donor site, with a further 2 patients requiring orthoses.

On the basis of this long term review, we conclude that the long term outcome of the wrap-around flap based on appearance and function can be regarded as successful, with minimal donor morbidity and a high rate of patient acceptance.



FP014

The segmueller neurovascular island flap in fingertip injuries

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Introduction. The principles of reconstruction of traumatic fingertip defects include recreating a painless, sensate and aesthetically pleasing finger which minimizes time off work, reduces donor morbidity and maximizes functionality. We present our experience of the Segmueller neurovascular island flap for fingertip reconstruction.

Methods. 25 consecutive Segmueller island flaps were analyzed. We recorded mechanism of injury, level and obliquity of injury, percentage of nail remaining, complications, time to return to work, range of motion, hypersensitivity, cold intolerance, two-point discrimination, grip and pinch strength, pain score, time to discharge, aesthetic rating and total patient satisfaction.

Results. Overall patient satisfaction rating was very good (ave 8.5/10). Aesthetic rating by the patient was also very good (ave 8.7/10). Range of motion (TAM) was good or excellent in 92% cases. There was 1 case of cold-sensitivity/RSD in a lady who smoked heavily and worked in a freezer storing food. One patient lost his nail remnant in a bilateral flap. There was one infection in a smoker. There were 2 cases of prolonged tip tenderness. Grip strength was reduced by 10-15% and pinch was reduced particularly if the affected side of a digit was involved in the pinch. Pain scores (visual analogue score out of 10) at discharge averaged (0-1) at rest, (0-2) normal activity and (0-2) heavy work. Most patients could perform normal duties at 7-8 weeks. There was no partial or total flap loss.

Conclusions. The Segmueller neurovascular island flap is a reliable and versatile flap. It usually results in a painless, sensate and functional fingertip with maximum length and optimal function. We have suggested some techniques to optimize aesthetics and function including double breasting of the flap, incision markings to reduce flexion contracture and management of the nail.



FP015

Reconstruction of finger and thumb pulp using hemipulp flap

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We report our experience of thirteen digital pulp reconstructions by lateral great toe hemipulps. The cases were 12 males and a female. Ages at the surgery ranged from 17 to 69 with an average of 40.6 years old. They were 10 emergency cases and 3 secondary sensory reconstructions after abdominal flap coverage. The flaps were elevated with a long pedicle in 8 cases, a short pedicle in 5. In long pedicled flaps, the dorsalis pedis arteries were anastomosed to the radial artery in end-to-end or end-to-side fashion at the anatomical snuff box. In short pedicled flaps, the plantar metatarsal artery or the 1 st dorsal metatarsal artery was anastomosed to the palmar digital artery. In all cases, plantar digital nerves were connected to the palmar digital nerve, in one case neuroorrhaphy between the deep peroneal nerve and the palmar digital nerve was added. All flaps survived completely but one flap showed superficial and partial necrosis due to venous congestion after the operation. The follow-up periods ranged from 3 months to 3 years 8 months (mean: 14.4 months). Final follow-ups showed static two point discrimination of 7 from 22 mm (mean: 12.8mm). Cosmetic appearance and functional result were satisfactory in all patients. As postoperative complication, cold intolerance occurred in injured finger in 2 cases, necrosis of skin graft on donor site of the flap in 3, but these were healed conservatively. In conclusion, hemipulp flap is suitable reconstructive method for large skin defect of finger or thumb pulp which is not able to be treated with local flap or island flap in the hand.



FP016

Procedure for failed replantation of the thumb

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Failure of replantation is one of the most serious complications in replantation surgery, around 10% of failure rate are reported by many microsurgeons. Management of that unhappy situation is big dilemma in the microsurgical field.

We report 5 cases of thumb reconstruction in failed thumb replantation. The reconstructive surgery composed with early debridement of soft tissue that is under gangrenous processing, extract the phalangeal bone without any soft tissues. Osteosynthesis of the extracted phalangeal bone with living portion of the proximal bone. The exposed bony portion covered with vascularized flap such as reversed radial forearm pedicled flap, free radial forearm flap and neurovascular island finger flap. This procedure underwent within a week after vascular insufficiency developed.

All of the flaps were survived, bone union achieved within 3 months. The function and external appearance of the reconstructed thumb were encouraging; pinch power was average 1.2 pounds.

Early removal of necrotizing soft tissue followed by covering none vascular phalangeal bone which extracted from the dead phalanx with vascularized flap is one of the useful alternative solutions in failed replantation surgery in hand.



FP017

Reconstruction of fingertip with reverse dorsal digital island flap

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We report the results of the reconstruction of fingertips with reverse dorsal digital island flaps as described by Benne in 1994. Skin islands were designed to go over the dorsal aspect of fingers at the proximal phalanx to the PIP joint and were elevated distally with subcutaneous adipofascial tissue as a vascular pedicle. Eleven patients were thus treated; 1 thumb, 2 index, 4 middle, 3 ring, and 1 little fingers. In the case of the thumb, an ulcer of the nail bed associated with osteomyelitis of the distal phalanx was covered with the flap; in the other cases reconstructions were performed for traumatic skin defects. Flap sizes ranged from 10×15 to 15×25mm.

Five cases were survived uneventfully, although remaining the 6 showed insufficiencies of circulation to some extent and 2 became necrotic. Two cases required an additional operation due to unguual residues.

In 4 patients, the Semmes-Weinstein test was performed; results were 1 blue and 3 purple. Two patients showed slight limitation of ROM of PIP and DIP joints in flexion and extension, respectively.

This procedure has great advantages in that the collateral digital artery is not sacrificed, and flap dissection is quick and easy. However, vascular insufficiencies are frequently observed; compression of the bulky vascular pedicle is possibly the cause of such conditions. We recommended this flap for reconstruction of skin loss on the dorsal surface of fingers and for fingertip amputation accompanying loss of the nailmatrix.



FP018

Tendency for development of valgus deviation of the second toe metatarsophalangeal joint: A possible cause of instability of the reconstructed thumb after free toe-to-thumb transfer?

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This study aimed to show whether any tendency exists for development of deviation in the second toe, which could predispose to thumb instability following free-second toe-to-hand transfer for thumb reconstruction. Microvascular transfer of the second toe is now a widely-used and accepted modality of thumb reconstruction in both adults and children. Deviation of the reconstructed thumb is recognised as a possible complication of this procedure and is thought mainly to arise either as a result of poor placement of osteotomy, or post-operative trauma. However, a possible inherent tendency for the second toe to become deviated has not been considered in the literature. Western societies are prone to develop hallux valgus deformity. If individuals also have a propensity to develop valgus deformity of the second toe, this may have implications for the stability of reconstructed metacarpophalangeal (MCP) joints after free toe-to-thumb transfer.

In this retrospective investigation, the degree of valgus deviation of the second toe proximal phalanx was measured on sequential emergency department dorso-plantar x-rays, in both infants (mean age 3.7 years, n=23) and adults (mean age 33.1 years, n=22). Mann Whitney U-test analysis showed a significant difference between the degree of lateral deviation of the second toe in children (mean 3 o, sd 6.8 o) and that observed in adults (mean 28 o, sd 11.2 o, $P < 0.0001$).

These results suggest that in cases requiring free toe-to-thumb transfer, the ipsilateral second toe, due to its tendency to greater stability on the lateral side, may provide a more stable reconstructed thumb than the contralateral second toe, which would have a tendency to deviate radially, particularly when held in the key-grip functional position.



FP019

Compound flap from great toe and vascularized joint of second toe for post-traumatic thumb reconstruction at the level of proximal metacarpal bone

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Introduction: The purpose of this study is to describe the harvesting skills, anatomic variations and clinical applications for thumb reconstruction using a compound flap from the great toe and vascularized joint of the second toe.

Method: Five fresh cadaver dissections were studied for clinically relevant points, including dorsal and plantar dominance, position of the communicating branch between the dorsal and plantar system, the Gilbert classification, and the size of first dorsal metatarsal artery (FDMA) or first plantar metatarsal artery (FPMA) to the great toe and second toe. In addition, 3 compound flaps were performed between 1988 and 2003 on 3 patients with traumatic thumb amputation at the level of proximal metacarpal bone. The age of the patients ranged from 14 to 41 years. Follow-up period was eleven to twenty months.

Results: The anatomic study showed that FPMA had larger caliber in 40 % of dissections, FDMA had larger caliber in 40%, and the FDMA and FPMA had the same caliber in 20% respectively. The Gilbert classification of FDMA was 40% class I and 60% class III. The branch of FDMA or FPMA to the great toe was generally larger than to the second toe. In the clinical applications, all three patients required a secondary procedure to improve function following reconstruction. All patients eventually had good opposition and motion of transferred joints with good pinch and grip power. Donor-site morbidity was minimal.

Conclusion: The advantages of this compound flap over traditional toe transfer include: 1) provides better cosmesis and two functional joints 2) can be used for amputation of thumb at carpometacarpal joint level 3) significantly improves functional results 4) has minimal donor-site morbidity. 5) maintains growth potential in children through transfer of vascularized epiphyses. The disadvantages of this compound flap include: 1) technically challenging harvest 2) long operative time.



FP020

Microsurgical reconstruction of the thumb after complete or partial loss

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Background: The approach to thumb reconstruction is relevant because of serious loss of hand function after trauma. The main aims are to obtain good function and an acceptable cosmetic result.

Methods and results: 39 patients with posttraumatic thumb lesions were treated in the period from 1990 to 2005. Methods of microsurgical thumb reconstruction were as follows: *Toe to hand autotransplantation* (n=23). The advantages were: one stage reconstruction; restoration of very good sensibility and excellent cosmetic results. Disadvantages were the high risk of postoperative complications (13.4 %) and a contra-indication in cases of obliterating diseases of the lower extremities. *Vascularised reconstruction by forearm flaps* (n=14). This consisted of a radial flap with part of the radial bone and a dorsal forearm flap with a fragment of an ulna. The main advantages were: one stage reconstruction and a satisfactory two-point discrimination of sensibility. However, a disadvantage was the possibility of decreased blood flow to the hand. *Reconstruction by a groin flap* (n=2). This involved a new method of thumb reconstruction. The palmar surface of the thumb after bone grafting (typically from the iliac crest) was treated by a palmar metacarpal artery flap. Next, the dorsal and lateral surfaces were covered by the groin flap. This method may be most suitable when traction injuries of the digital nerves have occurred.

Conclusion: Toe to hand autotransplantation is the method of choice in cases of thumb loss. If this method is impossible, reconstruction by innervated forearm flaps or a groin flap may be used.



FP021

Toe to hand transplantation in traumatic thumb reconstruction: A review of 98 cases

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Subject: The goal of this study is to analyse cosmetic aspect, sensibility, strength, mobility, global hand function, rate and delay of return to work after toe to thumb transplantation.

Material And Method: 98 cases of toe to thumb transplantation are analysed and 65 patients are seen with 7 and half years follow-up. Precise hand function is examined in 47 patients. Five groups are compared: "wrap-around" transfers, composite on-made transfers, pulp, nail and second toe transfers.

Results: For partial great toe to hand transplantation, aesthetic and hand function are excellent and 90% of patients return to work. Second toe are not used yet because of is puffy aspect and is few functional results but there is few foot sequels. Sensibility is correlated with age and is the first restricted factor.

Conclusion: Quality of functional, cosmetic and psychological results justifies the complexity and heavy of this surgical procedure.



FP022

Thumb reconstruction with toe transfer technique

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Thumb reconstruction with microsurgery techniques has been a great contribution to resolve the problem of thumb absence. In the present article we present the transfer technique and its application for amputated thumb's reconstruction. First we made an experience in cadaver specimens. Then, between January 2001 and September 2005, 15 thumb reconstructions were performed in 15 men patients (20-43 years old). We used this technique in 2 cases with amputation at IP level, 9 cases at PF, 2 cases at MTCF and 2 cases at MTC level. The wrap-around technique was used in 11 cases and 2^o toe transfer in 4 cases. 9 cases were right and 6 left side. There were two vascular fails and one partial necrosis, that were concentrated in the first period of this series of patients.

Two patients presented a bone infection with non-union of the bone graft. Five patients with wrap-around technique presented a superficial infection and necrosis flap at the donor site in the foot that was treated with surgical irrigation and antibiotics. After a mean follow up of 19 months, the patients with vascular success were two-point discrimination mean of 14 mm and all of them returned to their previous work. There were no problems with push-off and difficulties walking. Thumb reconstruction with the transfer technique is demanding but permits an excellent functional and cosmetic result with minimal sequel in the donor site.



FP023

Post-traumatic bone lengthening of the thumb

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Introduction: This abstract considers our personal series of bone lengthening of the thumb as performed between 2002 and 2006 at the Verona University Hospital, Hand Surgery Dept., with Smart, a new external fixator system.

Material and methods: We have treated 20 cases requiring post-traumatic lengthening of a thumb stump.

The average lengthening was 3 cm, with a max. of 4 cm and a min. of 1,5 cm. Associated procedures where intramedullary pinning, adductor tenotomy, and the deepening of the first web.

In 15 cases the surgical technique was callotasis. In 5 cases we used bone grafting without removal of the external fixator.

The average treatment time was 80 days.

As to complications, we only had one case of metacarpal bowing due to intramedullary pin loosening. The problem was subsequently treated with osteotomy, followed by a second lengthening period.

In the final evaluation of the approach we have considered the length of the stump, the recuperation of the pinch function, the possibility of further prosthetic implant or microsurgical reconstruction.

Conclusions: Smart is simple to apply for the surgeon, while offering good patient's comfort thanks to its very small size. The millimeter bar reduces the amount of x-ray needed to check on the lengthening, and can be adjusted to best fit the patient.



FP024

Osseo-integrated finger prostheses

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Subtotal finger amputations are cosmetically unsightly. Matched silicone prostheses are cosmetically acceptable but due to a lack of fixation are functionally limiting. Osseointegration offers a solution to this problem but skin/implant infection is a real problem. We offer a novel solution to allow for keratinisation of the tract.

We would like to report a series of 5 Osseo-integrated prostheses using MODIFIED dental endoprosthetic technology. One prosthesis failed due to early loosening. 3 patients with three implants are satisfied with the clinical outcome.

In selected patients this is a technique that is useful and extremely cosmetically appealing.

Our technique and necessary adaptations to existing technology will be discussed.



FP025

Interposition arthroplasty of the DIP joint of the fingers and IP joint of the thumb

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Reconstructive procedures of the Terminal joints of the Hand due to post traumatic, inflammatory or septic arthritis had been primarily arthrodesis. Silicon Implant Arthroplasty has been attempted, but due to breakage of the implant, is not used by many hand surgeons and is contraindicated for septic arthritis. Interposition Anchovy Arthroplasty has been successfully done at the other joints of the upper extremity, but has never been reported for the DIP joints of the fingers or IP joint of the thumbs. I have successfully done this procedure in 20 patients, total of 22 joints. In 2 patients, 3 joints revisions were done. In most cases, a fragment of the Palmaris Longus (P.L.) tendon, or Flexor Carpi Radialis in absence of P.L., was used. Reconstruction of the Radial Col. Lig. for the fingers, or Ulnar Col. Lig. for the thumb must be done, for acceptable outcome. Adjustment or repair of the Extensor tendon insertion must be done, with K-wire fixation for 3 to 6 weeks with additional splinting of the joint for 3 to 6 weeks is necessary, according to the individual patient's need; followed by the hand therapy to increase the R.O.M. Patients must be informed that fusion is a better procedure for this condition and in case this procedure failed, arthrodesis with most likely bone graft, is the salvage procedure. The arc of motion following this procedure is from 10 to 40 degrees with the average arc of motion of 25 degrees. The follow up in this series is from 1 to 15 years with the average follow up of 6 years.

Conclusion: For Symptomatic arthritic condition of the D.I.P. joint of the fingers, or I.P. joint of the thumbs, arthrodesis is a better procedure. But since fusion is not always successful; or if the patient desires to keep some motion of the terminal joints, the Interposition Arthroplasty as was done by this author, is an alternative procedure to the fusion, with the understanding that if this procedure failed, fusion with bone graft, is the salvage procedure.



FP026

Use of a heterodox headless cannulated compressive screw for distal interphalangeal joint arthrodesis in digits: Clinical evaluation of 24 cases

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Multiple fixation techniques have been developed for distal interphalangeal joint arthrodesis in digits. Complication rates, such as delayed and non union, reached 20 % and did not differ between technical alternatives.

Eighteen patients underwent twenty-four arthrodesis of finger distal interphalangeal joints and thumb interphalangeal joints. All patients had a primary osteoarthritic disease. The screw used is the headless cannulated SCR2 (AREX®). This screw is heterodox because the diameter of the penetrating tip is 3 mm on the top of the thread and 2.5 mm on the top of the second thread. The articular surface is removed with a rongeur and a 1 mm K-wire is drilled antegrade through the base of the distal phalanx out the finger tip, just deep to the nail bed. Then the K-wire is passed retrograde the head of the middle phalanx and the screw is inserted distal to proximal. The screw penetrating tip is self-drilling and self-taping, and the second thread is self-compressive. The screw is buried in the distal phalanx. There was no immobilization, and motion was started the following day.

Twenty-three of the twenty-four joints demonstrated complete fusion within 5 weeks. One non-union due to infection is reported. Three screws necessitate to be removed. Two patients presented protruding hardware, and one had a bone fracture of the middle phalanx.

Despite the fact that the fusion must occur without flexion, the screw SCR2 ensures a high rate (95.8%) of consolidation of the distal interphalangeal joints arthrodesis in digits.



FP027

"DIGITAL" finger joints implants for PIP and MCP reconstruction: Preliminary report about 25 cases

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Introduction: The use of a semi-constrained prosthesis allows immediate mobility with good lateral stability after arthritis of PIP and MCP joints, avoiding joint arthrodesis, which relieves pain but resulted in a loss of movement.

Material: We report on a preliminary series of 25 cases in 16 patients (10 women – 6 men). The average age was 50.4 years old (range 25 to 80). Etiology was posttraumatic in 9 cases, degenerative in 4 cases and rheumatoid arthritis in 3 cases. Pain was always present pre operatively, with an average range of motion of 15° for MCP and 29° in PIP. There were 12 MCP joint reconstructions and 13 PIP joint reconstructions.

Methods: We used a posterior lateral approach. In MCP reconstruction, after placing the implant the dorsal extensor system was carefully reconstructed. In PIP reconstruction, the central slip of extensor tendon was protected in 7 cases and reconstructed with dorsal bone fixation in 6 cases.

Results: Our average follow-up is short: 21 months (range 14 to 46)

Pain completely disappeared in 92%.

Average flexion was 75° in PIP (range 60° to 95°) and 77,5° in MCP (range 60° to 90°)

Lack of extension was 20° in PIP (range 10° to 80°) and 17,5° in MCP (range 10° to 20°) We have a painful ankylosis of PIP in two cases, but no loosening, no fracture of implant and no dislocation/

Conclusion: DIGITAL finger joint implants allow significant improvement of some PIP and MCP joints destined for arthrodesis.



FP028

Pyrcarbon interposition implant for treatment of scapho trapezio trapezoid (STT) arthritis with arthroscopic assistance

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Introduction Isolated: STT arthritis is difficult to treat. Recent report of distal resection of scaphoid tubercle seems give painless but impingement is the rule after a few years.

The placement of Pyrocarbon implant between scaphoid and trapezium-trapezoid is an elegant solution.

Material and Methods: All patients were operated on as outpatient's basis under local regional anesthesia using a pneumatic tourniquet. The arm is laid flat on an arm table; axial traction is applied to the forearm and wrist using wrist «tower » traction. The traction force is usually 7 kgf. Firstly the arthroscope is positioned in the midcarpal joint using the radio midcarpal approach. After having located the STT joint, a 1-2 midcarpal surgical approach is performed. 3mm distal scaphoid tubercle resection is a relatively easy procedure with burr and bone rongeur. A short transversal approach allows the placement of test implant and definitive prosthesis. After correct capsule closure a splint is put in place for 3 weeks. We operated on 10 patients using this technique. The average age was 67 years old (range 48 to 79). We had 9 female for 1 male. All patients had permanent pain, disabling in 6 cases. Preoperative medical treatment was done for an average of 3 years.

Results: Our average follow up is short 28 months (range 14 to 36 months). We had two implant dislocations because the resection was insufficient. We don't have any problem in one case after replacement. One other case necessitated a complete trapezectomy for trapezo-metacarpal arthritis because a bad first indication. All the 7 other cases had had excellent result without any pain.

Discussion: The indications are rare but when the rules of surgical placement are respected (sufficient resection, good capsule fixation) the results are very good. The use of wrist arthroscopy allows a short approach for implant placement increasing primary stability. The indications are limited to only isolated STT arthritis.



FP029

Four corner arthrodesis- The advantages of radiotransparent circular plate fixation

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Purpose: Four-corner arthrodesis with scaphoid excision has become a classical treatment for radioscapoid arthritis. This study aims to clinically evaluate the results of four-corner arthrodesis with scaphoid excision using radiotransparent circular plate fixation.

Methods: Over one year, 12 patients were treated with four-corner arthrodesis: for posttraumatic arthritis-10 cases (7 SLAC wrists, 2 SNAC wrists, 1 scaphoid malunion), for irreducible perilunate dislocation -1 case and for the sequels of septic arthritis - 1 case. 11 patients were evaluated by radiographs, objective examination and functional questionnaire. The average follow-up was 11 months.

Results: The union was obtained in 11 cases, one patient reported to have had revision surgery for non-union in another centre. 8 patients were pain free, 3 presented pain with activities or weather related but said they were relieved. The average wrist mobility for these 11 cases averaged 39° in extension, 24° in flexion, 22° in ulnar deviation et 13° in radial deviation

The average grip strength was 21 kgf (56 % of the opposite wrist). One patient had two symptomatic screws: one entered the pisotriquetral joint and the other ruptured the flexor digitorum profundus of the 5 th finger.

Conclusions: The use of a radiotransparent plate allowed an easier union follow-up.

The results obtained with these 12 patients are comparable with those obtained with other fixation methods. They are better than those using the circular metal plate fixed with one screw in each bone. Our osteosynthesis method using 2 screws in each bone seemed sufficiently stable to allow early rehabilitation but the late results haven't shown the interest of early rehabilitation;



FP030

Carpal arthrodesis with the limited wrist fusion plate (hub cap)

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The plate was designed to provide an easy and strong fixation technique in limited wrist fusion.

We used the plate in 8 patients to achieve a partial arthrodesis of the carpal bones. In one patient it was used for a STT-arthrodesis, in 4 patients we did an RSL fusion and in 3 patients it was used for a 4 corner fusion. All patients had a bony union. There was no loosening of the implant and no infection occurred. In one patient we had to remove the plate because of adhesions on the dorsum of the hand. After removal of the plate and tenolysis there was an uneventful course.

The limited fusion plate offers a safe and reliable technique for establishing partial arthrodesis in the wrist.



FP031

Ultrasonograph assessment and force measurement of M. extensor digitorum communis in rheumatoid arthritis (RA) and healthy controls

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Background: Although RA patients frequently experience muscle symptoms limited information exists concerning RA influence on muscle structure and function. The aim of this study was to compare muscle architecture and force developing capacity in RA patients with healthy controls.

Method: M. extensor digitorum communis were examined using ultrasound in 40 women, 20 patients with RA (1987 ACR criteria, mean disease duration 19.9 years) and 20 healthy age-matched controls. Muscle volume, cross-section area (CSA), pennation angles and contraction pattern by from relaxed to fully extended. Finger extension force was measured with a new instrument.

Results: The mean volumes of controls were 16.6 cm³ and RA 12.7 cm³, $p < 0.007$. The control CSA were 1.78 cm² and 1.63 cm² in RA, $p < 0.04$. Pennation angles ranged from 3-9° in both groups. Contraction time of controls were 2.16s and RA 3.11s, $p < 0.001$. The shape changes was 1.6 in the control group and 1.4 at RA, $p < 0.03$. Finger extension force was 39.6 N and RA 18.1 N, $p < 0.001$.

Conclusion: The results show differences in structural parameters as well as functional tests, i.e. contraction time and extension muscle force development, between normal and RA muscles. If these differences depend on a direct disease-specific effect on RA muscles, or is secondary to inactivity, is still to be elucidated. Ultrasound in combination with extension force measurement is a powerful set-up for non-invasive investigations of muscles. It also provides a tool to study how the muscles adapt to physical therapy and surgical intervention procedures. Studies on RA muscle response to activity/training could provide an explanation to the differences found in this study and influence the choice of future therapeutic strategies.



FP032

Kinematics of the midcarpal joint in rheumatoid wrists: A three-dimensional motion analysis

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Purpose : Radiolunate (RL) fusion of the wrist is well-established procedure for rheumatoid arthritis (RA). To achieve successful result of the procedure, it is essential to preoperatively evaluate remaining function of the midcarpal joint. The preoperative kinematic evaluation, however, has not been described even by the lateral view of the X-ray. The purpose of our study was to quantify the motion of the midcarpal joint in various types of RA deformities and to clarify superiority of RL fusion procedure.

Materials and Methods : We acquired *in vivo* 3-dimensional (3D) kinematic data of the 30 wrists of 29 RA patients by 3D computed topographies in wrist neutral and 2 extreme positions of flexion-extension motion. RA type was classified radiographically as the ankylosis, osteoarthritis or disintegration type by Simmen and Huber classification. We created 3D bone models and investigated relative motion of the midcarpal joint with use of a markerless registration technique. We calculated the precise range of capitate motion relative to the lunate and its contribution to the global wrist motion in the flexion-extension plane according to the RA types.

Results : The overall average range of capitate motion relative to the lunate was $31.1 \pm 18.5^\circ$. The average contribution ratio of the midcarpal joint was 51.5%. Average contribution ratio of midcarpal joint in the disintegration type was 59.0%, which was significantly higher than 38.3% in the ankylosis type and 52.6% in osteoarthritis type.

Conclusion : Our results suggested the midcarpal function of the RA patients was more well-preserved than previously thought. We confirmed RL fusion is reasonable option of the treatment for the advanced RA wrist, especially in the disintegration type. This operation may have more global indication for the severe cases which would have been attempted total wrist fusion



FP033

Osteochondral grafting of the metacarpophalangeal joint in rheumatoid arthritis

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Introduction: Isolated metacarpophalangeal joint involvement with dorsal bone loss from proximal phalanx in rheumatoid arthritis is not common and poses a difficult surgical situation. Palmar subluxation with pain and weakness are common presenting features. Osteochondral grafting to the defect can restore the joint stability which might lead to good long term functional outcome.

Methods: Autogenous osteochondral graft was taken from ipsilateral radial styloid process and the results of this procedure performed were retrospectively reviewed.

Results: There were 5 female patients with 3 right and 2 left index finger. Patient's mean age at the time of surgery was 37 years (range 29 to 46 years). The mean duration of follow-up was 53 months (range 16 to 97 months). After the operations, all patients were satisfied and there was no significant pain in all digits; the average flexion arc was 51° (range 40° to 70°); the average tip pinch and grip strength were 71% (range 44%-100%) and 95% (range 83% to 130%) of non-operated side respectively. There was no surgical complication and no donor site morbidity.

Discussion And Conclusion: Stable reduction of the joint was maintained with the current technique but at the expense of diminution in the range of motion. It also appeared to have delayed the deterioration of the joint as seen in cases with longer follow-up.



FP034

NeuFlex and Swanson metacarpophalangeal implants for rheumatoid arthritis: A prospective controlled clinical trial

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This prospective controlled clinical trial compares the outcomes of metacarpophalangeal (MCP) arthroplasty in rheumatoid arthritis patients using the Swanson (S) and NeuFlex (N) MCP implants. Forty hands (37 patients) were randomized and evaluated preoperatively and at one year following MCP arthroplasty in digits 2 to 5 for range of motion (ROM; active and passive extension and flexion), ulnar drift and grip strength.

Both implants restored extension and corrected flexion deformities. There was no significant difference in extension of all digits (summed) between the NeuFlex and Swanson implants (N: -20.8 o; S: -13.8 o; p=0.29). The NeuFlex implant, which is pre-flexed at 30°, preserved more flexion at the MCP joint than the Swanson implant in all digits (summed) (N:74.5 o; S:55.8 o; p=0.005), with the greatest difference observed in the fifth digit (N:69.6 o; S:48.7 o; p=0.009). The total arc of motion improved in all digits, with no significant differences between the NeuFlex and Swanson groups in the second through fourth digits (N:53.8 o; S:43.8 o; p=0.154); a significantly greater improvement was observed in the NeuFlex group for the fifth digit (N:53.3 o; S:42.5 o; p=0.028). Both implants corrected ulnar drift deformity, while neither led to loss of grip strength.

Hand function as measured by Sollerman score and Michigan Hand Questionnaire (MHQ) improved significantly in both groups (p=0.0119, p<0.0001, respectively) with no significant difference between the Swanson and NeuFlex implants, except for MHQ function, aesthetics, and overall scores, which demonstrated superiority of the Swanson.

Overall, there was a significant improvement in the range of motion, deformity and grip strength following MCP arthroplasty for the full patient group. While both implants restored similar amounts of extension, the NeuFlex implant maintained greater flexion and total range of motion, with the greatest difference in the fifth digit. The Swanson implant had better MHQ function and aesthetics subscores.



FP035

Total wrist replacement. A resurfacing arthroplasty

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Introduction: Replacement of the wrist by anatomic resurfacing provides a new approach to painful arthritic wrist in the rheumatoid and post-traumatic patient. We will report our experience with a new resurfacing wrist arthroplasty

Methods : A review of 25 patients with wrist arthroplasty was performed. The implant involves bone integration proximally and distally. Bone cement is not required. Nineteen were rheumatoid and six were post-traumatic conditions. Precise alignment guides and imaging was performed during the procedure. Supplemental bone graft was used in 5 patients. Pre and post operative pain, motion, strength and function were assessed. Mayo wrist score and DASH were assessed. Radiographic evaluation of the implant for alignment, loosening, subluxation was studied.

Results and Data assessment : Range of motion average 42* of extension and 38* of flexion. Grip strength increased 15%. There were no cases of loosening, instability, infection, or tendon injury (rupture) One case of flexor carpi radialis tendinitis was noted. The total wrist was combined with distal ulna replacement in 4 cases. There was high patient satisfaction with two patients converted from wrist fusion to wrist arthroplasty. Based on DASH and Mayo wrist score there were 18 excellent and 7 good with no fair or poor results.

Conclusion : Total wrist replacement with resurfacing components provides good outcome and function based on preliminary assessment of clinical results. There was high level of patient satisfaction



FP036

One-year results from an on-going multi-center study of the Avanta total wrist implant R

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Introduction: The Avanta Total Wrist Implant R is non-constrained with ellipsoid (bi-axial) joint surfaces and titanium stems for non-cemented fixation. August 2004 we started a prospective multi-center study including six hospitals in Sweden and Denmark. We plan to include 60 patients and follow them with standardized measurements for five years.

Method: Patients scheduled for total wrist arthroplasty were consecutively included after informed consent. The protocol comprised of x-ray, DASH-score and clinical measurements pre-operatively, at 6 weeks, 3, 6, 12, 24, 48 and 60 months post-operatively. Hitherto we have included 57 patients (12 men, 45 women) with an age of 61 (30 – 82) years. Indication for surgery was rheumatoid arthritis (48), osteoarthritis (4), post-traumatic arthritis (4) and Kienbock (1). 22 patients have passed the one-year re-examination with the following results (mean values).

Results: No serious per- or post-operative complication was registered. At one year, all but one patient reported improved function and less pain, the DASH score improved from pre-op 83 (60-113) to 61(28-121). In 14 patients ROM improved, average improvement was 11 o. In 8 patients ROM decreased, in average 8 o. ROM at one year was 56 o (30 o-135 o). Radial deviation did not change (mean 9 o), while ulnar deviation improved from 15 o to 17 o. X-ray showed in 9 cases a radial tilt of the radial component exceeding 10 o. In 8 cases the cup had poor contact with the underlying bone, but there were no signs of loosening.

Conclusion: Short- term results from this ongoing study are encouraging in terms of no complications, reduction of pain and improved function. The recent release of a new surgical instrumentation will probably enable a more accurate positioning of the implant. We will present a larger one-year material from the study, as well as five-year results in the future.



FP037

Non-bridging external fixation for unstable fractures of the distal radius

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Introduction: In this study, non-bridging external fixation was performed for unstable fractures of the distal radius and the radiographic alignment and clinical results were followed-up.

Method: 80 patients (55 women, 25 men) with fractures of the distal radius were treated by non-bridging external fixation with Hoffmann 2 compact external fixator. But fractures that have comminution of articular surface and volar cortex were excluded. Their average age at surgery was 61 years (range, 22 to 92). The average periods of fixation was 6.6 weeks. The average follow-up period was 1.3years (range, 1to 3). At follow-up examinations, radial inclination (RI), palmar tilt (PT) and ulnar variance (UV) were measured as the radiographic alignment at the point of injured and at reduction, at removal of external fixation and at follow-up to evaluate acquirement and maintenance of reduction. Clinical assessment was achieved through the use of Mayo wrist scoring chart.

Results: At follow-up, patients had acquired satisfactory range of motion of their wrists; flexion $60\pm 10^\circ$, extension $61\pm 10^\circ$, supination $85\pm 7^\circ$ and pronation $86\pm 8^\circ$ (mean \pm SD). Grip strength was 81.4% of the contralateral side. According to Mayo score there were 32 excellent, 34 good, and 14 fair results. Radiographic alignment, RI was $15.9\pm 7.5^\circ$ at injured and $24.4\pm 4.5^\circ$ at the point of reduction ($p<0.001$), $25.0\pm 5.5^\circ$ at removal of fixator, $24.4\pm 4.5^\circ$ at follow up. PT was $-15\pm 16.9^\circ$ and $10.6\pm 4.0^\circ$ ($p<0.001$), $10.8\pm 4.5^\circ$ ($p<0.05$), $10.3\pm 6.4^\circ$. UV was 4.0 ± 2.5 mm and 1.2 ± 1.3 mm ($p<0.001$), 1.8 ± 1.6 mm ($p<0.05$), 2.0 ± 1.6 mm. Only 4 cases had a loosening of half pin and 3 cases had pin site infection. No patients had extensor tendon injury.

Conclusion: Non-bridging external fixation can acquire good stability to resist dorsal tilt and axial shortening by using subchondral support, and satisfactory clinical results were gained even for unstable fractures of the distal radius. Non-bridging external fixation was considered to be one of the useful surgical procedures for unstable fracture of the distal radius .



FP038

Minimally invasive plate osteosynthesis for distal radius fractures

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Purpose: Palmer locking plate has been undergone for dorsally displaced fractures of distal radius. But it is usually required with wide exposure involving the pronator quadratus muscle. A new technique of minimally invasive osteosynthesis using a new palmer locking plate system which are developed by authors is reported.

Methods: From 2004 to 2006, 35 wrists in 35 patients with the mean age of 58 years. The type of fractures consist on 14 wrists in A2, 10 in A3, 7 in C1, 4 in C2 according to the AO classification. The follow-up period ranged from six to 24 months, with a mean of nine months. After incising the distal and proximal edges of the PQ, it is elevated subperiosteally. A locking plate is passed beneath the pronator quadratus muscle from the distal margin without transecting the muscle. Insertion of the proximal screws and reduction of the intra-articular fragment are performed through the limited incision of the pronator quadratus muscle. Active motion of fingers and wrist are started at next day after surgery.

Results: Union was achieved in all fractures without loss of reduction in X-ray measurement. The clinical evaluations were excellent in 33 wrists, good in 2 according to a modified the Green and O'Brien score. An average term of return to daily activities was 3 weeks after surgery .

Conclusions: This new technique prevents soft tissue damage and adhesion around the pronator quadratus muscle. Although the indications of this technique are limited for the fractures of all extra-articular fractures or simple type of intra-articular fractures, we believe that distal radius fractures without severe comminution can be cured within three weeks.



FP039

Is bone augmentation required for fractures of the distal radius? Results of a prospective, randomized clinical study to evaluate the benefits of bone augmentation of the dorsal comminution zone in high grade distal intraarticular radius fractures

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Background: The large dorsal comminution zone in extension-type fractures of the distal radius is often augmented with bone substitutes during dorsal Pi-Plate osteosynthesis. Currently there is no consensus as to whether this is required or not. A study was designed to evaluate the functional and radiologic outcome with and without bone augmentation.

Material and Methods: 40 patients with high grade, distal intraarticular radius fractures (AO-Classification C1- C3) were enrolled in a prospective, randomised trial. 20 patients received bone augmentation with Cronos during dorsal Pi-plate osteosynthesis, whereas in the other 20 only internal fixation with the same implant was performed. Clinical follow up was scheduled at 2, 6, 12, 24 and 48 weeks. Implant removal was performed 6-8 months postoperatively. Joint surface position, secondary dislocations, range of motion, individual pain, return to work and DASH score were the main parameters.

Results: No significant differences were observed between the two groups in regard to motion and strength. Similar results were also observed in joint surface position, DASH score and length of absence from work.

Conclusion: Bone augmentation of the dorsal comminution zone is often performed simultaneously with internal plate fixation in high-grade intraarticular fractures of the distal radius. 1 year post-OP there are no significant differences between groups that received a bone substitute and those treated with osteosynthesis alone. We thus conclude that bone augmentation increases the cost of treatment without a clear benefit for the patient.



FP040

Two kinds of fast and slowly resorbable and injectable bone substitutes used in osteotomies for malunion of the distal radius

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Patients with a painful malunion after a distal radius fracture and a limited pronation-supination might benefit from a radius osteotomy. To fill the gap most often a bone graft is used harvested from the iliac crest. To avoid the morbidity correlated to the graft harvest bone substitutes can be used and we present our experience with two kinds of injectable and resorbable bone substitutes combined with the TriMed ®

Wrist fixation system.

25 patients, 18 women and 7 males were treated. The osteotomy was performed at the site of malunion with correction of the malposition and internal fixation. In 15 cases the osteotomy gap was filled with Norian SRS ®, which is a less resorbable Calcium Phosphate and in 10 cases with Cerament ®, a mix of Calcium Phosphate and Calcium Sulfate which resorbs within weeks to months. Both bone substitutes are injectable and hardens in situ. The study was prospective and grip strength, ROM, pain (VAS) and DASH were analyzed.

Grip strength and ROM in pronation-supination improved significantly. DASH decreased more than 10 points. Most of the patients could be treated ambulatory and none stayed more than one night in the hospital. The correction of the dorsal and radial angulations and the ulna plus were significant and no loss of correction was observed during the follow-up.

Both Norian SRS ® and Cerament ® showed a solid stabilization of the osteotomy together with the TriMed ® fixation. The resorption was slow and incomplete for the Norian ® in contrast to the Cerament ®, which disappeared rapidly on the radiographs.

This study shows that an injectable and resorbable bone substitutes can be successfully used in radius osteotomy avoiding the potential complications related to the harvest of an iliac crest bone graft. The correction is retained also when using a fast resorbable bone graft.



FP041

Variable angle locked volar plating in distal radius fractures

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Introduction: Interest in locked volar plating of distal radius fractures has grown enormously over the last 5 years. Our unit has been able to expand the indications for this technique with the use of a new plate that allows variable screw angulation but still has angular stability.

Methods: 27 consecutive distal radius fractures were followed prospectively with recording of subjective (PRWE) and objective and radiographic outcome measures. Using the AO classification there were 5 A3, 2 C1, 12 C2 and 8 C3 fractures. 22 were high energy fractures.

Results: Mean average flexion was 68°(55-85) and extension was 69° (50-85). Mean supination was 82° (72-90) and pronation was 86°(75-90). Average palmar tilt was restored to +5° and radial inclination to 21°. Average ulnar variance was -1mm.

Discussion: These results compare very favourably with published data for similar series of fractures. We have been able to deal with a greater range of fractures with a variable angle locked plate than was possible with a fixed angle device. In addition technical manouvres possible with such a device which improve fracture management are discussed. Operative time has also been reduced when compared to other techniques utilized in our unit for more complex fractures.



FP042

Assembling the jigsaw: Osteo-plastic fixation of the distal radius

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Comminuted distal radial fractures are relatively common and new techniques of fixation are evolving. There is currently no consensus on the treatment of unstable distal radial fractures. Utilizing "fragment specific fixation" we describe a potentially useful form of internal fixation. Our aim was to report on the outcome and any complications for patients fixed via this method.

A retrospective review of 16 patients admitted to the Sydney Hand Unit with highly comminuted intra-articular distal radial fractures was performed. We describe the operative fixation technique, and report on follow-up radiographic, and clinical outcome data in these patients.

The technique involves a progressive approach from proximal to distal, with reduction and fixation of specific fragments using Luhr Pan-fix plates. The construct can then be definitively fixed using the surgeons method of choice (eg volar plate).

The average postoperative radial inclination was 20 degrees, the average palmar tilt was plus 4 degrees, and the average ulna variance was -0.35mm. The position was maintained in 12/13 cases over a minimum 6month followup. The average PWRE score was 20.5. The only complication was a late FDP rupture to the index finger which was treated with metal removal and a tendon weave to the adjacent flexor tendon.



FP043

The volar approach for fractures of the distal radius: 100 patients analysis

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We review the results of 100 patients with distal radius fractures treated surgically by the volar approach and fixation with fixed-angle volar plate, since March 2002 to December 2005. The indications were: instability only (17%), instability and articular displacement (72%), articular displacement only (5%), contralateral upper limb fracture (3%) and refusal of non-operative treatment by the patient (3%). There was 58% female and 42% male, age was 46,8 years (11 to 81 years). Radiographic averages results after surgery shows Dorsal Tilt of -8° (2° to -18°), Radial Inclination of 19° (-8° to 24°), Radial Shortening of 0,5mm (0mm to 6mm) and articular surface displacement of 0,13mm (0mm to 1mm). Compared to the contralateral wrist we found the Dorsal Tilt correction of 97% (70% to 100%) and Radial Inclination correction of 95% (65% to 100%). The flexion-extension range of motion was 144° again 147° of opposite side (98% of normal ROM), pronation-supination ROM was 176° again 177° of contralateral limb (99% of normal ROM) and radial-ulnar deviation of 41° again 45° of other wrist (91% of normal ROM). According Gartland score we found 86% of excellent, 10% good and 4% fair results. There was 2 infections, and 2 patients with loosening of reduction. Fracture healing occurs at an average 8 weeks time in all patients. We consider the volar approach and fixation with volar fixed-angle plates the best treatment choice for fractures of the distal radius when surgical treatment is indicated. This can lead to lower rates of complications and improved functional and radiographic results compared to other techniques.



FP044

Closed reduction and open fixation of distal radius fracture. An innovative method using Chinese finger trap traction

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Introduction: Distal radius fractures are a common injury encountered in every trauma unit. Various treatment modalities have been described in treating these common fractures depending on their severity. We describe an innovative method for closed reduction of these fractures using Chinese finger trap traction followed by open fixation with a pi plate. This is similar to DHS fixation of an inter trochanteric fracture.

Methods: The patient is placed supine on a standard traction table. An above elbow tourniquet is placed and the arm is prepared and draped. Chinese finger traps are attached to the index, middle and ring fingers. Using the traction table traction is applied through the Chinese finger traps with counter traction applied in the axilla via a bollard.

Under image intensifier control the fracture is reduced and either through a dorsal and volar approach the fracture is approached depending on the type of the fracture i.e. dorsal or volar displaced. With minimal soft tissue disruption the fracture is fixed with either a dorsal pi plate or a volar T shaped plate without actually opening up the fracture haematoma.

Conclusion: This is an innovative method for treating a common fracture. The advantages are accurate reduction, maintenance of reduction while fracture is fixed and minimal soft tissue dissection.



FP045

Early prognostic factors for a bad outcome in non-osteoporotic distal radius fractures

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Background: Various causes are correlated to a bad outcome after distal radius fractures (DRF). Classifications according to Frykman and AO could not correlate radiographic findings with outcome (Flinkkila et al 1998). Especially in the non-osteoporotic population, a subgroup involving high energy trauma (Lindau et al 1997) and complex associated injuries (Lindau et al 1996), it is important to find prognostic markers to detect and treat fractures likely to result in a bad outcome. Aim: To assess which parameters on the initial pre-reduction radiographs (X) correlate with clinical outcome in DRF.

Methods: 66 patients (34 F, 32 M) of non-osteoporotic age (F18-60 years, M 18-50; median 42) with DRF were treated conservatively or surgically during 1 year at the Department of Orthopaedics in Lund, Sweden. Clinical outcome was assessed, at a median follow-up of 27 months, using subjective and objective evaluations of Gartland and Werley score (GW). The X was evaluated regarding dorsal tilt, radial length, radial angulation, ulnar variance, comminution, involvement of articular surfaces or ulnar styloid and fracture classifications. Multivariate analysis was performed to correlate outcome (GW) to radiographic findings.

Results: Positive ulnar variance > 2mm (Ulna +) was the only factor predicting outcome ($p = 0.017$; Odds ratio 2.53; 95% conf int. 1.18-5.41). The dorsal angulation (Odds ratio 1.06; 95% conf int. 0.99-1.14) and a fracture involving the radiocarpal joint (Odds ratio 4.41; 95% conf int. 0.94-20.59) were weak factors. No correlation was found for the classifications.

Discussion and conclusion: Ulna + is a strong prognostic factor for a bad outcome in non-osteoporotic DRF and should be considered when selecting appropriate treatment in non-osteoporotic patients. The tendency that dorsal angulation and intra-articular involvement seem important should be kept in mind in managing these fractures. Finally, there is no support for the use of classifications.



FP046

Plate removal after forearm fracture repair: To do or not to do?

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Removal of metal implants after open reduction and internal fixation of fractures is controversial. Potential negative aspects of indwelling implants such as stress shielding, metal release, allergies, limitations for later surgical procedures contrast with high cost and potential risks. However, knowledge about indication, timing and complications associated with metal removal procedures remains very limited. Purpose of this study was to analyse published data on indication, timing and complications of forearm plate removal.

Fourteen studies including a total number of 635 cases of forearm plate removal were analysed for indication, timing, complication and recommendations given by the authors.

While 69.1% of the patients were asymptomatic at the time of surgery, 30.9% complained of tenderness, barometric pain, implant prominence and bone infections. The average total frequency of complications was 24.0 (11.8-40)%: Iatrogenic nerve injuries occurred in 11.5 (2.0-29.1)%, refractures in 7.7 (2.0-26.1)%, wound infections in 6.8 (4.8-11.5)% and hypertrophic scars in up to 9.1%. However, e.g. the increased forearm refracture rate turned out to be clearly associated with the use of 4.5mm DC plates, plate removal after less than twelve months, poor anatomic reduction and open fractures. Furthermore, a higher complication rate seems to be associated with a lower surgeon`s level of training.

Considering the identified risk factors, forearm plate removal can be performed with a complication rate of less than 2.0%. However, major prospective clinical multicentre studies are required to finally answer the question whether to remove the implants or not



FP047

Children with surgically corrected hand deformities and upper limb deficiencies: Self-concept and psychological well-being

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Purpose: To study the self-concept and psychological well-being in a representative group of children who had undergone surgery for hand deformities or had been fitted with prosthesis.

Methods: Ninety-two children, 53 boys, 39 girls, aged 9-11 years were targeted for this study. The children in the study group were subdivided into two subgroups – one with simple finger-hand deformities and another one with complex finger-hand deformities. Of the 92 children, 79 had received corrective surgery (28 of those had also been treated with orthoses) and 13 had been treated with prostheses. The Piers-Harris Children's Self-Concept Scale (PHCSCS) was used to measure self-esteem. The results were compared to a group of normal children.

Summary: Overall PHCSCS scores showed that the whole hand deformity group had "good" self-concepts with mean scores in excess of 60 points, with total score 65.8 for the deformity group and 64.7 for the comparison group. However, within the hand deformity group, those children with mild deformities had significantly lower total scores than those with more severe deformities ($p < .004$). Of the 80 items there were 16 showing significant difference between the severe and mild hand deformities subgroups. The group with severe hand deformities had higher self-esteem than the group with mild deformities.

Conclusions: Children with hand deformities had overall a high self-esteem in comparison with normal children. However the results also indicated that the children with the milder hand deformities had poorer self-concept than the ones with more severe malformations. Hence, the children with milder hand deformities might need more support by healthcare, school and parents.



FP048

The characterisation of causative mutations in an unselected cohort of 203 patients with congenital limb malformations requiring reconstructive surgery

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Congenital limb malformations (CLMs) are common, presenting to both specialist and general hand surgeons. Their aetiology is heterogeneous, but the major causes are genetic mutations and intrauterine disruptions. We aimed to characterise the causative mutations in an unselected cohort of patients with limb malformations requiring reconstructive surgery.

Patients presenting with CLMs requiring surgical intervention were recruited. At operation, blood was taken for DNA extraction and karyotype analysis. Candidate genes were screened for point mutations using DHPLC and direct sequencing, and for deletions by MLPA. We describe the clinical characteristics of the cohort, and the results of mutation screening.

From an unselected cohort of 203 patients, causative genetic changes were identified in 22 (11%). Factors which predicted the discovery of a genetic cause included a bilateral malformation, positive family history, and having increasing numbers of limbs affected (all $p \leq 0.01$). A further 39 patients had a family history of consistent limb malformations, and 5 patients had identified syndromes, strongly suggesting a genetic cause of the limb malformation. Therefore, at least 32% of CLMs have a genetic aetiology.

This study is the first to systematically screen for genetic mutations in an unselected cohort of patients with CLMs requiring surgical intervention. We have found mutations in 11% of cases. The presence of family history, bilaterality, an increased number of limbs affected, as well as specific patterns of malformation, predict a genetic aetiology, and helps to refine the selection of patients for referral to a Clinical Geneticist.



FP049

Normative grip strength data on JAMAR dynamometer in young children (4-12)

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Objective: Grip strength is a key parameter in the assessment of hand function. The instrument most often used is the JAMAR Dynamometer. It has good validity and reliability in adults. However grip strength measurements are often performed in children with congenital hand problems. Therefore normative data are necessary to compare these children with healthy children. Purpose of this study was to establish good normative data in healthy children under the age of 12 with the use of the JAMAR Dynamometer.

Methods: Children from a primary school were approached to participate. A total of 130 children were included. Subjects were divided into three groups: 4-6 & 7-9 & 10-12 years of age. Grip strength was measured for both hands with JAMAR Dynamometer using the standard protocols as described in the literature. For all measurements, the mean of three maximum voluntary contractions was recorded. Linear regression analysis was performed to estimate the relation between the mean strength with the JAMAR for the dominant and non-dominant hand as a function of age.

Results: The Mean (and Standard Deviation) for the dominant and non-dominant hand respectively were 13,15 (5,47) and 12,25 (5,19) for "the total group"; for "the 4-6 year olds"(n=35): 7,21 (2,43) and 6,76 (2,06); for "the 7-9 year olds"(n=52): 12,62 (2,71) and 11,89 (2,61); and finally for "the 10-12 year olds"(n=43): 18,63 (4,21) and 17,40 (3,98).

For the dominant hand, the relation between age (between 4 and 12) and strength of the JAMAR in Kilo Newton was: $\text{strength} = -3.2 + 1.96 * \text{age}$. For the non-dominant hand, the relation was: $\text{strength} = -3.1 + 1.84 * \text{age}$.

Conclusion: With the use of these formulas it is possible to predict a child's strength and strength development over time. The data and strength development formulas are a good baseline for comparison with children, who do have congenital hand problems.



FP050

Normal thumb length in children

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Determination of thumb length in children is helpful in the diagnosis of congenital syndromes and in the evaluation of the outcome after reconstruction of the thumb in congenital or posttraumatic conditions.

We examined 262 normal school-aged children using a simple technique and simple equipment to gather information related to age, dominance and gender. The key pinch and the palmar crease were noted. This survey is an extension of the work of Sunil (2004) , who did a study with 26 adults. Using our statistical conclusions on 262 children , we illustrate the differences between children and adults.

The data were used to draw up growth curves and percentiles, which can be used as guidelines to detect early pathologies and syndromes in children. This information may also be useful to obtain a favorable and functional result when carrying out pollicization, bone lengthening and microvascular toe transfers as a treatment for posttraumatic partial or complete amputation.

Catalano III LW 2001, Goldfarb C 2005, Gupta A 1998, Littler JW 1973, Park AE 2003, Sunil TM 2004



FP051

The length of the first metacarpal in the treatment of triphalangeal thumb

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Purpose: The Triphalangeal Thumb (TPT) is not a normal functioning thumb due to its extra length, altered stability and position and often hypoplastic thenar musculature. Is the additional length only caused by the extra phalanx or is the first metacarpal of influence as well? Purpose of this study is to establish length of the first metacarpal in TPT for the different types of TPT and the possible influence on corrective surgery.

Methods: Hands of patients with TPT (N=59) were examined on type of TPT (Delta, Trapezoid and Full type), position of growth plate and relative length of the first metacarpal. Ratios of the measurements were calculated (Second Metacarpal / First Metacarpal) and compared to a normal population.

Results: First metacarpals in all three types of TPT were significantly longer compared to a normal population. Full and Trapezoid type TPT are significantly longer than Delta type TPT. From the different positions (distal, proximal and double) the distal growth plate (58%) was the most common.

Conclusions: Positions of the growth plate vary in TPT more when compared with a normal population. All types of TPT have a longer first metacarpal. A reduction osteotomy of the first metacarpal can therefore be a logical step to reduce thumb length in addition to either removal or arthrodesis with reduction at an interphalangeal joint.



FP052

Index finger pollicisation: Factors affecting outcome

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Pollicisation is performed sufficiently infrequently that there are few large series with outcomes analysed.

The purpose of this study was to evaluate the aesthetic and functional outcome of pollicisation by a single surgeon and to assess the influence of factors that may affect outcome.

All pollicisations, performed by a single surgeon from 1989 - 2000 for congenital aplasia or hypoplasia of the thumb were reviewed. The relationship of outcome to the presence of other upper limb anomalies and to the timing of surgery was examined. The patients were assessed clinically at a median of 65 months post surgery (range 6-119 months). Their outcome was rated using the Percival score.

Eighty-one patients had had 95 pollicisations. Forty-two had bilateral thumb hypoplasia, 55 had other upper limb problems, whilst 51 had other congenital anomalies. Seventeen patients had isolated unilateral hypoplasia without any associated upper limb abnormality. Only two patients had isolated unilateral thumb hypoplasia, suitable for pollicisation, but without any other congenital anomalies.

Fifty-two patients with 64 pollicisations were available for review. Thirty-three thumbs had an excellent or good result whilst 23 thumbs had a fair or poor result. Age at surgery per se did not appear to affect outcome whereas the presence of radial club hand correlated with a poorer outcome. Neither mirror hand nor polysyndactyly appeared to correlate with a particular prognostic outcome.

The results of pollicisation by an experienced surgeon are influenced by the case-mix of patients treated. The presence of radial club hand and its associated deficiencies was the greatest single determinant of poorer outcome.



FP053

Long term results after surgical correction of radius dysplasia

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Introduction: The purpose of this study was to evaluate functional and radiographic long-term results of surgical treatment of radius dysplasia.

Methods: 8 patients with 11 radius deficiencies (7 type IV, 2 type III and 2 type II according to Bayne and Klug) were included in the study. 5 extremities were treated with a centralisation and 6 with a radialisation procedure. Average age at surgery was $3,3 \pm 2$ years and average follow-up period $8,1 \pm 4,7$ years. X-rays were assessed according to the criteria of Manske. Hand function was evaluated with the Millesi and the Jebsen-Taylor hand test.

Results: Radial deviation measured $13,2 \pm 38,5^\circ$, hand-forearm position was $6,6 \pm 11,6$ mm and ulna bowing $31,8 \pm 23,9^\circ$. The small and the ring finger contributed 50% to the total ROM of the hand. Millesi scoring yielded 37 ± 22 of 100% hand function in accordance with altered Jebsen-Taylor scores of $+88 \pm 95\%$ compared with normal values. There was no statistically significant difference between the two surgical techniques.

Conclusion: In our series both surgical techniques led to acceptable and stable results with minimal reoccurrence of the deformity. Concerning the functional outcome it seemed to make no difference whether a centralisation or radialisation procedure was chosen. The evaluation of a non-treated adult patient suffering from bilateral radius dysplasia showed us that surgical intervention is not only a cosmetic, but also an important functional correction of this mutilating deformity. Surgery does not affect the actual hand function but the realignment of the hand-forearm axis provides additional upper extremity length to the patient, thus enabling distance reaching and ano-genital care.

References: Goldfarb CA 2001, Buck-Gramcko D 1985, Bora FW 1981.



FP055

Bone growth of the ulna after lengthening in radial club hands

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Introduction: Bone lengthening has been proved to be useful method in treating congenital short ulna in radial club hand deformity. However, it has a potential risk of deteriorating original growth ability of the ulna. The purpose of the current study was to investigate changes in growth rate before and after bone lengthening in radial club hands.

Materials: We performed bone lengthening of the ulna in 8 patients (once 4 patients, twice 4 patients). The mean age was 6.4 years at the first lengthening and 10.6 years at the second lengthening. Mean follow-up was 9.3 years.

Results: The mean length gained was 4.2 cm, (46.1% of original ulna) after the first lengthening and 7.0cm, (53.2%) after the second lengthening. The mean Healing Index was 47.9 and 30.1 respectively. The mean growth ratio of the affected ulna to the contralateral ulna was 59.8% before the first lengthening, but decreased to 39.7% after the first lengthening and to 6.2% after the second lengthening. No serious complication occurred at the first operation, but at the second operation we experienced joint contracture in 3 patients and callus fractures after removal of external fixator in 2 patients.

Conclusion: Bone lengthening, especially the second lengthening resulted in significant retardation of growth rate. Complication was more often and severe in the second lengthening. We should consider the period and the number of times of the operation.



FP056

Iliac bone with apophysis grafting to donor site of toe phalanx transfer to short digits with defective phalanx of the hand

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Introduction: Nonvascularized toe phalanx transfer can be chosen to elongate short digits with defective phalanx of the hand. The open epiphysis and growth of the transferred toe phalanx is thought to be expected with high percentages if this procedure is performed earlier than 2 years old. However, this procedure trades down short deformity of the donor toe. We transfer iliac bone with its apophysis to the donor toe to avoid shortening.

Materials and Methods: We transferred 20 toe phalanges to 8 cases with short digits of the hand. The patient average age at operation was 1 year and 3 months. Follow-up time averaged 5 years and 8 months. Iliac bone with its apophysis was grafted to 10 toe donor site defects in recent 5 cases.

Results: Fourteen grafted toe phalanges with more than 5 years and 7 months in 4 cases were evaluated. The epiphyses of the 6 out of 14 phalanges were open. There was notable growth in 10 out of 14 grafted phalanges. The growth rated 50 to 87 % with the average of 74% of contralateral unoperated site. New joint was created between the base bone and grafted toe phalanx in 7 of 14 transfers with average range motion of 41 degree. The iliac bone apophysis grafted to the toe donor site was kept open in all 10 transfers and shortening of the donor toe was well prevented. Even the tendency of postoperative overgrowth of the grafted iliac bone was noted in more than half of the cases.

Discussion: Toe phalanx transfer to short digits with defective phalanx of the hand successfully elongated the digits and provided useful function to the operated hand. Interposition grafting of iliac bone with its apophysis well prevented shortening of the donor toe which has been the significant donor site morbidity.



FP057

Congenital duplication of the thumb

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Duplication or polydactyly of the thumb is among the most common of congenital deformities that involve the hand. The Wassel classification was used to indicate the type of bone and soft tissue deformity. There are three main surgical treatments: excision of one of the duplicates, resection of the mid-portion of the duplicates and retention of one of the duplicates with addition of tissues from the resected duplicate.

The purpose of this study is to report the incidence, operative approach and results associated with treatment of thumb duplication and to compare the results with a previous series from the same institution. **Methods and Materials:** A total of 31 patients with 35 congenital thumb duplications were reviewed from clinical record review and with a modified DASH score. There were 19 males and 12 females. The average age of surgery was 15.5 months. The most common duplications were type II (eight thumbs), type IV (12 thumbs), and type V (five thumbs). There were six type VII triphalangeal thumbs. In this series, there were thirty-three combination procedures, and no simple deletions. In the six triphalangeal thumb, the treatment was delta or extra phalanx deletion, joint reconstruction, joint stabilization, and transfer of combined parts. Radiographic assessment was used to determine residual phalangeal or metacarpal angulation. The results of these procedures were evaluated by the method of Dobyns. **Results:** In this series of thirty-five thumbs there were 4 excellent, 29 good and 2 fair results. The poor results were related to instability and deformity. The two Bilhaut-Cloquet procedures were considered functional well but cosmetically fair to poor. Problems included nail deformity, short and stubby distal phalanx, and stiffness of the interphalangeal joint. The excellent results were found in duplications with asymmetry in which tissue was added to the ulnar duplicate. The present series was compared with our previous experience on this subject.



FP058

Reconstruction algorithm for congenital hand contractures

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Congenital hand contractures are generally classified as arthrogryposis multiplex congenita, congenital clasped thumb, ulnar drift accompanied by congenital finger contractures and camptodactyly. The aim of this study is to compile a reliable algorithm for the surgical treatment of congenital hand contractures. Unlike other hand contractures originating from different etiologies, the reconstruction of congenital hand contractures necessitates not only the reconstruction of soft tissue coverage but also mechanical restoration as well. To achieve a more functional posture and subsequently restore the active and passive motion, we utilized procedures such as skin grafting, local flaps, dorsal capsulotomy, thenar muscle release and tendon transfers. This study examines the preferred surgical methods for congenital hand contracture cases admitted to our clinic and their final outcomes. 19 children (11 male, 8 female) whose age ranged between 3 and 12 years (mean age 6.1) operated between 1998 and 2006 were included in this study. The study group consisted of 10 arthrogryposis multiplex congenita and 9 ulnar drift cases. In most cases, full thickness skin grafts were used to release the metacarpophalangeal and distal interphalangeal joints. For the reconstruction of the first web, various techniques like z plasty, double z plasty and dorsolateral rotation flap from second finger were used. K-plasty technique was utilized to deepen other webs. To release the contracted thumb from the palm, the transfer of EIP or EDM to the EPL-EPB complex was performed in selected cases and/or adductor release was applied. The shortened tendons were lengthened using z plasties. In almost all cases, satisfying postural and functional results were achieved.

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2. Wood VE, Biondi J. Treatment of the windblown hand. *J Hand Surg [Am].* 1990 15(3): 431-8.



FP059

FCR tendinitis and radial sided wrist pain

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This is the largest series of surgically treated cases of FCR tendinitis.

We retrospectively analysed the data of 37 cases with FCR tendinitis operated on between 1996 and 2006. Nine patients had no swelling over the FCR tendon, nor the STT joint. On examination the majority of patients had pain over the STT joint which coincides with the entrance of the fibro-osseous tunnel of FCR. Two patients had no swelling but pain over the STT joint and normal x-rays. 26 patients had significant STT arthritis. Five patients had pantrapezial arthritis. Six patients had normal x-rays. All cases of clinically suspected tendinitis were confirmed by high resolution ultrasound examination and verified during surgical decompression.

During follow-up, three patients had some mild discomfort when stressing the STT joint. One had minimal pain in the CMC joint. None of these patients required further treatment. One patient underwent a resection interposition arthroplasty two years after FCR decompression for ongoing pain in the basal joints.

We conclude that reliance on clinical examination and x-rays alone will miss some cases of FCR tendinitis. We propose in cases of predominant STT arthritis and radial sided wrist pain to perform further imaging either by high resolution ultrasound or by MRI scan to clearly evaluate the FCR tendon in its fibro-osseous tunnel.

Even in the presence of advanced STT arthritis treating concomitant FCR tendinitis brought lasting pain relief in this series.



FP060

Osteoarthritis of trapeziometacarpal (TM) joint

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Introduction: Few sporadic cases of intrarticular Hyaluronic acid (HA) administration for treating trapeziometacarpal (TM) joint arthritis were reported. The study aimed at prospectively investigating the effect of intraarticular administration of HA in early stages of TMJ arthritis in comparison to steroid injection.

Methods: 52 patients with symptomatic TMJ grade II arthritis were randomized prospectively for steroid or HA injections. 25 patients (Mean age 62) were treated with steroid injections. 27 patients (Mean age 62) were treated with 15 mg sodium hyaluronate. Pre-injection evaluation included estimation of pain severity, grip and pinch strengths, and functional evaluation by Purdue Pegboard test (PPT). Evaluation was repeated at 1, 3, and 6 months, and compared (paired *t* test) to initial measurements.

Results: Both groups had similar initial mean level of the pain (VAS- 4.5, 4.2 at rest; 7.7,7.9 following activity). Significant relief of pain was achieved in both groups after one month, and maintained up to six months ($P < 0.001$). In the group treated by steroids grip strength improved significantly during the whole six months of follow up ($p < 0.05$), without significant change in pinch measurements and PPT. The group treated with HA showed significant improvement in grip strength only at the six months, and a significant improvement in the three-point pinch, lateral pinch and PPT starting at three months follow up. There were no side effects in all patients.

Conclusion: Both therapeutic modalities have been found highly effective in reducing pain. The HA appeared to be more effective in improving hand function, though this became apparent more than a month following injection. Initial treatment of TMJ arthritis by intraarticular injection of HA is effective and presents better short-term functional outcome compared to treatment with steroids injection. Further long-term studies are necessary to establish the most appropriate HA preparation, and the effective regimen for treatment.



FP061

Osteoarthritis of the carpometacarpal joint of the thumb: Simple total trapeziectomy arthroscopically assisted

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Introduction: in the treatment of the trapezio-metacarpal joint, the simple total trapeziectomy technique has been refloated in the last decade. The arthroscopic techniques allowed the development of the trapeziectomy alone offering a better life quality in the immediate postoperative period.

Material and method: we operated 38 between 2001 and 2005, with a mean age of 58. For the total excision of the trapezium, we used an arthroscopic technique with two basic portals, a 2,4 mm camera and a 3,5 mm burr, always assisted with an image intensifier. We stimulated an early rehabilitation (7-10 postoperative days) without immobilization.

Results: we compared postoperative results with the non-operated hand, and we found increments in 92% and 86% in grip and pinch strength respectively. We also found 86% of excellent and good results in terms of pain using a subjective scale.

Conclusions: simple total trapeziectomy is a still valid technique in the treatment of non-complicated trapezio-metacarpal osteoarthritis. Arthroscopic simple total trapeziectomy is better than other techniques in the immediate postoperative period.

Key words: arthroscopy, trapezio-metacarpal osteoarthritis, trapeziectomy.



FP062

Clinical results of the Thompson abductor pollicis longus suspensionplasty

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Little information exists regarding outcomes of Thompson's Abductor pollicis longus suspensionplasty. 132 patients (28 women and 4 men) with an average age of 69, underwent surgery for refractory painful trapeziometacarpal and/or scaphotrapezoidal-trapezoidal (STT) arthritis. 2 cases revised failed flexor carpi radialis reconstructions (LRTI). Follow-up averaged 25 months (range 9-62). Patients rated their results with respect to certain outcome criteria as excellent (=1), good (=2), fair (=3), or poor (=4). These average final scores were observed: pain relief= 1.7; grip improvement= 2.2; pinch improvement= 2.2; mobility= 2.0; function in activity of daily living= 1.9, in recreational pursuits= 2, and in work= 1.7. Overall result = 1.83. Patients also completed a visual analog scale (0-5) for rest pain (average= 0.5), pinch pain (average= 0.8), and grip pain (average= 0.8). Average DASH disability score= 28.3. Physical examination compared (involved/uninvolved) average thumb opposition (distance (cm) of tip of thumb to small finger MCPJ flexion crease) =1.3 / 0.5, distance (cm) of tip of thumb to tip of small finger with thumb and finger in maximum spread= 17.3/18.6, palmar thumb abduction 52°/53°, palmar thumb adduction 22°/22°, and radial thumb abduction 50°/52°. Radiographic analysis revealed an average loss of the trapezoidal resection space (comparing most recent and initial post-op radiographs) of 28%. Three complications occurred: intraoperative radial artery laceration, deep infection requiring revision, and continued pain necessitating excision of the entire trapezoid. This procedure yields predictable pain relief and reasonable maintenance of mobility. Grip and pinch strength are not always ideally or predictably restored, but generally adequate for activities of daily living, recreation, and work.

1Thompson JS. 1986.



FP063

Interposition arthroplasty using trapezium tendon ball for osteoarthritis of the carpometacarpal joint of the thumb

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Purpose: In order to prevent a central migration of the first metacarpal bone after trapeziectomy at the interposition arthroplasty for osteoarthritis (OA) in the carpometacarpal (CM) joint, a new surgical procedure was developed using a trapezium tendon ball wrapped with the palmaris longus tendon.

Methods: The subjects consisted of 11 joints of 9 patients with CM joint OA. There were one man and 7 women, and mean age was 61 years. After a total dissection of the trapezium, the palmaris longus was wrapped around the trapezium with the surfaces of both the CM joint and the scaphotrapezium (ST) joint tightly covered. Grafted trapezium was repositioned and a congruency of the CM joint was confirmed. The volar oblique ligament was sutured attached to the graft tendon over the trapezium, if it was noticed. After surgery, the thumb was immobilized in a splint with radial abduction and palmar abduction in 2 weeks. Mean follow-up period was 5 years.

Results: CM joint pain was relieved or decreased in all patients after surgery. Clinical results were graded according to the criteria by Eaton, et al. and 5 patients were graded as excellent, 4 as good, 2 as fair, and no patients were graded as failure. The mean radial abduction, mean pinch strength, and mean grip strength was significantly ($p < 0.005$) improved after surgery. Radiographically, the trapezium showed a sclerotic change from an osteonecrosis at follow-up. However, the trapezium bone had been playing a role as a spacer in the CM joint, and the mean width of the CM joint space increased significantly ($p < 0.05$) after surgery. Central migration of the first metacarpal bone was not found.

Conclusion: Clinical results of this new procedure were excellent, and there was no central migration of the first metacarpal bone with the CM joint space increased.



FP064

The painful TMC-joint of the thumb treated by a modified Brunelli - APL capsuloplasty

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From 1994 to 2005 23 painful, hypermobile and/or unstable thumb basal joints in 19 patients (18 females, 1 male) were stabilized by a slightly modified Brunelli-type ligamentoplasty to reconstruct the I-II intermetacarpal ligament, using one third of the long abductor tendon of the thumb. Preoperatively, the patients were investigated by a fluoroscopic stress test and an intraarticular infiltration of Xylocaïne. Radiologically all joints were classified without or only slight (Dell I) arthritic changes.

The outcomes of 19 capsuloplasties in 16 patients were evaluated by a further fluoroscopic stress test after 0.6 to 1 years as well as an adapted Dash-type questionnaire filled out by all patients after a mean period of 4.1 years (0.6 to 11 years).

Casuistics, the surgical technique, the encouraging results and problems are discussed and illustrated by some clinical examples. However, the ability of such operations to prevent degenerative osteoarthritis in these joints cannot be definitively answered.



FP065

Use of the entire flexor carpi radialis tendon for basal thumb ligament reconstruction interposition arthroplasty

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Although the original technical description of the ligament reconstruction tendon interposition arthroplasty at the base of the thumb included use of one half of the width of the flexor carpi radialis (FCR) tendon, it can produce postoperative pain at the level of the remaining tendon. Harvesting the entire tendon is simpler and provides more tissue for ligament interposition. The objectives of this study were to evaluate the results on clinical and self-assessment criteria, with particular attention to postoperative wrist ulnar deviation. In this prospective study we included two men and 15 women aged between 46 and 79 years (mean age 64 years). Preoperative osteoarthritis was staged 4 (Dell classification) in 14 cases. Preoperative DASH score was 47 (28-61). Follow-up ranges between 3 and 11 months (mean 6 months). Our findings show no ulnar deviation of the wrist after 3 months. Pinch strength and thumb range of motion are not significantly different pre- and postoperatively. Postoperative DASH is scored 19 (0 to 42). The difference between pre- and postoperative DASH score is 27 (7 to 51). All the patients returned to their previous occupations. In conclusion, we consider that harvesting the entire FCR tendon yielded satisfactory results on both clinical and self-assessment points of view.



FP066

Full thickness FCR harvest for LRTI alters wrist kinetics

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Objective: To demonstrate that thumb CMC arthroplasty with entire thickness FCR is not only an effective surgical protocol for improving arthritic thumb function, but also alters isokinetic wrist flexion/extension torque and flexion fatigue strength of the surgical wrist when compared to the non-surgical wrist.

Methods: Thirty nine patients with osteoarthritis with *unilateral* thumb CMC arthroplasty with entire FCR tendon were prospectively studied with a minimum postoperative follow-up of 24 months. Preoperative DASH, grip, pinch, and postoperative DASH, grip, pinch, and Biodex isokinetic wrist flexion/extension torques were recorded. The nonsurgical extremity served as the control for each patient with unilateral LRTI. Peak torque ratios, and fatigue were measured for the control and the surgical extremity with the Biodex.

Results: Postoperative DASH scores were 12 ± 4 and were significantly improved from preoperative scores 43 ± 4 ($p < .0001$). The surgical extremity showed a significantly lower wrist flexion to extension peak torque ratio than the control extremity ($p = .05$). The control extremity had 2.5 times higher wrist flexion fatigue resistance than the surgical side ($p = .049$).

Conclusions: Use of the entire FCR tendon for thumb CMC arthroplasty is prevalent in the clinical arena. Unlike previous studies, the above data conclusively show that wrist flexion torque decreases, and wrist flexion fatigue resistance decreases by harvesting the entire FCR tendon even though the final outcome is uniformly superior based on traditional DASH, and grip scores.



FP067

Key-points about trapezectomy and suspensionplasty for thumb basal joint arthrosis after twenty-years experience and four hundred patients operated

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Which technical surgical points are really useful in performing trapezectomy and suspensioplasty for thumb basal joint arthrosis? How long the postoperation splinting must work? When the rehabilitation have to start?

Our goal is to give an answer to the patients suffering for thumb basal joint arthrosis non responding to conservative treatment. The Eaton classification with four growing gravity stages is useful to rationalize surgical treatment. In the Eaton fourth stage a trapezectomy is necessary. This procedure introduced by Gervis in 1949 doesn't restore a strong and steady thumb; in the meantime is the development of biological methods with the intention to substitute the removed trapezium with tendinous material and to suspend the whole system remaking ligamentous structures, so in the most physiological way by a mechanical point of view. This kind of method is becoming reliable without great complications. We analyse our twenty-years experience in biological arthroplasty for trapezium-metacarpal arthrosis. From 1985 to 2006 we have treated 427 hands beginning with trapezectomy and anchovy of PI (one case), method of Pellegrini-Burton (3 cases), Weilby (3 cases) Apl tendonplasty with several modification of the original technique (421cases). From our experience we deduced some critical points: and performing surgery (short incision with second very short incision more proximal to cut one of the APL tendons; how to pass the Apl around FCR; the importance of a capsular triangular flap inserted on metacarpal to pass APL to stabilize; the importance of remodelling the base of first metacarpal for second metacarpal impingement; the utility of the "tail" of APL); and post operation (splint for two weeks); and for rehabilitation(at two weeks). During the years we have checked the operated patients (follow-up to 20years to four months). The results we obtained (satisfactions of patients in recovery strongness and ability and pain disappearance) are superior than our expectations.



FP068

Use of ELEKTRA prosthesis to treat painful osteoarthritis of CMC joint of the thumb. 290 cases.

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The author presents his experience to treat painful osteoarthritis of the CMC joint of the thumb with a Elektra prosthesis

This prosthesis made by SBI is metal-metal, non cemented and nonconstraining prosthesis. The idea was to use the ball and socket principle, but with very high mobility (120°) in each direction.

The dorsal approach was used. The author presents quickly his technique, before the results of the series of 290 cases with maximal follow-up of 9 years and minimal of 1 year.

The results were studied with 5 items: speed of recovery, evolution of pain, mobility (maximal abduction and opposition), strength (Grasp and key pinch), x-ray aspects.

After presentation of the results good in 87% of the cases, the author presents the complications that were observed: 12 cases of dislocation, 4 cases of allergy to the metal, 2 cases of fracture of the trapezium and the major problem that was loosening of the cup (16%).

In a first part of the series the problem of loosening was observed often early after implantation and no fixation of the cup was probably better word to describe this problem. We then solve this difficult problem with increased roughness of the external surface of the cup. After this modification the goal seems obtained with good result and no early loosening after this light modification. The cases of dislocation and loosening were finely studied and high trauma of the thumb was often found. It seems that lateral trauma can give dislocation because fracture of the metacarpal bone is impossible and the axial trauma of the thumb could destroy the osteointegration of the cup.

This prosthesis seems a good possibility to treat the painful osteoarthritis of CMC joint of the thumb.



FP069

Multiple isolated neurofibromas of the hand and upper extremity

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Introduction: Neurofibromas are rare tumors of the nerve sheath, which can affect the hand and upper extremity. Recently, a rare condition termed Multiple Isolated Neurofibromas (MIN), characterized by multiple neurofibromatosis without other stigmata of NF1 has been described. We report four cases of MIN treated in our institution.

Materials and methods: Four patients with multiple pathologically proven neurofibromas affecting the hand and/or upper extremity and without other diagnostic criteria for NF1 at age greater than 12 years were seen in the Neurofibromatosis Clinic of our institution.

Results: Patients consisted of three women and one man with an average age of onset of symptoms of 18 years (range 3 to 53 years). The distribution of tumors within the upper extremity included hand, forearm, arm and shoulder. One patient also had an extensive tumor load outside of the upper extremity. Only one patient had significant neurological disability. Indications for surgical intervention included cosmesis, pain relief and debulking of a rapidly growing tumor. The mean age at first surgery was 24 years, with a range of 6 to 55. One patient had subjective improvement in pain after surgery. Two patients had regrowth of tumors, and one patient has been placed on the chemotherapeutic agent temozolamide because of an intractable and widespread tumor load.

Discussion: We present a rare type of neurofibromatosis, which may be especially important for the hand surgeon to be aware of. Indications for surgery in these patients include initial pathological clarification, pain relief and cosmesis.



FP070

The relationship between pre-operative clinical findings, operative findings and postoperative neurological complications in schwannomas

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Purpose: To analyze schwannomas retrospectively and study the relationship between the preoperative clinical examination, operative findings and postoperative neurological complications.

Methods: Twenty-three tumors with a histological diagnosis of schwannoma in 22 patients who underwent surgery between 1998 and 2005 were the basis of this study. One patient had two different schwannomas on different nerves .

Results: Enucleation of tumors was possible in 19 tumors. None of them had neurological complications before surgery, but nine had mild neurological complications postoperatively. They consisted of sensory deficit in six patients, motor weakness in one, and both in two. Enucleation of the tumors was impossible in four patients. These schwannomas originated from brachial plexus in three patients and ulnar nerve located at the proximal arm in one patient. These four schwannomas had shown some neurological signs preoperatively, were difficult to enucleate and neurological deficits worsened after surgery.

Conclusion: In general, schwannomas are placed eccentrically in the nerve and meticulous dissection with magnification can achieve complete enucleation without neurological deficit. However, our study suggests that schwannomas may not be always able to completely enucleate and some schwannomas may have neurological complications after the surgery even when enucleation is possible.

In our study, tumors with preoperative symptoms and tumors located at the proximal site of the limb tended to be impossible to enucleate. The density of the funiculi becomes higher and thicker in the proximal site extremities, so the tumor developed at these sites are easily compressed and become more difficult to separate even under microscopy.



FP071

Surgical treatment of Ollier's disease of the hand in children

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Multiple enchondromatosis (OLLIER's disease) is an uncommon nonhereditary skeletal disorder (prevalence 1: 1 million) characterized by the presence of multiple enchondromas or cartilaginous masses in the metaphysis and diaphysis of long bones or short tubular bones of the hands and feet. There is no definite surgical concept for treatment of these tumors in the literature. 9 patients (4 girls / women, 5 boys / men) with OLLIER's disease of the hands were treated in our hospital in the last 6 years. The age of onset varied between 3 years and 18 years. At the time of surgery the patients were 3, 6, 6, 9, 9, 9, 12, 15, 19 and 20 years old. Only left hand was involved in 4 patients, only the right hand in 2 patients and in 3 patients both hands showed enchondromas. The number of tumors (in total 104 enchondromas) in one hand varied from 3 (only one ray) up to 16 (all finger rays). 3 patients showed enchondromas only in the 4th and 5th ray, 2 patients only in the 2nd and 3rd ray, and 4 patients had tumors in every ray. With increasing diameter of the tumors (with increasing age) there was an increasing deformity of the fingers and the operative treatment was more difficult.

Our concept: 1. X-ray of both hands (and other regions of interest),

2. MR of the involved hands to detect all enchondromas very early,

3. dorsolateral or lateral opening of the bones with preservation of the periosteum and gliding membranes, 4. intralesional curettage of all tumors, 5. bone transplantation in children in most cases is not necessary (in our patients 0). 6. X-ray control after 6 month.

In the follow up of 3 years using this concept we had a progression in 2 out of 4 children. These tumors could be resected easily. But there was no increasing deformity in all treated fingers with full range of motion.

In the follow up of 3 years using this concept we had a progression in 2 out of 4 children



FP072

Hand and wrist giant melanocytic nevi in children

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Introduction: Giant congenital nevi raise two problems: cosmetic disfigurement and malignant transformation risk. Their excision is more difficult when they are localised on the hand and wrist.

Material and Methods: From 1976 to 2002, twenty-five children presenting with twenty-five hand and wrist giant nevi were treated in our department. Seventeen patients were girls and eight were boys. The patients ranged in age from nine months to fifteen years. Different surgical procedures were used to remove the nevi: staged excision, excision and split-thickness or full-thickness skin graft, excision and expanded full-thickness skin graft, tissue expansion.

Results: Histologic examination revealed no melanoma and a majority of compound nevi. No recurrence was observed after excision. Functional results were good. From esthetic point of view, two full-thickness skin grafts of the fingers showed strong pigmentation, three staged-excision scars became hypertrophic. One expanded full-thickness skin graft, which took incompletely, and three split-thickness skin grafts produced poor cosmetic results.

Discussion: We advise complete excision of hand and wrist giant congenital nevi, in the infancy or early childhood, using staged excision or full-thickness skin graft when feasible.



FP073

Ganglion cysts of the hand and wrist in a paediatric population

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Introduction: Ganglion cysts of the hand and wrist are a frequent reason for referral to hand surgery services. They occur most commonly during the second to fourth decades but may arise in the paediatric population. A series of 543 cases reported an incidence of 10% in patients under 20 years of age and less than 2% in those under 10. Longitudinal observations have suggested that most ganglion cysts in children resolve spontaneously but study numbers are small. We aimed to investigate a paediatric population referred to our hand surgery service with ganglion cysts of the hand and wrist.

Methods: A retrospective case note review of 45 patients referred with ganglion cysts of the hand and wrist.

Results: 45 patients with 48 ganglion cysts were identified. There were 14 males and 31 females. The age at referral ranged from 3 months to 16 years. Most patients were referred by their General Practitioner, usually due to concerns about increasing size of the cyst or pain. There was a preponderance of wrist lesions in older children and of flexor sheath lesions in younger children. Imaging in the form of x-ray and/or ultrasound scanning was undertaken in 21 cases. Over half of the ganglia had resolved spontaneously at follow-up. Active treatment included aspiration in 11 cases and surgery in 14 cases. Aspiration was reserved for symptomatic dorsal wrist ganglia in co-operative age-groups. There were 6 recurrences post-aspiration and none following surgery.

Conclusion: A female preponderance was identified. The anatomical site of ganglia was age related. Ultrasound was a helpful diagnostic tool. Spontaneous resolution occurred in more than 50% of cases. Aspiration may be useful in older children. The small number of cases treated surgically had a favourable outcome.

References: Nelson CL 1972, Nahara ME 2004, Wang AA 2001, MacCollum MS 1977.



FP074

Treatment of interosseous ganglion and bone cyst of the carpal bone with injectable calcium phosphate bone cement

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Purpose: To report the outcomes of treatment of interosseous ganglion and bone cyst of the carpal bone managed by curettage and injectable calcium phosphate bone cement (CPC; Biopex; Mitsubishi Materials Corp., Tokyo, Japan) grafting.

Materials: The patients consist of 4 men and 2 women, ages at operation ranging from 19 to 62 years (mean, 35). The cystic lesions were seen in the scaphoid in 1 patient and in the lunate in 5 patients. MRI was performed in 4 patients (T1 low, 4; T2 high, 3; T2 iso, 1). Four patients had pain at the wrist joint and 2 had swelling. In 2 patients, range of the wrist motion was slightly limited.

Surgical Treatment: In 5 patients with lunate lesion, dorsal approach was selected and, palmar approach in one patient with scaphoid lesion. The lesions were diagnosed from the operative findings (jelly like content or not). Four patients were diagnosed as a ganglion and 2 a solitary bone cyst. After curettage of the lesions, CPC was injected into the cavity. After consolidation of the CPC (approximately 5 minutes), the wrist joint capsule was repaired. A bulky dressing and splint was applied for 1 week. Thereafter, full wrist motion was permitted in all patients.

Results: Follow-up periods ranged from 6 to 31 months (mean, 14). No recurrence of tumor occurred and no other complications were encountered. Among the 4 patients with wrist pain, pain disappeared completely in 3 and decreased in 1. Radiographs showed apparent partial absorption of CPC in 3 patients.

Conclusion: Calcium phosphate bone cement is a useful material for repairing bone defect after curettage of the interosseous ganglion or bone cyst of the carpal bone. This technique is easier than autogenous bone grafting. In addition, postoperative immobilization is only 1 week.



FP075

Tumours of the finger

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Introduction: Neoplasms of the hand are common pathological disorders but there isn't many reports about finger tumours in the literature. The aim of this study is to evaluate the pathological diagnosis, localization and frequency of the finger tumours of patients with finger tumour and tumour like lesions.

Material and Method: 100 patients treated between 1995-2005 at the Uludağ University, Faculty of Medicine, Department of Hand Surgery Clinic were analysed retrospectively. Male and female ratio were investigated.. Fingers were divided into different zones for classification. Three zones are accepted for localisation of tumour.

Results: The majority of patients were females with sex ratio of 2:1.The mean age was 38 and most of the patients were in their third to fifth decade of life. %20 of the tumours were located in zone 1, % 15 were located in zone 2 and % 22 in zone 3. Pathological analyses of the tumours are reviewed according to localisation. % 22 of the tumours were giant cell tumour, % 22 enchondroma, % 12 osteochondroma, %11 hemangioma, % 9 glomus tumour, %8 lipoma and % 7 ganglioma.

Conclusion: Malign tumour of finger is rare lesion. Giant cell tumour of tendon sheath and enchondroma are the most common primary tumour of the finger.



FP076

Lipoma of the finger with large bone erosion : A case report

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Lipoma is a common soft tissue tumor and can occur in any location . It is, however, extremely rare in the finger. Here, a case of lipoma of the finger causing bone erosion is reported. A 38-year-old man presented with a mass in his left index finger, which had been slowly enlarging for approximately 18 years. The lesion was 3.5 x 2 x 2 cm, painful, tender, moderately soft and immobile. It was palpated on the palmar aspect from the distal to middle phalange. The nail was also slightly elevated by the dorsal part of the lesion. Radiography revealed a marked erosion of the distal phalanx mimicking giant cell tumor of tendon sheath. Magnetic resonance imaging revealed high signal intensities on both T1- and T2-weighted images, suggesting lipoma. Lipoma was confirmed by histopathological examination after the resection of the lesion. During the surgery, a marked erosion of the palmar aspect of the distal phalanx was observed. The lesion extended into the bone and also around the distal phalanx to the dorsal side. The excision of the lesion was easily performed because there was no firm adhesion to surrounding tissues. There was no recurrence during 5 months of follow-up. This lesion showed that a long-standing lesion in the finger can erode bone owing to limited space, even if it is lipoma. We discuss this and other lipomas occurring in the finger.



FP077

A unique surgical approach for mucous cyst resection – Curvilinear incision from the eponychial fold to the distal interphalangeal joint

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Multiple techniques are available for the treatment of mucous cysts of the hand. We present a unique approach for mucous cyst resection, using a curvilinear incision extending from the eponychial fold to the distal interphalangeal (DIP) joint, raising a flap over the nail and extensor tendon insertion. Between the years 1997 and 2005, twenty-five patients (25 mucous cysts) were surgically treated by the senior author. Retrospective review of data was performed on pre-operative radiographs, digit involvement, pain, nail deformity, duration of symptoms, previous treatment, and presence or absence of drainage. We describe our operative technique in detail, along with outcome data. Charts were analyzed with respect to range of motion, wound complications, and resolution or appearance of nail deformity. The middle finger (60%) was the most frequently involved digit, followed by the index (20%), thumb (8%), small (8%), and ring finger (4%). Six patients underwent operative and non-operative treatments prior to cyst excision. Mean post-operative follow up time was 120 weeks (2.3 years). Post-operative wound complications included two infections (8.7%), however, one had undergone incision and drainage prior to excision. One patient reported recurrence of the mucous cyst. No patient demonstrated new evidence of extension lag or new nail deformity. Eight of thirteen (61.5%) patients with pre-operative evidence of nail deformity demonstrated improvement within the post-operative follow up period. We conclude that this technique provides excellent exposure and is a safe and effective method of treatment for mucous cysts.



FP078

Multiple hereditary osteochondromatosis causing limitation of the forearm rotation

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Introduction: Multiple hereditary osteochondromatosis frequently affects the forearm bones. Some of them can cause limitation of the forearm rotation because of mechanical block by the mass(es). However, it is very hard to find the literature which mentioned this rotational problem of the forearm.

Patients And Methods: We reviewed the clinical and radiologic al results of the 10 upper extremities of the 7 patients with multiple hereditary osteochondroma tosis suffering from limited rotation of the forearm that were treated by the operative treatment . There were 4 males and 3 females , and their average age was 7.8 years (range, 3 years 4 month s to 12 years 9 months). Three of them had bilateral involvement. Average postoperative follow up period was 39 months.

Results: Preoperative range of motion (ROM) of the forearm rotation , was average 75 (range, 20 to 130) degrees. Their average supination was 39 (range, 0 – 70) degrees , and pronation 36 (range, 0 – 75) degrees.

Postoperative ly the ROM w as increased to average 127 (range, 80 to 160) degrees . Their average supination was 65.5 (range, 30 – 80) degrees , and pronation 61.5 (range, 30 – 80) degrees.

Conclusion: Multiple hereditary osteochondromatosis, when occurred in the forearm, can cause functional impairment of the forearm rotation. Surgical excision of the mass(es) which block forearm rotation, can improve the ROM.



FP079

Replantation service in a Malaysian public hospital

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Replantation service is a highly specialized field that is usually rendered by a tertiary center. Usually these centers would have an established plastic surgery unit or a dedicated hand department. To ensure an acceptable success rate is obtained for the cases that are operated on, a high-level of expertise and dedication is expected from the team members that are running the service. There is also a steep learning curve for these personnel to obtain the required skills necessary for the survival and functional rehabilitation of the replanted limb.

In a developing country like Malaysia, replantation service does exist and are mainly taken up by a few centers with established hand units. Due to the fact that there are quite a large number of cases that presented themselves this service is also offered by our hospital, which is a public hospital on the East Coast of Peninsular Malaysia with no established plastic surgery or hand surgery unit. This service was started in early 2005 due to the need and we would like to share our experience on running such a service in our setting.

The majority of the cases are due to industrial injuries, mainly bandsaw or chainsaw injures while working in a timber mill, and most of them occurred in remote areas. We have 12 cases of partial amputations and 7 total amputations. For revascularization cases, we obtained a 100 % success rate, and about 80 % for the replantation cases. We considered this as a reasonably good achievement considering our setup as an orthopaedics unit within a Malaysian public hospital. These cases are still on our clinic follow up but a few have defaulted treatment despite our insistence to continue with their aftercare. We are still at the early stage of setting up the service and there are still many obstacles that hinder our progress. However, we hope that we could build up the service further to provide better service that is greatly needed by the population in this part of Malaysia.



FP080

Single finger distal amputation - Replant or terminalize?: Comparison of costs and functional outcome

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Introduction and Aims: This study looks at the cost and functional outcome of single digit distal replantation as compared to terminalisation (shortening and closure). We attempt to justify it as a functional and not purely cosmetic reconstruction .

Methods: All patients with single digit amputations distal to the FDS insertion with no other injuries or contraindications to replantation who were treated by replantation or primary terminalisation between 2003 and 2005 were included. Direct costs of treatment and rehabilitation, and indirect costs from loss of productivity (medical leave) and compensation were compared. Patients' satisfaction with cosmesis and function was assessed with a Visual Analog Scale. Function was assessed clinically using static 2-point discrimination, grip strength, key pinch, pulp-to-pulp pinch, and total active motion. A modified Purdue pegboard time test was used to compare fine manipulation of the injured and uninjured hands. Patients were assessed a minimum of six months after surgery.

Results : 36 fingertips were replanted, with a viability rate of 78%. 32 underwent primary terminalisation. The direct costs of an uncomplicated replantation were 4.94 times that of an uncomplicated terminalisation. After including a prosthesis, this ratio dropped to 2.47. Duration of medical leave and light duties was 2.48 times greater for uncomplicated replantation. Compensation for disability was not significantly different. Patients with distal replantation had better Purdue pegboard results, stronger precision pinch, less hypersensitivity and cold intolerance, and better satisfaction.

Conclusion : Single digit distal replantation is costlier than terminalisation, but provides superior function and cosmesis, with higher patient satisfaction.



FP081

Bone growth after replantation of fingers in children

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Purpose: From 1983 through 2000, we replanted 67 fingers in 47 children. We wanted to examine the bonegrowth after replantation of a finger in a child.

Methods: The patients were called for examination in 2005 and 2006. The patients who had an arthrodesis performed in the DIP joint of the replanted finger were excluded. The number of arterial anastomoses was recorded. All the osteosynthesis was performed using K-wires. In some patients, a temporarily transfixation of the IP joints was performed. At follow-up, X-rays were taken in PA- and side views of the injured finger as well as of the concomitant finger of the opposite, non-injured hand. The length of the distal phalanx was measured on both fingers. If there were no contractures or no flexion of the joints, the length was measured in the PA-view. If a contracture were found, the length was measured in the side.view. All the measurements were done directly on the pictures using a PC. To run the statistics, we used the Wilcoxon Test.

Results: In this follow-up study 9-16 years after replantation of fingers in children, we found that the growth of a phalanx distal of the amputation level in a replanted finger was less ($p < 0,05$) as compared to the concomitant phalanx of the non-injured side.

Conclusion: The bonegrowth after replantation of a finger in a child is inferior to the bonegrowth of the concomitant finger of the non-injured hand.



FP082

Long-term results after upper major limb replantation

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Introduction: Emergency management of a total or subtotal upper limb amputation poses a complex problem for the therapy team (surgeon, anesthesiologist, nurses, physiotherapist, social service, family doctor) and the patient. With today`s therapeutic and technological advances, the surgeon has the ability to salvage viability in most severe upper limb injuries (1). Nowadays restoration of viability alone is not sufficient to fulfil the criteria of a successful replantation.

Patients and Method: Using our personal series of 65 patients operated between 1981 and 1993 (upper arm: n = 18, proximal and middle forearm: n = 32, distal forearm and wrist level: n = 15) and the results of an extensive literature review the following criteria were evaluated; 1) survival rate, 2) possible individual motor and sensory functions of the extremity, 3) global upper extremity function judged according to Chen`s classification, and 4) socioeconomic aspects, and 5) number and nature of local and/or systemic complication and subjective judgment by the patient.

Results: The survival rate of upper limb replantation, which only means perfect restoration of viability is about 76 to 92,3%. With the amputation level going distally there is an increase of individual motor and sensory functions of the "functional chain upper extremity". Taking grade I and II results together a "functional extremity" can be reconstructed at the upper arm level in 22 to 34%, proximal forearm level 30 to operative distal forearm level 56 to 80%. All patients needed at least 2 secondary operative procedures. 5 of 65 patients were re-amputated because of postoperative complications.

Discussion: As the functional results after replantation are at least equal (proximal level) or even far superior (distal level), some protective sensibility at the hand can be expected even at the most proximal levels, and the missing psychological impairment caused by missing body integrity, reconstruction should be carried out if possible, reasonable with regard to the expected function, estimated of low risk for the patient and desired. The higher cost and amount of operations needed, as well as the longer postoperative care and longer time of disability after replantation are justified by a significant increase in life quality.



FP083

Long term results after major upper limb replantation: Critical analysis of 38 cases

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The indication to replantation are extending year after year to older patient, to higher level of amputation or to avulsion injury. This is due to the improved microsurgical techniques and to the possibility to perform secondary procedures.

Between 1996 and 2003, 53 patients underwent major upper limb replantation in CTO Hospital of Turin. A retrospective review of 35 patients with 38 major replantations was carried out (8 amputations upper arm, 5 through the elbow, 7 proximal forearm, 10 medial forearm, 8 distal forearm). The average follow-up was 3, 2 years (range: 2 to 5 years) in order to assess the survival rate, global upper extremity functional outcome (Chen), complications' rate, number of secondary procedures.

Limb survival rate was very high (95%) despite the severity of the injuries; two cases required a secondary amputation at 10 and 20 days after surgery. Successful replantations at the level of the distal and middle third forearm provided a better functional result than in arm and proximal forearm replantations; sharp lesions provided better functional results than crush injury. The complications developed were: non-union (7), bone infection (4), skin or muscle necrosis (13), bleeding (4) and brachial plexus palsy (2). Some patients required secondary surgery for tendon transfer (44%), skin graft (36%), non-union treatment (19%), nerve graft (16%), tenolysis-arthrolysis (13%), free functional muscle transfer (8%), free flaps (8%), brachial plexus repair (5%), but some did not. Level of amputation and mechanism of amputation significantly influenced the functional result. A good result is often possible depending on number of secondary reconstruction and on patient's collaboration and motivation. In spite of the possible complications discussed, proper patient selection, good surgical skills and postoperative care are extremely important in achieving a high success rate in replantation and a better functional outcome.



FP084

Successful composite graft using ice-cooling and PGE1 injection in fingertip amputation

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Distal fingertip amputation can be treated in a variety of ways, including simple dressing changes, shortening with primary closure, skin graft or microvascular procedure. If the amputated fingertip is too distal to be replanted, composite graft might offer the possibility of maintaining digital length and function using the patient's own tissue. Many trials have been reported to improve the survival rate of composite graft in fingertip amputation including ice-cooling, hyperbaric oxygen, nail bed graft.

Between May 2005 and July 2006, 19 cases of fingertip amputation underwent composite graft at Hallym University Sacred Heart Hospital. Patient's age and sex, smoking history, the presence of diabetes, mechanism of injury, time, site of graft were all recorded. All fingertips are amputated too far distal for microvascular replantation. We keep the grafted fingertip cool with various methods using ice and also injected Egladin[®] (Lipo-PGE 1, Alprostadiol, 10mcg/2ml/A, 0.167mcg/Kg) intravenously mixed with Hartman's solution for 2~20 days (average 10 day) after operation. There were 11 male and 8 female patients, who ranged in age from 1 to 52 years (average, 24 years). 12 cases showed only soft tissue injury, 7 cases were combined with digital phalanx tip fracture. Only one patient had smoked and there were no diabetic, atherosclerotic history in all patients. Range of follow up was 4 months to 1 year. All the patients showed successful outcome.

Authors applied the continuous ice-cooling and the PGE 1 (Egladin[®]) injection to increase the survival rate of complete graft in fingertip amputation. Although there are some limitations in these small sized population, we still believe therapeutic angiogenesis using Ice-cooling and PGE 1 can help the survival of the composite graft of the fingertip injury.

Conclusion : Authors applied the cautious ice-cooling and the PGE 1 (Egladin[®]) injection to increase the survival rate of complete graft in fingertip amputation. Although there are some limitations ! in these small sized population, we still believe therapeutic angiogenesis using Ice-cooling and PGE 1 can help the survival of the composite graft of the fingertip injury.

Key Words: Composite graft, PGE₁, Fingertip amputation



FP085

Intravascular stenting IVaS method for safe and accurate replantation

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Introduction: The definition of supermicrosurgery is a surgical procedure conducted on a vessel with a diameter of 0.5 mm or less. A small number of micro-surgeons have incorporated these techniques in supermicrosurgery. This presentation shows a new method for super-microsurgical anastomosing

Materials & Methods: The first step is the selection of a suitable nylon yarn. Next, the IVaS is inserted into both ends of the vessel. The vessel wall is sutured using 11-0 or 12-0 nylon. The last one or two stitches are left untied. Then, the IVaS is removed from the space between the free vessel ends. The last one or two stitches are sutured. The SIEA flaps of rats were used for this study. On a trial basis, The epigastric artery of the mice (diameter, 0.15 mm) was transected and reanastomosed. After that, I used for finger tip replantation.

Results: The SIEA flaps of 10 rats were elevated. The immediate patency rate both rats and mice was 100%. Seven days after, the flap survival rate was 80%. Finger-tip replantation was succeeded.

Discussion: Problems in supermicrosurgery arise when vessels are too thin and too small. During anastomosis, there is a risk that the back wall of the vessel will catch involuntarily and obstruct the flow of blood. In this study, no cases were observed in which the back wall caught and obstructed blood flow. This means that there is no need to suture more than once. In the present study, the anastomosis of vessels with a diameter of 0.15 mm was successful. Nylons of varied sizes are available, thus the appropriate size IVaS for a variety of vessel diameters can be selected. IVaS can be used for such procedures as finger-tip replantation, true perforator flap transplantation, and lymphatico-venous anastomosis of lymphoedema etc.



FP086

Preservation of muscle bulk: A new model to assess heterotopically transplanted muscle

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Objectives: Muscle bulk may be preserved by re-established innervation. Often no expendable nerve is available. End-to-side neurotaphy could be the answer. Previous models were criticized due to maintaining the muscle at the origin. We present a new model to assess the impact of the sensory and motor reinnervation in the heterotopically transplanted muscle.

Methods: Twenty Wistar rats in five groups. The medial gastrocnemius was transposed to the abdominal region and wrapped with Goretex® to prevent neural contamination. Group I maintained the innervation (PMN). Group II had the tibialis branch to the gastrocnemius end-to-end to the donor motor nerve (EEMM). Group III had the saphenous nerve end-to-end to the motor branch (EEMS). Group IV had the motor nerve end-to-side to motor nerve (ESMM). Group V had the motor nerve attached end-to-side to the saphenous (ESMS). ESMS maintained original saphenous destination. After 16 weeks, muscles were collected and compared to the contralateral leg. Wet weight and histology were assessed. Statistical analysis utilized SPSS – version 11, 5. Alfa = 80%.

Results: Atrophy was present in all groups. PMN had the lowest degree of atrophy ($p > 0,05$). ESMS had substantial degree of atrophy ($p > 005$), with findings of denervated muscle. The loss of muscle weight was lower when the motor nerve was utilized. ESMM and EEMM had similar results in preserving muscle weight and trophism.

Conclusion: The heterotopical transplant model of gastrocnemius could differentiate the amount of muscle atrophy after end-to-side and end-to-end sensory and motor reinnervation. The sensory nerve with maintained original destination – ESMS – is probably of no utility in preservation of muscle bulk. End-to-side motor to motor re-innervation could be considered. We still need to assess the impact of the end-to-side neighbour nerve in the muscle suffering from previous denervation.



FP087

Functional outcome of emergency proximal row carpectomy(PRC) in replantation and revascularisation at the level of the wrist

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Purpose: To assess the functional outcome after emergency proximal row carpectomy done during replantation / revascularization of wrist level amputations.

Methods: 4 patients who underwent emergency PRC were followed up for a period ranging 2 – 6 years. The range of motion, grip and pinch strength, pain status, job status and duration for maximum recovery were studied. 1 patient had total wrist level amputation, 2 patients had fracture of lunate and scaphoid, and 1 had fractures of distal radius, lunate and scaphoid. All hands were avascular and needed microvascular repair. After PRC, wrist was stabilized by K wires and capsule repaired with 3.0 vicryl. K wires were removed by 4-6 weeks and wrist mobilization started with splintage.

Result: All patients were back to the same job in 6 months with no pain.

DF-Dorsi Flexion, VF-Volar Flexion, UD-Ulnar Deviation, RD-Radial Deviation

Pt.	Age /sex /side	DF	VF	UD	RD	Grip strength	Pinch Strength	Time for max recovery (months)
1	25/M/L	35	20	10	0	12(35)	2(5.5)	5
2	22/M/R	50	40	20	10	20(40)	2.5(6)	4.5
3	42/M/L	30	15	10	0	15(45)	2(6)	5
4	28/M/L	40	10	20	10	10(25)	2(6)	6

Conclusion: PRC gives good results in emergency replantation and revascularization situations. The shortening obtained enables primary vessel and nerve repair without the need for graft. Though literature abounds with the results of PRC done for Keinbock's disease, Wrist arthritis and Secondary surgery in carpal bone fractures, there is paucity of literature of functional outcome of PRC done in emergency situations.



FP088

A case of triple macroreplantation: Out of the media spotlight to 2 years postoperative. Was it a success?

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Background: The authors would like to present the case discussion of a 10 year old boy from Perth, Australia who sustained crush, avulsion amputations to his right and left hands and left foot. This occurred as a wall of several courses of bricks, from a garage, fell upon his outstretched limbs. The wall had been used to secure a basketball ring and backboard and could not withstand the extra weight of the boy's post 'slam dunk' swinging.

Aim: i) To discuss the unusual case of a triple limb amputation and subsequent macroreplantation, ii) to discuss the intense media interest in the case and the influence this had on the management of the case and iii) to discuss the opportunities this case presented for public education, both for the safety issues of this case and the wider exposure of surgery in a positive light

Discussion: The initial presentation, operative team mobilisation over an Easter weekend and technique of surgical replantation of all parts will be discussed. The early postoperative course will be detailed culminating in the amputation of the left foot nine days postoperatively. The subsequent inpatient and outpatient progress will be followed including the enormous and ongoing media interest generated and the effect this has had on his care.

Conclusion: The surgical and post operative success of this case will be assessed by the following subjective outcome perspectives:

1. Those of the case - ie his return to ADLs and participation in life as an active teenager
2. Those of the medical team - ie his surgical success
3. Those of the general public - a) education regarding the safety of backyard basketball hoops, b) exposure to the possibilities that modern reconstructive plastic and microsurgery might deliver
4. And finally those of the media! – the interest the story has generated



FP089

Ulnar side wrist pain on tennis player: Diagnosis and treatment

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Introduction: Ulnar side wrist pain is a common complaint on patients who play racquet sports, like tennis. Hand surgeons must recognize the specific factors related to wrist pain on this sport activity, such as, inappropriate racquet grip size, bad technique, overtraining, trauma and anatomic variation ("ulna plus").

Due to development of magnetic resonance imaging (MRI) and arthroscopy, now we know that there are many possible causes of pain, making the diagnostic complex.

Methods: We observed 53 high performance tennis players with ulnar side wrist pain for at least 03 weeks of history from March/ 1998 to May/2006. All were submitted to MRI. Discussion of predisponentefactors, clinical examination specific tests, algorithm for diagnosis and treatment options are summarized. The results were evaluated by measurements of range of motion, grip strength, visual analogic scale for pain and return for tennis activity.

Results: The average age was 27.56 years-old. Twenty-three had ulna-plus wrist. 45/53 were male. The most common find were extensor ulnar carpal tendinosis and central tear of triangular fibrocartilage complex (TFCC) with ulnar impact. Other disorders were synovitis, extensor ulnar carpal tendon subluxation, luno-triquetal ligament tear, sinovial cyst and other TFCC injuries.



FP090

Magic angle effect can help decipher the mystery of ECU tendon pathology and ulnocarpal wrist pain

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Aim: To increase awareness of the magic angle effect and demonstrate how to use it to gain additional information regarding ECU pathology.

The magic angle effect utilises the peculiar property of tendon which when aligned at 55 degrees to the main magnetic field of an MRI produces an increased signal. Previously this has been considered an artifact and may result in erroneous interpretation of an intense signal. Recently the effect has been utilised to improve the ability of MRI scanning with regard to pathology within tendons of the shoulder and lower limb and visualizing the flexor tendons. The technique can also be applied to the ECU tendon.

Assisting to distinguish between the numerous pathological conditions which cause ulnar sided wrist pain. The magic angle effect is used in identifying and distinguishing intratendinous tears and complete disruption from tendonitis affecting the ECU tendon or synovitis affecting the underlying joint capsule. Case studies to demonstrate MRI findings compare favorably with pathology demonstrated clinically and with other imaging modalities and at surgery.



FP091

Pain in the ulnar side of the wrist caused by erosion of the 6 th dorsal space

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Introduction: Ulnar side wrist pain can be disabling for patients, especially athletes because of limitation of pronation- supination during sports such as tennis and golf. Erosion of the floor of the 6 th dorsal space is a poorly described condition that should be a diagnostic consideration for non- responsive ulnar sided wrist pain. The author describes a surgical technique for correction.

Methods : Nine patients with severe unresponsive ulnar side wrist pain were identified. Since the usual treatment regimens were ineffective in all cases, surgery was indicated to attempt mitigation of symptoms. During surgical exploration all patients presented inflammatory tendon changes and erosions in the floor of the 6 th dorsal space, deep to the extensor carpi ulnaris (ECU). A soft tissue interposition flap fashioned from the roof of the 6 th compartment was utilized to cover the defect.

Results : Patients were evaluated by re-examination for range of motion, ability to perform daily and sports activities, strength and residual pain. All patients had relief of their symptoms, normal range of motion with no residual pain and returned to tennis and golf. Strength improved a mean of 15 pounds after surgery. The follow-up was 19 to 40 months (mean 33 months).

Conclusions: Erosion of the 6 th compartment floor has been given very little attention in the literature. It should be suspected when severe ulnar sided pain persists in active patients following the usual methods of treatment. The interposition surgery described herein has been effective in nine cases previously unresponsive to usual methods of treatment for chronic tendonitis of the ECU or triangular fibrocartilage rupture.



FP092

Stability and congruity of DRUJ as a key to injury type and classification

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Aim: Our objective was to estimate the DRUJ congruity and stability on wrist function in the long-term result after distal forearm fractures.

Materials And Methods: There were investigated 166 cases of unilateral, displaced distal forearm fractures (A2, A3, and C1 by AO classification) in average period of 2 years after trauma. All the patients were treated by close reduction. There were noted dorsal and radial tilts, ulna variance, ulna styloid fracture and it level. The clinical study consisted of measuring grip strength for both injured and uninjured limbs, range of rotation. Stability of DRUJ was assessed by the piano key and "press-test".

There were appreciated the influence of radial and dorsal tilts, ulna variance, ulna styloid fracture and it union, distal ulna instability and "press-test" on grip strength and rotation movement in percentage to uninjured hand.

Results: There was found the significant influence of positive piano key and "press-test" on grip strength ($p < 0.05$). There was no significant influence of radial tilt on range of rotation. The dorsal tilt of less than 0° authentically decreases the range of rotation. Ulna variance of more than 3 mm significantly influence the grip strength but not on the range of movement. There were no any influence of the ulna styloid fracture, it level and union formation on grip strength and movement.

Conclusion: The stability and congruity are two parameters that comprehensively describe the DRUJ condition in acute injury cases. The received data allow us to share the 4 (0-3) grades of stability (S) and congruity (C) which classify the DRUJ current condition and be helpful in making the treatment decision.



FP093

Reconstruction for voluntary palmar dislocation of the distal radioulnar joint: A new surgical technique

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Purpose: We present a new surgical technique for reconstruction of voluntary palmar dislocation of the distal radioulnar joint (DRUJ) due to instability of TFCC and malaligned forearm bones after trauma.

Cases and surgical procedure: We experienced 5 cases of voluntary palmar dislocation of DRUJ treated by our new technique. 3 male and 2 female. Age ranged from 6 to 21 years old (mean age 15). When reattachment of the old avulsed triangular ligament (deep layer of palmar and dorsal radioulnar ligament) of TFC to the fovea of ulna head could not prevent palmar dislocation of DRUJ on forearm supination, free palmaris longus tendon fixed at the ulnar border of ulna neck was turned along the palmar aspect of the neck, pulled out dorsally and fixed at the dorsoulnar edge of the radius with tight tension on moderate forearm pronation. Forearm supination tightens the grafted tendon which brakes the ulna head slipping down from the palmar edge of the sigmoid notch but forearm pronation relaxes the tendon. After 5 -6 weeks casting with neutral rotation of the forearm active forearm rotation was permitted.

Results : Follow up period was ranged from 2 to 9 years (mean 6 years). 4 cases maintained normal forearm rotation without dislocation. But one case recurred one year after surgery, which had non- union of the ulna styloid, large hole of TFC and ulna minus variant.

Discussion: 4 cases had remodeled and malaligned radius and ulna and experienced first dislocation by minor trauma 2 to 10 years after initial fracture. 1 case with radius end fracture experienced first dislocation just after discarded the cast. Avulsed TFC from the fovea on initial injury and excessive supination stress of DRUJ by malalignment of forearm bones may cause this type of dislocation. Our new surgical technique is one of the choices to solve the problem of DRUJ.



FP094

Arthroscopic treatment of TFCC lesions

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Introduction: Triangular fibrocartilage complex supplies stability and cushioning for wrist function. TFCC lesions are common cause of ulnar sided wrist pain. TFCC may have traumatic (Palmer I) or degenerative (Palmer II) character. Clinical assessment is basic for making diagnosis but imaging may be helpful. Conservative treatment is best choice for most of the acute cases. If symptoms persist operative treatment has better prognosis for pain relief. Wrist arthroscopy has a major role to play in diagnosis and treatment of TFCC lesions.

Material and Methods: 19 patients were operated in Hand Surgery Department in Poznan due to TFCC lesions. 15 patients were qualified as Palmer type I (sport injuries- 9, sprains- 7). 4 patients had Palmer type II lesions. All patients suffered ulnar wrist pain and revealed positive provocative tests. Indication for operation were symptoms non-responsive to conservative treatment. Different operative procedures were performed depending on type of lesion: arthroscopic debridement (with or without ulnar shortening), arthroscopic restabilization of TFCC, arthroscopic wafer resection of ulnar head. Rehabilitation was introduced following period of immobilization.

Results: Wrist pain was significantly diminished or disappeared after operative treatment and period of rehabilitation.

Conclusion: Good functional result and pain relief may be anticipated following operative treatment of TFCC injuries.



FP095

Reconstruction of the TFCC using ECU half slip and interference screw – A new technique

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Purpose: Since 1998, we treated 29 wrists of ulnar detachment of the TFCC by reconstruction technique using half-slip of the extensor carpi ulnaris (ECU) tendon. We described the technique of the reconstruction and examine clinical results of the procedure.

Methods: There were 19 right, 8 left and 1 bilateral wrist with an average age of 34.8 years (range 13-68). All complained ulnar sided wrist pain and severe distal radioulnar joint (DRUJ) instability. The neutral ulnar variance was indicated in 23 wrists and positive in 6. In the positive variance wrists, the ulnar shortening equalized the abutment before the reconstruction. Periods from initial injury were 1 month to 48 years. Diagnosis of the TFCC avulsion was done by arthrogram and MRI. Radiocarpal arthroscopy could demonstrate loss of trampoline effect in all wrists. DRUJ arthroscopy revealed detachment of the radioulnar ligament origin at the fovea in recent 9 cases. The ECU half-slip was harvested and was induced inside the TFCC through the fovea area. The half-slip was tightly sutured to the remnant TFCC, then pulled out through the bone tunnel that was made at the center of the fovea by 2.5 mm diameter drill. The ECU half-slip was subsequently anchored to the ulnar fovea with the small interference screw. Two weeks long arm cast was occurred, followed by three weeks of short arm cast. Clinical results were evaluated by pain, range of rotation and DRUJ instability.

Results: At final follow-up (average 21.5months), 26 wrists indicated no pain and slight pain remained in 3 wrists. Complete re-stabilization of the DRUJ was noted in 26 wrists, however there remained moderate DRUJ instability in 2 wrists. Severe DRUJ instability remained in 1 wrist. There were 25 excellent, 2 good, 1 fair and 1 poor results.

Conclusions: This reconstruction technique represented real anatomical reattachment of the TFCC to the ulnar fovea, which induced excellent DRUJ stability and clinical result.



FP096

Brachialis tenotomy for the treatment of ulna stump instability after Sauvé-Kapandji procedure

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Purpose : Treatment of Painful Ulna Stump Instability (PUSI) after a Sauvé-Kapandji (S-K) procedure.

Introduction : PUSI can occur when the proximal ulna has lost its stabilizing static and dynamic structures: pronator quadratus and FCU muscles, interosseous membrane and ECU tendon. Various surgical procedures have been described for its treatment, but most have proved to be ineffective.

Methods : Proximal ulna instability is particularly symptomatic when holding an object with the elbow flexed and the forearm in neutral prono-supination. In this position, the contraction of the brachialis muscle (BM) impinges the ulna against the radius, which is being brought down from the weight of the object held by the hand. We hypothesized that decreasing BM power would diminish radio-ulnar impingement, as this is the only elbow flexor muscle flexor which inserts into the ulna. We have decreased BM contraction force using an intramuscular injection of type A botulinum toxine (BT) in 2 women complaining of chronic PUSI after a S-K procedure. In one of them, several surgical procedures aimed at the stabilization of the proximal ulna stump had failed. 1½ months after the infiltration with BT, both patients experienced decrease of pain and improvement of grip strength. Pain reappeared after the paralyzing effect of the BT had worn off. A BM tenotomy was performed in one of the patients after a second BT infiltration provided temporary relief of the symptoms.

Results: Although the ulnar stump was still unstable and impingement could still be seen on stress x-ray examination, pain and grip strength improved in both cases. Neither of the patients complained of decreased elbow flexion strength, as this was obtained after contraction of the biceps and brachioradialis muscles.

Conclusion: Brachialis muscle tenotomy has proven effective for the treatment of painful ulna stump instability after a Sauvé-Kapandji procedure.



FP097

Failed Darrach procedure: An allograft solution

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We describe a new technique for the treatment of painful instability of the distal ulna after Darrach procedure using an allograft as a mechanical interposition.

Methods: We report on 17 patients who underwent revision of their Darrach procedure using an allograft (human Achilles tendon allograft). The average age of the patients was 47 years and the average time after the original procedure was 15 months. The indication for the revision surgery in all patients was incapacitating pain over the distal stump of the ulna which increased during pronation or supination and with active grip. Pain was assessed using a Visual Analog Scale. Grip strength was measured using a dynamometer. All patients had instability of the distal ulna, and crepitus or palpable “clicking” during forearm rotation. Radiographs of all patients demonstrated erosion of the medial cortex of the radius, indicating impingement. Technique: 2 or 3 suture anchors were placed into the medial cortex of the radius, proximal to the sigmoid notch where the impingement occurred. Sutures were placed through the allograft, creating a pillow-shaped spacer. Two or three drill holes were then placed into the distal ulna for fixation of the allograft to the ulna. With final allograft placement there should be significant padding between the radius and the ulna to prevent any palpable crepitus.

Results: After an average follow-up time of 34 months all patients were re-evaluated by subjective assessment, range of motion, grip strength, pain relief and radiographs. We report 16 patients with good and excellent results and 1 patient with persistent complaints.

Conclusions: The use of an allograft as a mechanical interposition between the radius and the ulna has not been described previously. We believe that this technique is an excellent alternative to metal arthroplasty for reconstruction of difficult cases of failed distal ulna resection.



FP098

Ulnar shortening – A biomechanical evaluation of the fractional load changes in the wrist joints

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Introduction: The present study was designed to evaluate the pressure distribution in the radiocarpal (RCJ), the ulnocarpal (UCJ), and the distal radioulnar (DRUJ) joints with and without ulnar shortening and while applying a traction to the flexed fingers.

Methods: The arm and forearm muscles except the flexor digitorum profundus (FDP) were excised in five frozen and thawed cadaver arms amputated and suspended at midhumerus. The distal ulna was fixed with a Mini-Orthofix® and a 1 cm section of the bone was excised. The compressive forces at the wrist level were measured with three sensors (Tekscan®) inserted into the RCJ, the UCJ, and the DRUJ respectively. The clawed fingers were then loaded and unloaded three times with a one kilogram weight applied at the distal skin crease. This was repeated with the length of the ulna changed in steps of 1 mm from - 5 to + 5 mm.

Results: The ratio of the moment arms of the FDP to the external load was 1:4. With the fingers unloaded hardly any pressure was registered. With the 1 kilo weight applied 30 N compressive forces were registered in the wrist divided with 70 % to the RCJ and 30 % to the UCJ. The pressure in the DRUJ changed at the same time from an average of 4 N in the unloaded hands to 0 N in the loaded. This was however not significant. With decreasing length of the ulna the load share of the UCJ decreased from 33 % to 23 % with a minimum at -3 mm. With increasing length the share increased to 74 % at + 5 mm.

Conclusion: Traction in the fingers produces compression in the UCJ and RCJ. Reducing the length of the ulna with 3 mm relieves pressure in the UCJ with 30 %.



FP099

A new concept in the treatment of distal radio-ulnar joint (DRUJ) with an implant that respects the ulnar head and the length of the ulna

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The morbidity and complications following resection of the ulna head are frequent with painful pronation and supination because of impingement between the radius and ulna. The different techniques described for resection of the ulna head all leads to a potential ulna stump instability and all described stabilization methods have shown inconstant and more or less poor results.

We present a new implant, which only resurfaces the articulation but preserves the ulna head and the stabilizing structures at the ulnar border of the wrist including the TFCC and the Ulna-Triquetral ligaments. The distance between the radius and ulna is maintained in all positions with or without loading of the wrist. The radius and the carpus attached to the radius articulate with the implant at the sigmoid notch and a new stable and mobile joint provides a pain free and normal pronation-supination without impingement and ulna stump instability.

A simple surgical approach in association with an adequate instrumentation makes a good positioning of the Hemi DRUJ implant possible with minimal bone resection respecting the ligaments and stabilizing structures. A direct stability of the implant is obtained and postoperative immobilization can be minimized.

If the promising early clinical results can be maintained in a longer follow-up, the pathology of the DRUJ can be treated without sacrificing the ulna head, the cornerstone and an essential weight bearing part of the wrist.



FP100

Distal ulna prosthetic replacement. Experience in 30 patients

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The purpose of this study is to present the results of patients with distal ulna replacement as a result of pain, instability or failed distal ulna resection. Patients with rheumatoid disease are excluded.

Methods and Material: Thirty patients with greater than 2 year's followup are reported after distal ulna replacement. We analyzed the preoperative condition of pain, instability and failed distal ulna resection. Prosthetic replacement was performed with the SBI U-head prosthesis with or without ligament reconstruction. Radiographic analysis of implant position, instability and loosening were assessed.

Results: Patients expressed uniform improvement in pain and instability except for two patients who required revision surgery secondary to loosening. Both patients had a previous wrist fusion. They had reinsertion of the prosthesis with bone cement. There was an increase of 40 points (range 20-60 patients) in the Mayo Wrist score before and after surgery. Forearm pronation-supination averaged 120*. Patient satisfaction was excellent.

Conclusion: Ulna head replacement is indicated in failed distal ulna resection and in primary treatment of pain and instability of the distal radio-ulnar joint.



FP101

Natural history of carpal tunnel syndrome

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The natural history of carpal tunnel syndrome (CTS), if not treated by surgical release, is not well documented in the literature. We have studied the progress of CTS in patients in whom the diagnosis had been confirmed but no surgery undertaken.

Our neurophysiology department provided results graded in severity on a validated six-point scale. Patients with CTS were identified in whom surgical treatment had never been undertaken. These patients were invited back for re-examination with further conduction studies. A total of 129 hands in 70 patients were successfully re-examined. Patients with diabetic peripheral neuropathy, rheumatoid arthritis, CTS during pregnancy and following carpal fractures were excluded, leaving exactly 100 hands (59 patients). The mean age of the patients was 58.5 yrs; 21 were male and 38 females. The mean period from first to last examination was 78 months. Of the 100 hands examined, 44 (44%) showed no change in graded severity over the course of the study. 26 (26%) showed improvement while 30(30%) showed deterioration. 15(15%) showed an improvement of 1grade, 18(18%) showed a deterioration of 1 grade. 6(6%) showed improvement of 2 grades while 9(9%) showed deterioration of 2 grades. 4(4%) showed improvement by 3 grades and 3(3%) showed deterioration of 3 grades and one (1%) showed improvement of 4 grades. Of those showing improvement only one had steroid injections; 25 did not. Of those showing deterioration 3 had been given a steroid injection; 27 did not. We believe that carpal tunnel syndrome, if untreated by surgical release, is most likely to remain unchanged in severity over the periods documented in this study; and that as many cases will improve as will deteriorate. The administration of steroid injections does not seem to affect the eventual outcome. The effects of age and gender on the trends demonstrated is discussed



FP102

Carpal tunnel syndrome in the elderly: Long term follow-up after surgical decompression

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This study looked at objective outcome following carpal tunnel decompression in the elderly.

A clinical and neurophysiological follow-up study was undertaken in 26 elderly patients with carpal tunnel syndrome 17 to 43 months following surgical decompression in 32 hands. The age range at surgery was 70-90 years.

All but one were satisfied with the outcome at the time of follow-up. A complete cure was obtained in 22 hands (69%), whereas minor symptoms persisted in 9 hands (28%). Nerve conduction studies were undertaken in all patients within 6 months before surgical decompression. They showed mild changes in 5 hands (16%), moderate changes in 10 hands (31%) and severe changes in 17 hands (53%).

At follow up 5 hands (16%) had normal nerve conduction studies and 25 hands (78%) showed improvements in neurophysiology. Two patients were satisfied with the surgical intervention despite one hand showing worsening neurophysiology and one hand having persistent severe changes.

This study showed that surgery is beneficial in an elderly population with carpal tunnel syndrome even when neurophysiology tests show marked changes suggesting axonotmesis. The parameters improve but most show incomplete recovery (persistent slowing) explained by remyelination and axonal regeneration.



FP103

Relationship between age and postoperative recovery of abductor pollicis brevis muscle strength in carpal tunnel syndrome patients

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In some carpal tunnel syndrome (CTS) patients, recovery of abductor pollicis brevis (APB) muscle strength is achieved within normal range following median nerve decompression surgery, however, these postoperative recovery results cannot be predicted. Some doctors recommend tendon transfers be performed in conjunction with median nerve decompression surgery while others do not. We analyzed the relationship between age and recovery rate of APB muscle strength following endoscopic carpal canal release surgery.

Using the Universal Subcutaneous Endoscope (USE) system, 993 hands of 606 idiopathic CTS patients received endoscopic carpal canal release. They were grouped by age and their pre- and postoperative APB muscle strengths were graded by manual muscle testing (MMT). The patients were divided into six age groups: under forty, forties, fifties, sixties, seventies, and 80+ years old. The 338 hands with preoperative MMT of 0, 1 or 2 and recovery rates of MMT to 4 or 5 were analyzed. The mean follow up period was 8 months.

The recovery rate for the under forty group was 67%, forties was 64%, fifties was 71%, sixties was 60%, seventies was 38% and 80+ years old was 38%. There was a significant statistical difference in recovery rates between the sixties and the seventies age groups ($p < 0.05$). Satisfactory recovery rates were obtained following endoscopic carpal canal release surgery using the USE system in the younger patients. Contra-laterally, these same results were not obtained in elderly patients. We recommend, therefore, that procedures be determined based upon the patients' APB muscle strength and age, and that tendon transfers for treatment of APB muscle weakness only be considered after 8 months following the initial endoscopic surgery.



FP104

Are there gender differences in outcome following open carpal tunnel decompression?

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Background: The aim is to determine if there is a gender specific difference in outcome following open decompression for carpal tunnel syndrome (CTS).

Materials and Methods: Fifty-six patients undergoing open carpal tunnel decompression by a single surgeon were followed up prospectively. There were 16 men and 40 women with a mean age of 58 years (range 34-85). Data was collected on demographics, possible confounding variables (BMI, previous treatment for CTS, hand dominance, exposure to vibrating tools, and compensation claims pending). Pre-operative function was recorded by means of the DASH score, and grip strength using a dynamometer. At a minimum of 12 months after surgery the DASH and grip strength were re-measured, examination performed for pillar pain, scar tenderness and patient satisfaction measured on a visual analogue scale (VAS).

Results: There were no significant differences in age, hand dominance, BMI, or DASH score between the two genders. Males had a higher incidence of exposure to vibrating tools (63% males, 15% females, $p < 0.001$) and were more likely to be involved in compensation claims (31% males, no females, $p = 0.001$). All patients had a significant improvement in DASH scores following surgery (Mean DASH improvement: Males 29.8(95%c.i.16.0 to 43.6); females 35.7(95%c.i.28.5 to 42.8). There were no gender specific differences in DASH score improvement, patient reported satisfaction on VAS (mean 9/10), incidence of pillar pain, scar tenderness or relief of symptoms.

Conclusion: In male patients with a clinical diagnosis of CTS supported by nerve conduction study findings the expected outcome one year following open decompression is no worse than for female patients despite a higher incidence of compensation claim.



FP105

Surgical treatment of carpal tunnel syndrome using the knifelight - compared with open carpal tunnel release

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We have performed a prospective trial to compare the results of open carpal tunnel release with those of carpal tunnel release using Knifelight ® (Stryker Instruments, USA). This is a new knife with its own battery-powered light source which enables the operation to be performed through a small incision in the palm of the hand.

There were 42 patients (53 cases) in the open operating group and 27 patients (32 cases) in the Knifelight ® group from 2003 to 2005. The patients were assessed Carpal tunnel Syndrome Symptom Severity Score (CTS-SSS), Carpal Tunnel Syndrome Functional Status Score (CTS-FSS) and visual analogue scale of the patient satisfaction on pre-operative, post-operative 2, 6, 24 and 48 weeks. The patients were evaluated the operating time, the scar tenderness, the time to return to work and grip strength.

In all groups, Carpal tunnel Syndrome Symptom Severity Score (CTS-SSS), Carpal Tunnel Syndrome Functional Status Score (CTS-FSS) and visual analogue scale of the patient satisfaction improved postoperatively. However, there was no statistical significance between groups. The mean operating time was 28 minutes in the open group and 9 minutes in the Knifelight ® group. The mean time to return to work was 27.8 days in the open group and 19.4 days in the Knifelight ® group. We found no statistical differences in the grip strength and the scar tenderness except at 6 weeks postoperatively. Patients in the Knifelight ® group had statistically significant improvement in the operating time, in the time to return to work and in scar tenderness at 6 weeks postoperatively.

Carpal tunnel release using Knifelight ® may be an effective treatment for surgical treating carpal tunnel syndrome compared with open carpal tunnel release.



FP106

Bilateral carpal tunnel, simultaneous release

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Purpose: Many patients have symptoms of bilateral carpal tunnel and require surgical release of both hands. Surgeons choose to repair one hand at a time thinking that morbidity and disability of simultaneous, such as pain, hand incapacity, would be too great. The purpose of this study is report results with simultaneous surgery.

Methods: prospective paper: Jan 2001 to Jan 2005. 50 patients with clinical and EMG test diagnosis of bilateral carpal tunnel. Surgical technique used was mini open incision of 1.3cm. EMG in all cases. Distal motor latency of more than 4,5 ms and distal sensitive latency of more than 3,5 ms were considered abnormal. Electromyography of tenar muscles seeking signs of denervation aid to determine the severity. Clinical commands final decision for surgery. The cases of clearly bilateral compromises were selected for surgery. Case of carpal tunnel and arteriovenous fistula, was preferred not to use ischemia, and case with normal EMG test are presented.

Results: Of the 50 patients who underwent simultaneous release, 49 (98%) were satisfied with the overall results of their surgery, and that they would undergo simultaneous release again. No post op immobilization. No neurological neither vascular lesions. Patients were follow clinically until complete relief of the symptoms. 80% of the symptoms relief in the first 2 weeks post op, some delay up to 4 months. 60% refer smaller inconveniences in the zone of the injury. The grip power recovers in 4-6 months. The most frequent associated pathologies were: High blood pressure, Diabetes mellitus, smoking, Hypercholesterolemia. No cases of reoperaciones.

Conclusion: simultaneous carpal tunnel surgery, when correctly indicated, and in selected cases, has high grade of satisfaction. Mini open technique is simple and safe with reduced operating time and complications. We recommend simultaneous bilateral carpal tunnel release in patients who have bilateral carpal tunnel syndrome.



FP107

Endoscopic carpal tunnel release in post traumatic compressive neuropathies of the median nerve

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Our objective was to evaluate the role of endoscopic carpal tunnel release (ECTR) in the subset of patients with acute traumatic compressive neuropathy of the median nerve and concomitant distal radius fracture. Six hundred fifty-nine patients with the diagnosis of a distal radius fracture were evaluated by a single surgeon (LGW) at the University of Massachusetts Medical Center between January 1999 and July 2006. One hundred seventy-nine patients (27%) required operative fracture fixation. Twenty-six patients (15%) had persistent symptoms of median neuropathy at the time of surgery and required simultaneous carpal tunnel decompression. Fifteen patients (58%) were male and 11 patients (42%) were female. The average patient age was 43 years (range 19-85 years). Seven patients (27%) underwent open carpal tunnel release at the time of operative fixation of the distal radius while 19 patients (73%) had endoscopic carpal tunnel release using the MicroAire® single portal system. Poor visualization in one endoscopic patient required the conversion to an open carpal tunnel release for an overall conversion rate of 5%. There were no complications in any of these patients. All patients were examined within one week after surgery and followed for an average of four months post-operatively. Residual median neuropathy symptoms at the first post-operative visit were reported as moderate in one patient (5%), minimal in 15 patients (79%) and none in 3 patients (16%). Average time to begin active wrist range of motion was 7 days after surgery. Several previous studies cite swelling and hemorrhage within the carpal tunnel as contraindications to ECTR. We conclude that ECTR can be safely and effectively performed at the time of fixation of most distal radius fractures.



FP108

Flexor retinaculum reconstruction after CTS release. Long term review of 248 cases

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Purpose : To develop a surgical technique of reconstructing the flexor retinaculum (FR), easy to perform under local anesthesia, to prevent the main drawbacks from surgery, which are prolonged palmar scar pain and decrease of grip strength.

Surgical technique : The distal FR is divided close to its insertion at the hook of the hamate bone. The division is continued proximally in an ulnar direction of 45° towards the pisiform bone, and again longitudinally until the antebrachial fascia is reached. The proximal part of the radially based flap of the FR is then anchored to the hook of the hamate with a single suture, preventing anterior dislocation of the finger flexor tendons. Postoperatively, the wrist is immobilized in moderate extension for 3 weeks.

Clinical study : 198 patients (248 treated hands) were reviewed at an average of 8 years and 7 months after surgery (from 5 to 16.5 years). Grip strength with a Jamar dynamometer was measured in both hands with the wrist in both extension and 20° of flexion.

Results : All patients experienced complete disappearance of the symptoms without recurrences. The average grip strength in extension was 29 kg, and in flexion 17 kg. These values were 28% higher than those obtained in a series of 220 hands that were reviewed at an average of 3 years and 10 months after surgery and who did not have the FR reconstructed. Only 6 of the patients had pain in the palmar scar on an average of three weeks after the plaster was removed.

Conclusion : FR reconstruction with the present technique provides immediate relief of CTS symptoms without the risk of future recurrence, as the FR is kept undisturbed for the gliding of the median nerve and flexor tendons. FR reconstruction has the advantage of not decreasing grip strength and, what it is most important, absence of postoperative palmar scar pain.



FP109

A double blind randomised controlled study comparing the infiltration of warm -V- refrigerated local anaesthetic (1% lidocaine with adrenaline 1:200,000) prior to open carpal tunnel release

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Carpal tunnel syndrome is a common condition, occurring in 2% of the U.K. population and is routinely treated by open release under local anaesthetic (L.A.). Previous studies have shown a decrease in pain with the use of room temperature Lidocaine but this has not been demonstrated with Lidocaine plus Adrenaline prior to open carpal tunnel surgery.

The aim of this study was to determine whether administration of Lidocaine with Adrenaline is less painful when injected at a room compared to refrigerated temperature.

50 patients were randomised to administration of either refrigerated temperature or room temperature Lidocaine 1% with Adrenaline 1:200,000 (8ml) into one hand.

A second group of 25 subjects had bilateral injections, one at room temperature and one refrigerated. These patients were able to directly compare the degree of pain from the different temperature injections, thereby reducing the potential interference from patients' different subjective pain thresholds.

Pain was assessed using a 10-mm visual analogue scale (V.A.S.). Results were analysed using the Student's t-Test.

In Group 1 mean V.A.S. score for the room temperature L.A. was 4.2, whilst the refrigerated group was 6.36. The difference was statistically significant with a p value of 0.001. In Group 2 the scores were 3.56 and 6.52 respectively with a p value of <0.00001.

This study shows that administration of Lidocaine with Adrenaline at refrigerated temperatures results in increased subjective pain scores prior to open carpal tunnel release and should therefore be allowed to reach room temperature prior to injection.



FP110

Patterns of hand use activities as risk factors for carpal tunnel syndrome in Indian patients

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Purpose: To determine the types of hand use activities associated with carpal tunnel syndrome in Indian patients and identify groups at high risk while improving recognition of CTS in previously unstudied ethnicities worldwide.

Method: A hospital based matched case-control study was done with incident suspected CTS cases recruited prospectively at this first hand surgery and therapy centre in India. Cases without an identifiable known cause for CTS were matched for age and gender with controls recruited from inpatients, having no neurologic comorbidity. Hand use activities were noted according to type of exposure, determined by pilot interviews using modified definitions and culturally relevant examples of BCTQ 1. Demographic data and activities of lifting, forceful work, repetitive movements, keyboarding, vibration exposure, and other uses were assessed. Correlation of increasing levels of hand use with CTS for each activity was determined by multivariate conditional logistic regression. The Odds ratio and its 95% Confidence interval for each association was calculated.

Summary: Seventy five percent of confirmed CTS cases were not attributable to known causes for CTS and 70% of idiopathic CTS patients were housewives with a mean age of 39.6 years. Increasing BMI was positively correlated with CTS (OR 1.6, 95% CI 0.99-2.7) in women. There were trends toward positive association of CTS with increasing daily durations of total hand use (OR 1.2, 95% CI 0.8-1.9), general hand activities (OR 1.3, 95% CI 0.8-2.2), exposure to vibration (OR 1.98, 95% CI 0.9-4.6), and repetitive hand activities (OR 1.2, 95% CI 0.8-2.0).

Conclusions: There is a positive association of increasing levels of hand activities in Indian patients with idiopathic CTS suggesting that occupational hand activities play an important role in the development of CTS in patients already at higher risk for CTS

Ref: 1. Levine, DW, Simmons BP.1993. J Bone Joint Surg; 75(A): 1585-92.



FP111

Long term results following endoscopic carpal tunnel release (ECTR) in Agee technique

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The 2003 Cochrane Analysis confirms ECTR to be safe and efficient as OCTR with advantages for the patients due to a shortened postoperative rehabilitation period after ECTR. Only single data are available referring the long term outcome since ECTR was established in 1987.

There are still known methodical problems of studies asking for recurrence rate and patient`s satisfaction because of three important reasons: 1. poor feed back rate of questionnaires in retrospective studies. 2. there is no certain indicator for the efficiency of a nerve decompression operation besides patient`s estimation and ENG studies, which unfortunately are not done in all cases. 3. small groups in the study.

Methods: In 2006 we designed a prospective study which will be watching patients up to 5 years after ECTR searching for the conclusive recurrence rate. We present now data out of a pilot-study concerning the recurrence of typical symptoms of CTS in a group of 3500 patients operated by the first author since 1992. We developed a new questionnaire regarding the Boston System, which focuses parameters of quality of life as they indicate the grade of effectiveness of the Agee operation. The status of pain and numbness in a group of 580 patients with a minimum follow up of 3 years after ECTR will be presented. In an additional group of 1000 patients a true comparison of ENG studies preop./postop. ECTR (Agee) was done and will be discussed.

Conclusion: Only the individual relief of pain and sensory disturbances leads the patient to decide wether he feels recovered from CTS. Self assessment by the patient correlated with ENG studies in a large study group allows an excellent view on long term results of nerve decompression including ECTR despite of statistical problems.



FP112

For fast return of grip strength after open carpal tunnel release, minimize the days of sick leave

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Purpose: Many studies on carpal tunnel release have compared grip strength and different surgical methods. This study on one surgical method is looking at the length of sick leave in relation to the return of grip strength.

Method : 104 consecutive patients treated with open carpal tunnel release, and no other diagnoses affecting the hand, were operated between May 2005 and March 2006. Two patients were drop outs because of other illnesses. All patients were operated by one and the same surgeon. Grip strength was measured by one and the same physiotherapist preoperatively, 2, 5, 8 and 12 weeks after surgery. The wrist was supported by a dorsal plaster for 2 weeks to facilitate the use of the fingers and the hand. All patients were given an exercise program and were encouraged to use the hand as much as possible in all activities that did not cause pain and to return to work as soon as possible.

Results : One quarter of the patients were retired from work. One third of the rest returned to work before 2 weeks. Before 5 weeks two thirds had returned to work. Patients working had a faster return of grip strength than the patients on sick leave. The patients retired were the best at getting back their strength and they were on average stronger than preoperatively already at 5 weeks. At 12 weeks the grip strength was better than preoperatively in all subgroups even in the little group of only 5 patients who had not yet returned to work.

Conclusion: Early return to ordinary activities speeds up the return of grip strength after open carpal tunnel release. When comparing different surgical methods for carpal tunnel release by using grip strength one has to consider the influence of early return to work on the grip strength.



FP113

A prospective randomized study comparing homodigital island flaps and the reversed flow homodigital flap for reconstruction of the finger pulp

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Objectives: To verify the results of finger pulp reconstruction after the utilization of the direct and reverse homodigital island flap in terms of discriminative sensitivity, joint stiffness and flap necrosis.

Material: A hundred and twenty patients with finger pulp losses underwent finger pulp reconstruction with direct homodigital island flap (62) or reverse homodigital island flap (60) between 1992 and 2004. The most frequent involved finger was the index finger (20) to the homodigital island flap. To the reversed homodigital flap the most frequent digit was the middle finger (18). The majority of the lesions were on the dominant pulp.

Results: In the series of the direct homodigital island flap, we verified using two point static discrimination test that a deficit of 2mm was present compared to the opposite side. To the Semmes- Weinstein test, a sensitivity deficit (4,31) was obtained in the involved digit compared to the contralateral side (2,83). Range of motion deficit obtained at the level of the proximal interphalangeal joint in 8 cases was of 15°. In the series of the reversed homodigital island flap, we observed a mean deficit of 4mm in comparison to the opposite side finger utilizing the two point discrimination test. With the Semmes-Weinstein test, we observed deficit of sensitivity (5,07) on the repaired finger, compared to the contralateral side (2,83). Range of motion deficit at the level of the proximal interphalangeal joint in 6 cases was of 15°. In three patients, it was observed partial flap necrosis.

Conclusions: We verified better results in the discriminative sensitivity after the utilization of the direct homodigital island flap ($p < 0,05$). However, when the reverse homodigital island flap was utilized, the residual articular deficit was lower compared to the other type of homodigital flap.



FP114

New classification of neuro-vascular island flaps for digital reconstruction: New technique of neuro-vascular island flaps for dorsal finger defects is presented

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A new technique of neurovascular transposition and advancement flaps is presented. Report of a case of full thickness burns to dorsum of index, middle, ring and little fingers treated with previously unreported neuro-vascular transposition island flaps. Despite minor flap losses in two fingers, the reconstruction was successful in covering exposed extensor tendons and achieving good functional outcome. Literature of neuro-vascular flaps was reviewed and a new classification for neuro-vascular island flaps is proposed.



FP115

Neuro-vascular island flaps for digital reconstruction

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Full thickness skin and soft tissue defects in fingers and thumb can be challenging to reconstruct. Personal experience with different methods of reconstruction of finger defects using vascularized island pedicle flaps is presented. A series of 68 flaps in 63 patients, from personal experience during 1998 to 2006 is presented. These include proximally and distally based types of homo- and hetero-digital flaps for defects on fingers and thumbs. With the exception of three cases, all others were performed as single stage procedures. Technical details, long term follow up and complications are discussed.



FP116

Innervated reverse digital artery island flap for a large pulp defect by bilateral neuroorrhaphy using the direct small branches of the digital nerve

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To provide sensation to the RDA flap, this flap can be raised along with either the dorsal branch of the digital N or superficial branch. However, superficial sensory branch from the radial or ulnar N innervates the dorsal skin of the proximal phalanx, and the dorsal branch innervates mainly the dorsal skin of the middle phalanx. Furthermore, paraesthesia was noted in the dorsal skin of the middle phalanx in patients where the dorsal branch was sacrificed. In an effort to overcome these problems, we have been using the direct small branches of the digital N. We present the arising pattern of the direct small branch from the digital N in cadaver, and our experience with innervated RDA flap using the direct small branches used to treat 14 pulp defects.

The sensory branches of 80 digital nerves were studied in cadaver. Two or three direct small branches of the digital N after interfascicular dissection were identified and sectioned proximally, leaving a 1cm nerve tail attached to the flap. The main digital N and its dorsal branch were left undisturbed. Neuroorrhaphies were performed between the two flap attached sensory nerves and both cut ends of the digital nerves at the defect site.

Anatomic dissections of the digital nerves showed that the 2-3 small branches of the digital N to lateral surface of the proximal phalanx were constantly present. All flaps survived. These flaps provided sensate coverage with static 2PD of about 6mm.

This flap supplies glabrous skin with near normal sensibility. In particular, by preserving the digital N and its dorsal branch in continuity in the finger, the injured finger retains a normal sensate middle phalanx. Furthermore, the two digital N coaptations implemented at the recipient site may have prevented the development of painful neuroma due to an unrepaired digital N stump.



FP117

Square thenar flap for digital tip injuries

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There were 22 patients who has digital tip injuries treated with thenar flap have been evaluated at the İstanbul Hospital Hand and Microsurgery Center, from 2000 to 2005. All injuries were transverse or palmar oblique finger tip amputation.

21 patients were male (%95,5), and 1 patients was female (%4,5). The mean age was 33(13-64). 11 patients were injured with right hand, and 11 patients were left. There were 12 patients with second finger, and 10 patients with third finger tip amputation.

The square proximal flap is sutured to the fingertip. 3 weeks later the flap is detached. The fingertip is closed with the proximal flap, and the margin of the thenar defect is sutured for closing of it without any graft.

All patients have had physical therapy after 3 rd week. Mean follow-up was 26 months. There was full function of the finger after ~55 days of the surgery. We have no complications like joint or 1 st web contracture.

Thenar flap is the reliable method for the treatment of the fingertip amputation with a large tissue defect. Closing of the donor side primarily, can be decreased of developing the scar formation of the tissue or the complication of the graft.



FP118

Vascularized skin-bone island flap for treatment of claw-nail deformity

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Limited amputation of the third phalanx may let the nail matrix remain in place and this may lead to a claw finger. Several treatments have been described for this condition.

It is well-known that a bone fragment implanted at the end of the phalanx will be resorbed in some months.

We then propose a vascularised skin-bone island flap based on the Venkataswani vascularised island flap combined with the resection of a lateral fragment of the third phalanx. This skin and bone are linked together by two or more transverse arteries, branches of digital arteries. Experimental work using cadaver injections have proved the constancy of these arteries.

The flap will be placed on the top of the remaining bone and fixed by a K-wire. Healing will take place in 45 days in average. The vascularised bone does not resorb with time and a better fingertip may be reconstructed, giving a support to the nail and decreasing the claw-nail appearance.

Results will be reported for 30 cases and discussion will be made on the size of the possible flap, the level of amputation and the cosmetic aspect obtained by this technique. Limitations are given for claw-nail deformity repair.



FP119

Half big toe-nail flaps with a pedicle of submillimeter vessels

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Background: We have been challenging the special range containing vessels of less than 0.5 mm in diameter. Vessels of the range are nameless anatomically. So we call the range "the innominate vessel field ". To handle this field, we manufactured a stereoscopic surgical microscope with 50 times magnifying power, the smallest needle in the world, and a high-resolution ultrasound tomograph. We report the half big toe-nail flap for reconstruction of distal finger phalanges . The flap has been sophisticated by these tools, and evolved into the flap with a pedicle of innominate vessels.

Patients: Half big toe-nail flaps were utilized in 17 patients since 1990. Donor sites were completely closed primarily without any other procedures. In the beginning of the series, a dorsalis pedis artery was explored to raise the flap, which took 1.5-2 hours. With a new microscope, the time reduced to less than 45 minutes. In 2005, a 20-40 MHz ultrasound tomograph (Hi-UT) was available to locate vessels less than 0.5 mm in diameter. Hi-UT revealed 19 arterioles at IP joint level of the big toe in 10 persons. According to findings of Hi-UT, a flap with a pedicle of innominate vessels only was raised in 5 mm incision length, and transplanted successfully as a free vascularized flap.

Discussion: The flap nourished by innominate vessels does not contain a pedicle of ordinary vessels, nor the axis in the flap. The flap is not belongs to any type of McGregor's flap concept in standpoint of "pedicle and axis". We can create a new type of flaps by handling the submillimeter vessels with the innovation of the tools.



FP120

Finger tip coverage with partial medial second toe pulp free flap with short pedicle

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This paper reports the clinical experience and method of partial (half of the pulp) medial side second toe pulp flap for the finger tip defect.

Cross sectional dimension of the second toe has abundant pulp tissue because eccentrically located phalanx. Elliptical flap design on medial side pulp with incision extends to MTJ as zigzag fashion. Flap elevate from distal to proximal with care for saving subcutaneous vein. After identification of subcutaneous vein, dissection carried down to identify neuro-vascular pedicle, and finish the flap harvest with 2cm long vascular pedicle. And the flap transferred to the finger and artery and vein repaired directly with finger digital artery and volar vein and repair nerve. Donor defect usually close directly. It follows routine postoperative management of free flap.

From 1999 to 2006, total 717 people 788 digits of free partial pulp flap has done in case of finger pulp defect or amputated finger tip, 3 cases out of all were successfully survived, and commonly covered index and middle finger. And it has done on 689 male and 99 female. 120 people who followed over 1 year shows 7.3 mm 2PD without painful tip and donor problem. Average measured vascular pedicle size of artery was 1.2mm and vein was 1.4mm. Average surgical time was 90 minunte.

In conclusion , according to our experience shows short pedicle medial second toe pulp flap has excellent tissue matching with minimal donor morbidity and excellent recovery of sensation. So, our suggestion is partial second toe pulp flap with short pedicle is a good option for finger tip defect coverage, but it must be performed by experienced microsurgeon.



FP121

Arterialized venous free flap using the thenar region for the reconstruction of the pulp defect of fingers

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Various methods have been introduced to reconstruct the pulp defect of fingers. The region which has the similar skin texture of the pulp is suitable as a donor site. Arterialized venous free flaps are usually used for the reconstruction of the soft tissue of fingers because of the thickness of the flap which is thin. Thenar and hypothenar regions have similar skin texture to the finger pulp. There was a report in which the recovery of sensitivity is good without the nerve anastomosis, when thenar and hypothenar regions are used as a donor site. But using the hypothenar regions is more difficult, because the vessel of the hypothenar region is smaller than the thenar region.

Authors have performed 17 cases of arterialized venous free flap using thenar region to reconstruct the pulp defect of fingers between August 2003 and August 2004. The age of patients ranged from 21 years old to 64 years old. The size of the flap ranged from 1x1.5cm to 3x2cm. The mean flap area was 3.2cm². The type of arterialized venous free flap was an A-V type in all cases. Every donor site was closed directly.

Of this type of surgery 15 flaps (88.2%) survived, 2 flaps (11.8%) failed. Among the 15 flaps, 11 flaps survived without any complications. A further 4 flaps showed the partial marginal necrosis but healed without an additional operation. The sensory recovery was relatively good. The static 2 point discrimination ranged from 3mm to 11mm during the follow-up period. Authors believe that the arterialized venous free flap using thenar region is a good method for the reconstruction of pulp defects in fingers.

Hideo Kushima, 2002

Motonao Iwasawa, 1997



FP122

The first web space free flap of the foot to reconstruct the pulp of fingers

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To reconstruct the pulp of the fingers, the donor site should have a similar thickness and skin texture. The first web space of the foot has a similar thickness and skin texture of the pulp of the fingers. Moreover, it has a reliable blood vessel and sensory nerve. The blood vessel and sensory nerve of the first web space of the foot run parallel to each other, so it is easy to dissect the vessel and nerve. The rate of the donor site morbidity is low when this flap is used. Authors have performed 23 cases of first web space free flap to reconstruct the pulp defect of the fingers between June 2004 and May 2005. The age of the patients ranged from 20 years old to 55 years old. The size of the flap ranged from 1x1.5 cm to 8.5x2.5 cm. The mean flap area was 5.4 cm². In 4 cases, we elevated the flap including lateral aspect of the big toe and medial aspect of the second toe. And then we made an artificial syndactyly to reconstruct the pulps on two fingers at the same time. In all cases, we performed 1 digital artery and 1 dorsal vein anastomosis. Every donor site that had a small defect healed spontaneously without any additional operations to cover it. Of this type of surgery 21 flaps (91.3%) survived, 2 flaps (8.7%) failed. There was no complication in the donor sites. There was no walking disturbance due to the skin defect of the donor site. The static 2 point discrimination in 10 cases that we could check ranged from 3mm to 15mm. The authors believe that the first web space free flap of the foot is a good option for the reconstruction of the pulp of the fingers and it has a minimal donor site morbidity.

Sang Hyun Woo, 1999



FP123

Simultaneous venous and soft tissue reconstruction in ring avulsion injuries using the venous island conduit flap

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Ring avulsion injury frequently results in soft tissue and venous injury that mandates restoring venous flow with simultaneous soft tissue reconstruction.

We report on the use of a composite pedicled venous flow through flap to simultaneously provide venous reconstruction and well vascularised pliable soft tissue cover in 10 patients. An island of skin from the dorsum of the adjacent digit was pedicled proximally on the dorsal intermetacarpal veins and transposed to the dorsum of the ring finger. The congested veins of the degloved digit were then anastomosed to the distal ends of the veins in the transposed venous flap, that act as vascularised conduits for venous blood flow.

The good healing that follows the use of a well vascularised flap helps early hand therapy and a good outcome.



FP124

Lengthening of digit with external fixator callostasis

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Purpose: We reviewed the results of finger lengthening by callostasis using the mini external fixation apparatus. The efficacy, problems and its solution will be report.

Materials And Methods: From February 1991, authors underwent digital bone lengthening with callostasis method. We performed lengthening in the 37 patients, 44 cases using mini external fixator. There were 27 men and 10 women, with an average age was 21.4 years old. Diagnosis included traumatic finger amputations in 28 cases and congenital hypoplastic digits in 16 cases. A very small skin incision is made at dorsolateral aspect of finger, and then, a transverse subperiosteal osteotomy is used. Thereafter external fixator was applied. A week later, gradual distraction of the fragments is initiated. The distraction device are turned one full turn daily providing 1 mm of elongation of the bone. Site of lengthening were metacarpal bone in 26 cases, proximal phalanx in 18 cases. 41 of 44 lengthening procedures resulted in complete consolidation of the bone gap after the single stage procedure. In three cases, secondary bone graft were required for the bone defect.

Results: Average consolidation periods were 17 weeks. Average amount of lengthening were 14 mm and average percent of gained bone length was 46%. Target of lengthening was achieved in all patients. The periosteum, the muscles, the neurovascular bundles, and the skin successfully undergo a slow and gradual lengthening without any soft tissue problem. There were minimal complications including marginal necrosis of skin, transient numbness, bone tip exposure and flexion contracture that were responded to conservative manage, but stump revision for bone tip exposure was performed in one case. In all cases followed more than 2 years postoperatively, there was improvement of hand function and cosmetic aspect.

Conclusion: The callostasis lengthening using mini external fixation apparatus is one of the useful methods in short hand bone lengthening to improve function of hand and cosmetic demands.



FP125

An evolution in flexor tendon repair

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Serial audits of flexor tendon repair are presented in order to show how review of incremental modifications in management led to a dramatic reduction in rupture rate.

We have prospectively audited the results of zone 1 and 2 flexor tendon repair on 4 occasions over a 5-year period. Each audit led to changes in protocol which were subsequently re-analysed. The repair technique has evolved from haphazard to 2-strand prolene to 4-strand fibrewire. There has been a reduction in rupture rate from 30% to zero, and the percentage of excellent outcomes (modified Strickland) has improved from 7 to 61

The value of formally reviewing changes in practice is discussed. In addition, we highlight some of the properties of fibrewire which we feel makes it an excellent suture for tendon repair



FP126

Mesenchymal stem cells increase tendon healing rate after primary repair in rabbits

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A repaired tendon needs to be protected for weeks until the healing tendon has accrued enough strength to handle physiological loads. Tissue engineering techniques have shown promise in the treatment of tendon defects. We tested the hypothesis that bone marrow derived mesenchymal stem cells (bMSCs) can accelerate the rate of tendon healing after primary repair of a tendon injury.

The injury model was a sharp transection of the rabbit Achilles tendon. The transected tendon was repaired using a modified Kessler suture. Both limbs were used and each side was randomized to receive either bMSCs (in a fibrin carrier) or control (fibrin carrier alone). Post-operatively, the rabbits were allowed to mobilize. Specimens were harvested at 3, 6 and 12 weeks for gross morphology, cell tracing, histology, immunohistochemistry, morphometric analysis and biomechanical testing.

Labeled bMSCs demonstrated viability in the intratendinous region at 6 weeks. At 3 weeks, immunohistochemical staining for collagen I showed better organization of the collagen fibers and better morphometric nuclear analysis in the treated group ($p < 0.05$). Biomechanical testing showed improved modulus in the treated group versus control ($p < 0.05$). At 6 and 12 weeks, there were no differences in morphometric nuclear parameters or biomechanical properties between the treated and control groups.

Cell therapy with bMSCs following primary tendon repair can accelerate tendon healing. It improves histological and biomechanical parameters of the early healing tendon, although the final results appear to be unchanged. This finding has clinical significance as the early time period during tendon healing is crucial.



FP127

An ex vivo biomechanical study to determine the optimal tendon bite length to achieve maximum tensile strength following flexor tendon repair

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It is now well recognised that the section of a flexor tendon incorporated in a repair becomes avascular and dies, therefore the suture strength and repair method is crucial in the early post-operative stage. Consequently, a repair involves a fine balance between minimizing tendon death and maintaining maximum tensile strength of the repair. The length of a core suture bite at a flexor tendon end is one of the critical factors in determining repair strength . Historically, a bite length of approximately 1cm has been advocated. However, there has been no definitive study to determine the optimal bite distance.

84 porcine flexor profundus tendons were divided and repaired using varying core suture bite distances (1.33, 1, 0.66 and 0.33cm) using a 4-strand two horizontal Kessler repair with a peripheral epitendinous suture. Experiments were performed using bilateral equal bite lengths and also by standardising one tendon by fixing at 1cm. Experiments were also repeated following incubation in blood.

Results showed that a length of 1.33cm provided the greatest tensile strength with a linear decline in strength in the 1cm, 0.66cm and 0.33cm bite lengths. However, the difference in strength between the 1cm and 0.66cm was not statistically significant. Interestingly, with the exception of the 0.33cm group, video analysis demonstrated that the mode of failure was invariably suture failure and not due to suture/knot pullout.

In conclusion, a 1.33cm bite distance provides a statistically significant strength gain over the widely accepted 1cm distance, most probably due to improved re-distribution of forces over the increased tendon lengths along the longitudinal strands of the core suture. However, there was no difference in the strength of repair between 1cm and 0.66cm. Finally, the effect of blood on tendon architecture and strength was minimal after 24 hours.



FP128

Two times two is not always four in flexor tendon repair

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Introduction: With the changes to earlier and more active movement of the digits after flexor tendon repair, there is a need for stronger suture techniques. A logical step is to increase the number of core strands crossing the repair. However core suture geometry and load-sharing between epitenon and core suture appear equally important. The aim of this study was to demonstrate that simply increasing the number of strands not necessarily increases the repair strength.

Methods: 48 fresh cadaveric porcine superficial flexor tendons were transected following a specified protocol and randomly repaired by a Modified Kessler repair (K), Double modified Kessler repair (DK), or McLarney repair (ML), and the same groups with an additional epitenon suture. (EK, EDK, EML). Repairs were evaluated for elongation, at 15 N and at maximum load, maximum breaking strength in a digital strain gauge. Mode of failure was evaluated with digital video camera.

Results: Maximum breaking strength was 34N for K, 36N for the DK and 45N for the ML. Similarly 38N, 57N and 56N for the EK, EDK and EML. Elongation at 15N was 10mm, 9 mm and 7mm for the K, DK and ML and 6.5mm, 6.6mm and 5.0mm for the EK, EDK and EML. With or without epitenon, the K and DK failed by suture snapping, the ML failed by pull-out.

Conclusions: The results show that the double Kesslers is only as strong as a single Kessler, when an epitenon is not applied. For the individual Kesslers of the DK, the load-sharing properties radically changed on insertion of an epitenon suture. This suture almost doubled the strength of the repair by redistributing load equally over the two Kesslers, allowing adjustment to the increasing tension. Therefore, Load-sharing and core suture geometry play a significant role in the strength of a repair.



FP129

A comparative biomechanical study of traction resistance among hand tendon suturing techniques

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A Conjoint Study From Instituto De Ortopedia of Hospital Das Clinicas De São Paulo and Departamento De Ortopedia of Hospital Das Clínicas Of Unicamp, Brazil

Objective: This study aims to biomechanically assess the traction resistance of three different tendon suturing techniques.

Material: Selected 54 tendons from flexor digitorum profundus of index, middle, and ring digits from fresh cadavers were submitted to tendon suturing and biomechanical testing on Kratos universal assay machine for strength, resistance, and 2-mm gap formation. Cross-sectional area of all tendons was measured, and did not present significant differences. Three different tendon suturing techniques were tested: 1) modified Kessler's; 2) Indiana method with four passages; and 3) Ulson's modification from Brunelli anchoring method. Eighteen tendons were tested for each type of suturing techniques.

Results: 1) regarding force: a) 13.02 ± 4.41 N for Kessler's technique; b) 20.21 ± 11.23 N for anchoring technique; c) 18.10 ± 5.40 N for Indiana technique; 2) regarding resistance: a) 4.09 ± 1.00 N/mm for modified Kessler's technique; b) 5.96 ± 2.27 N/mm for the anchoring techniques; and c) 5.42 ± 1.78 N/mm for the Indiana technique; 3) regarding gap formation: a) 17.13 ± 6.63 N for Kessler's; b) 27.71 ± 9.74 N for anchoring; and c) 19.28 ± 7.71 N for Indiana technique.

Conclusion: Results showed that Ulson's modification of Brunelli anchoring technique was the most resistese, achieving higher strength values and showing more resistese to separation. Tendon area was not different in all 54 tendons tested

A comparative biomechanical study of traction resistance among hand flexor tendon suturing techniques.



FP130

Temporal augmentation of flexor tendon healing mediated by BMP13 in a rabbit model

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Introduction: If the biology of flexor tendon healing can be altered to provide a stronger repair with fewer adhesions, better results can be obtained. We postulate that adenoviral delivery of Bone Morphogenetic Protein (BMP) 13 will provide for an improved load to ultimate failure of the healing flexor tendon.

Methods: Recombinant adenovirus expressing BMP 13 (AdBMP13) was constructed and purified. A 50% tendon laceration of the 1 st-4 th tendons of the right and left hind-paws of 12 New Zealand white rabbits were performed. The tendon sheaths were injected under direct visualization with either 20 μ l (containing 1X10⁸ pfu) of AdBMP13 or AdGFP as a control. At 1, 2, and 3 weeks after surgery, rabbits were sacrificed and tendons harvested. The tendons were subjected to tensile strength testing to the point of ultimate failure.

Results: In the AdGFP group, 11 tendons were tested at 1 week, 12 tendons at 2 weeks, and 14 tendons at 3 weeks. In the AdBMP13 group, 14 tendons were tested at 1 week, 14 tendons at 2 weeks, and 14 tendons at 3 weeks. Load to failure was at 1 week= 10.58N, 2 weeks= 18.99N, 3 weeks=20.78N. The load to ultimate failure of the BMP 13 group was 79% higher at the 2 week time point and 96% higher at the 3 week time point when compared to the load to failure at the 1 week time point.

Conclusions: Adenoviral based gene therapy with BMP13 increases the load to ultimate failure in an *in vivo* rabbit model of flexor tendon laceration as early as two weeks. These results demonstrate the potential of BMP13 to improve flexor tendon healing. Improving the biology of healing tendons by delivering BMP13 remains a promising adjunct to treating tendon injuries in general and flexor tendon injuries in particular.



FP131

Spiral CT with 3D volume rendering of flexor tendons of the hand: Technique, normal anatomy and tendon ruptures

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Introduction : Flexor tendon injuries can usually be diagnosed based on accurately clinical examinations. However sometimes it may be difficult to differentiate tendon rupture from tendon adhesion and furthermore the size and location of the rupture may not be evident on clinical examination. Accurate diagnosis is critical, because the treatment of tendon rupture is completely different from the treatment of tendon adhesion. The aim of this work is to illustrate CT technique with 3D volume rendering in the study of the flexor tendons of the hand, to show its capacity in demonstrating normal tendon anatomy and to evaluate its clinical applications, particularly in tendon ruptures.

Material And Method : In the period between 2001-2005 21 patients with a different spectrum of finger flexion disturbances underwent spiral CT of the hand. None of the patients had an open injury. 3D volume rendering images were generated by commercially available software.

Results: 3D CT image gave a precise analysis in all cases and had been proved through surgical findings in 18 patients; 3 patients did not undergo operation.

Discussion : This technique allowed us to obtain an accurate representation of the normal tendon anatomy, to identify the exact site of rupture and the real gap between the tendon ends. The main disadvantage of CT imaging is that it must use ionizing radiation.

Conclusion: We believe that 3D VR CT, if correctly performed, can be an useful tool, particularly to plan surgical procedure in tendon rupture and may become the alternative to MRI and Ultrasound and finally it doesn't require the surgeon to mentally integrate multiple images and most clinicians can recognize tendon rupture easily.



FP132

The wide awake approach to flexor tendon repair

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Purpose: The wide awake approach to flexor tendon repair is performed in totally unседated comfortable cooperative patients for whom no tourniquet is required as finger and hand injected epinephrine is used with the lidocaine for hemostasis and pure local anesthesia (Lalonde D, Bell M, Sparkes G, et al. 2005).

Methods: The experience with 20 consecutive patients with Zone 1-4 flexor tendon injuries who had their flexor tendons repaired with the wide awake approach will be reported.

Summary: The wide awake patient is able to comfortably move the injured fingers during the surgery as there is no tourniquet. The surgeon, the patient and the therapist can all see the full range of active motion achieved by the repair before the skin is closed. We have seen intraoperative active flexion produce tendon repair gap which we have corrected before closing the skin. If required, unnecessary pulleys can be divided to obtain a full range of motion before the skin is closed. All of the repairs were performed in the clinic (n=15) or emergency department (n=5), which was found to be 1/10th as expensive and much more convenient than our previous practice of general anesthesia in the main operating room. The hand therapist attended the surgery for many of the repairs and participated with the surgeon in the teaching of the patient while the surgery was occurring. Patients become better educated members of the rehabilitation team.

Conclusion: The wide awake approach to tendon repair provides several advantages that are not seen with the conventional tourniquet and sedation/general anesthesia approach.



FP133

Clinical results after two-staged reconstruction of the flexor tendons

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Purpose: Our purpose was to assess the results after two stage flexor tendon repair using the technique of Paneva-Holevich in neglected lesions of the flexor tendons of the hand in zone II and III.

Methods: We analyze the results of 53 patients with neglected lesions of 61 flexor tendons in zones II and III of the hand for a period of 6 years. After routine diagnostic procedures we initiated the first stage of the Paneva-Holevich operation consisting of use of the same digit FDS as a pedicle graft for staged reconstructions. The severed proximal ends of the FDS and FDP are sutured to one another in the palm (stage 1). At the second stage after one month, the FDS is divided at its muscle-tendon junction and brought distally through the sheath.

We performed the operation on the second to fifth finger without the thumb. After completion of the second stage of this procedure the fingers were immobilized in the usual manner and early active rehabilitation was allowed.

Summary: Sixty-eight percent of the patients were in the Boyes salvage group before operation. Overall 54% had good or excellent results by the total active motion (TAM) as a percentage of total passive motion (TPM) method, although only 19% had final TAM of greater than 180 degrees. Complications included infection in 15%, rupture in 4%, amputation in 4%, and reflex sympathetic dystrophy in 1% of the patients. Sixteen percent of the patients required tenolysis after second stage.

Conclusion: Factors associated with a poor result included zone I or II injury and patients who were less than 10 years of age. Factors associated with a better result included zone IV or V injury and all postoperative therapy under the direct supervision of the treating surgeon.

References: [Amadio PC](#) 1988; [Kotwal PP](#) 2005.



FP134

Incidence of scaphoid fractures in Malmö; Comparison between the 1950's, 1990's and 2000's

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Introduction: During the century changes in the incidence of fractures has been found. This applies mainly to fragility fractures as the hip and the wrist.

The purpose of this study was to examine the change of incidence in scaphoid fractures during the last 50 years.

Methods: Retrospectively all film taken of the wrist region in the period 1953-57 and 1991-92 were examined. A prospective investigation in the 2003-05 period were compared to the earlier groups.

Results : During 1953-57, 150 fractures were found and 134 during the 1991-92 and finally 141 scaphoid fractures were found 2003-05. There were 3 times as many fractures in men. In the 1950's the incidence among men was 4/10.000 residents in age group 10-39 and declined thereafter. For women the incidence was 1/10.000 in age group 10-19 and after 50.

In the 1990's the incidence among men increased to 7-11/10.000 in age group 10-39. For women and increased incidence with bimodal distribution of higher incidence in age groups 10-19 and after 60 was found.

In the 2000's the incidence among men age 10-39 was 10-16/10.000 and for women a continued increase of incidence with a bimodal distribution was found.

Conclusion: A significant increase of scaphoid fracture incidence among men 10-39 years of age from the 50's until the 90's was found. The rise has continued during 2000's but is not statically significant in the two latter periods. There is probably a gender different causes of fractures. In men fractures occur mostly in the young. In women the bimodal distribution is probably due to osteoporosis in the elderly.



FP135

MRI in suspected scaphoid fractures reveals many other carpal fractures and CT scan is inferior to MRI in the diagnosis of suspected scaphoid fracture

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Introduction: MRI has become a popular investigation in patients with suspected scaphoid fracture when X-ray is negative. CT scans has been claimed to add higher specificity than plain X-ray.

The aim of this study was to reveal the number of false negative X-ray investigations in suspected carpal fractures and test the value of multislice-CT scan in scaphoid fractures.

Methods: A prospective investigation during a 2.3 year period including all suspected scaphoid fractures among a ¼ million inhabitant area.

Results : 310 patients with clinically suspected scaphoid fracture had an MRI within 1-7 days. 141 patients had a scaphoid fracture of which 113 (80%) were seen on primary x-ray. 29 radius fractures were seen on MRI of which 22 (76%) were diagnosed on X-ray. 14 capitate fractures were spotted in the MRI but only one could be seen on X-ray. 23 other carpal fractures were false negative on X-ray and only two triquetral fractures were diagnosed with X-ray. Of the false negative scaphoid X-rays no scaphoid fractures were seen on multislice-CT.

Conclusion: MRI in suspected scaphoid fractures reveals many other carpal fractures than the scaphoid and in particular capitate and triquetrum fractures are hard to diagnose by conventional means. Multislice-CT scans did not add anything to the x-ray investigation in terms of the diagnosis of scaphoid fractures, but gave the surgeon valuable information for the treatment.

Critical reference: Michael Sauerbier, 2004



FP136

A new technique for imaging longitudinal computed tomography of the scaphoid

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Scaphoid fracture is the most common in carpal bones. Although diagnosis of a fracture or judgment of the bone union usually depends on plain radiograms, we consider that recognition of a scaphoid fracture in detail is difficult with only a few plain radiograms. There are reports on efficacies of longitudinal CT in evaluations of scaphoid fracture but it remains as a qualitative evaluation because it has not been determined whether the scanning was in a true longitudinal plane. We developed a technique as below to accurately take longitudinal scans of the scaphoid and measured anatomical parameters of the normal scaphoid using these images.

The patient makes an equilateral triangle with bilateral thumbs in radial abduction with the index fingers lying prone on the scanner table with both hands on the midline above the head; ensuring that the axis of the thumbs is perpendicular to the body axis (i.e. the axis of the thumbs is parallel to the gantry). Images are then obtained without tilting the gantry. There is no need to adjust the position of the hands after scouting if the axis of the thumb is indeed perpendicular to the body axis. Special devices to immobilize the wrist are not used for this examination. Data was expressed as mean \pm SD. Longitudinal CT scans of 47 scaphoids were taken and evaluated. Scaphoid length was 27.1 ± 2.3 mm, and height was 13.8 ± 1.2 mm. The dorsal cortical angle was $137.9 \pm 5.8^\circ$.

For qualitative and quantitative evaluations in orthopedics, high reproducibility of images is essential. The anatomical parameters obtained from our scanning method are similar to values obtained from recent 3 dimensional CT analyses. We believe that longitudinal CTs of the scaphoid obtained by our methods were more precise than those by conventional scanning.



FP137

Persistent non-union of the scaphoid after failed bone graft - salvaged by the vascularised second metacarpal base bone graft

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Scaphoid nonunion is usually treated with a free bone graft with internal fixation. Reported union ratio is 100 to 47% (Gregory A. Merrell 2002). To increase the union rate, especially nonunion in the proximal segment, vascularised bone grafts have been developed. This is going to present one of the procedures of vascularised second metacarpal base bone graft (the method, Masaharu Makino 2000). (Materials and Methods) Surgical procedures of the method are dissection of the second dorsal metacarpal artery and two veins at the ulnar side of the second metacarpal, elevating of an adequate amount of vascularised bone tip, and grafting to the nonunion site after curettage of the scar and necrotic bone tissues. Grafting can be done from the both dorsal and also palmar directions. In the last eight years, four cases were operated on by the method. All of them were male, aged 26, 39, 42, and 59 year-old. The period from injury to the first surgery was 1.5 to 20 years. The sites of nonunion were in the distal one third in one, the middle in one, and the proximal one third in two cases. The first surgical intervention for all of them had been carried-out with iliac bone graft and internal fixation, but failed. The method was done in 6 to 26 months after the first surgery. (Results) The cases were followed 7 to 39 months. Union was achieved in around four months, showing bone trabeculae bridging, and decreasing bone atrophy in the proximal segment. Postoperative MRIs were available in two cases, revealing iso-intensity signals of the entire scaphoid. All of them returned to the previous job, or activities, complaining of a mild pain in only one case. (Summary) Four cases with persistent nonunion of the scaphoid after failed bone graft was salvaged by the method. (Conclusion) Scaphoid nonunion after failed bone graft was saved in all four cases. The method could be the one of the choice for this recalcitrant disease.



FP138

A biomechanical comparison in human cadavers between scaphoid fracture fixation and grafting with iliac bone versus distal radial bone

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Introduction: The two commonest sites of bone graft harvest for scaphoid grafting are the iliac crest and distal radius. We wished to discern if there are differences in the biomechanical properties of scaphoid fractures grafted with iliac crest and those grafted with distal radial graft and thus undertook a cadaveric study.

Methods: 28 paired human fresh frozen cadaver scaphoids were photographed, weighted and their dimensions measured before undergoing 16 multi-slice CT scanning and DEXA bone densitometry. 5mm mid-waist osteotomies were made using a custom-made jig and graft of the same dimensions inserted. One scaphoid from each cadaver received an iliac crest graft and the other paired scaphoid received a distal radial graft with the grafts being taken from the same cadaver. The scaphoid was then fixed with a miniAcutrak screw. The scaphoids were CT scanned post-fixation before being placed sequentially into a Zwick biomechanical testing machine. The scaphoid underwent gradual loading followed by assessment of load to failure, with the method of each type of individual failure being assessed.

Results: The scaphoids in each group had similar lengths, widths, weights and density. There were no differences in the biomechanical properties of the group of scaphoids grafted with iliac crest and the group grafted with distal radius. Load to 2mm displacement, load to failure, moment at 2mm displacement, moment at failure, and stiffness were similar, with or without correcting for density and testing.

Conclusions: Both the iliac crest and distal radius provided grafts of suitable size and shape for scaphoid grafting although iliac crest appeared to create a scaphoid morphology closer to that of the original bone. Biomechanical testing revealed that both sources of graft provide similar scaphoid biomechanical properties and as such we recommend the distal radius as the source of graft as there is less donor site morbidity.



FP139

Prospective randomized study comparing vascularized distal radial bone graft and iliac crest bone graft in scaphoid nonunion

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Objective: The purpose of this study was to evaluate functional recovery and consolidation time for scaphoid nonunion comparing distal radial vascularized bone graft and iliac crest bone graft.

Material and Methods: A prospective study including 80 patients, since January 1998 to December 2004, due to scaphoid nonunion. 57 patients were male, 23 females, mean age was 25, 85 years; mean time of fracture was 31, 69 weeks and 24 proximal pole and 56 middle third nonunion. The patients were randomized in 2 groups: the group 1 consisted in 45 patients treated with conventional iliac crest bone graft and the group 2 of 35 patients treated with distal radio vascularized bone grafts. When using the vascularized bone graft: proximal pole nonunion we had used Zaindemberg ´s technique; middle third Mathoulin ´s technique. For the iliac crest graft we had used Fernandez´s technique. Mean time of following was 40 weeks

Results: We have found union rates of 91, 42% in the vascularized bone graft group and 100 % in the iliac crest group, with 3 cases of nonunion in the first group. The average time for consolidation was 7,97 weeks for the vascularized group and 8,89 weeks for the iliac crest group but no significant statistical difference was noticed between them ($p= 0,135$). We reported no statistic difference in grip strength. Better results were seen in wrist flexion in the vascularized group. Extension was better in the iliac crest group, with mean of 55, 44 degrees and 83 % comparing to the healthy side (the vascularized bone graft group had mean of 49, 14 degrees and 64

Conclusion: We concluded that the principles of a precise surgical technique and post-surgical stability in nonunion site are essential to a good result despite of the kind of graft and technique used.



FP140

Successful treatment of complicated non-unions of the scaphoid with a vascularized bone graft: Surgery for proximal pole non-unions and revision after failed initial surgery

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Purpose: To determine union rate in complicated nonunions of the scaphoid treated with a vascularized bone graft.

Introduction: Vascularized bone grafting for scaphoid nonunions (1-2 ICSRA, Zaidenberg technique) has shown initial enthusiasm. Its usefulness has been challenged in cases where the proximal pole of the scaphoid is avascular. Complicated nonunions where the proximal pole is highly likely to be avascular occur in revision surgery and proximal pole nonunions.

Materials And Methods: Fourteen patients were retrospectively followed up. Eight had nonunion following previous scaphoid surgery (2 previous ORIF, 2 previous nonvascular grafting, and 4 with two previous surgeries). Six patients had no previous surgery for a proximal pole nonunion of 12.5 months' duration. All patients were male with an average age of 24. Delay from fracture to vascularized bone grafting was 20 months. Graft harvesting was done according to the Zaidenberg technique by 2 orthopaedic surgeons. CT-scan was used to confirm union in all patients except two who were lost of the follow-up. Twelve patients were followed up by an independent surgeon at a postoperative minimal period of 4 months. Functional status was assessed with the DASH questionnaire and follow x-rays were performed to determine the presence of degenerative changes.

Results: Union was confirmed by CT-scan in 11 of 12 followed patients (92%) at an average time of 6 months following vascularized graft. Radio-scaphoid osteoarthritis was seen in the 1 patient that didn't achieve union.

Discussion: This series suggests that the Zaidenberg graft is useful and may be proposed in situations of revision surgery and proximal pole non-unions. We achieved a high union rate in these complicated nonunions even though there was high likelihood that the proximal pole was avascular. This study stresses the importance of protective immobilization until documented union by CT-scan in this difficult subset of patients.



FP141

Scaphocapitate arthrodesis in the treatment of scaphoid non-union with proximal pole avascular necrosis

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The purpose of our study was to evaluate the results of excision of the proximal pole of the scaphoid combined with scaphocapitate arthrodesis in the treatment of scaphoid nonunion with avascular necrosis of the proximal pole. The procedure involves excision of the proximal pole of the scaphoid through a dorsal approach and a scapho-capitate arthrodesis with 2 non canulated Herbert screws via an additional radial incision. Twenty-two patients were included in this study. The mean follow-up period was 38 months. Evaluation included measurement of wrist range of motion, grip strength, assessment of pain, and evaluation of radiographic parameters. Postoperatively, wrist extension and flexion averaged 69 and 45 degrees, respectively. Radial deviation averaged 17 degrees and ulnar deviation averaged 13 degrees. Grip strength was 85% of the contralateral side. No patients showed progression of radioscaphoid arthritis or capitate proximal migration on follow-up radiographs. We conclude that scaphocapitate arthrodesis with excision of the proximal pole of the scaphoid is a viable option in the treatment of scaphoid nonunion associated with avascular necrosis of the proximal pole.



FP142

Adaptive proximal scaphoid implant (APSI) – A case series

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The treatment of scaphoid fracture non-union with a small proximal fragment is difficult. The Adaptive Proximal Scaphoid Implant (APSI) is a non-fixed implant that putatively follows the natural movements of the scaphoid that are induced by movements of the wrist. We present a case series where this implant was used.

Methods: Prospective study of six patients. Pre-operative level of discomfort and disability, pain visual analogue scores, range of movement and DASH scores were recorded. Post-operatively, DASH questionnaires, level of discomfort and disability, range of movement, grip strength, pinch strength, pain visual analogue scores and overall satisfaction were recorded. Average follow up of 14 months

Results: Six patients. 1 lost to follow up. 4 male, 1 female. Mean age 35.8 yrs range (21-62). Mean pain VAS scores pre-operatively 7.35 range (6-9). Post-operatively 3.75 range (1-7). Post-op grip strengths mean 30 poundsforce range (23-39). Opposite hand mean 41 (range 30-53). Post-op pinch strength mean 18 poundsforce range (15-21). Opposite hand mean 17 (range 15-20). Pre-Op DASH scores mean 43.6 range (23-66). Post-op DASH mean 18.3 range (1.6-50). Post-op mean flexion 32.5 degrees range (10-55), pre-op 23.7 range (5-50). Post-op mean extension 27.5 degrees range (20-40), pre-op extension 22.5 range (0-30). Post-op ulnar deviation mean 20 degrees range (5-30), pre-op 22.5 range (5-30). Post-op radial deviation mean 12.5 degrees range (5-30), pre-op 8.75 range (2.5-5). All patients had full pronation and supination pre and post op. Overall satisfaction mean 6.75 out of 10 range (5-9). 4 patients returned to work. There were no dislocations of the implant.

Conclusion: Our results offer some encouragement for use of the APSI. At present we limit its application to injuries where the proximal pole is non viable or fragmented. We are continuing to evaluate its use and results



FP143

Prospective randomized trial of injection of dexamethasone versus triamcinolone for idiopathic trigger finger

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Introduction: This is a prospective clinical trial comparing the efficacy of a soluble corticosteroid (e.g. dexamethasone) and an insoluble corticosteroid (e.g. triamcinolone) for treatment of idiopathic trigger finger.

Materials And Methods: Eighty-four patients were enrolled: 68 completed the six-week follow-up, 63 completed the three-month follow-up. Outcome measures included the Disability of the Arm, Shoulder and Hand (DASH) questionnaire, trigger finger grading according to Quinnell, and satisfaction on a visual analog scale (SVAS).

Results: At the six-week follow-up, the triamcinolone group demonstrated a statistically significant improvement in satisfaction ($p < 0.05$) and a trend toward improvement in Quinnell score over the dexamethasone group ($p = 0.17$). At the three-month follow-up, there was no difference in satisfaction ($p = 0.54$) and a significant improvement in Quinnell score in patients receiving triamcinolone ($p = 0.01$). Six patients in the dexamethasone group and only one patient in the triamcinolone group elected trigger finger release ($p = 0.03$). Absence of triggering was recorded in 45% of patients at 6 weeks and 60% of patients at 3 months with a trend towards better performance of triamcinolone ($p = 0.07$ and $p = 0.12$).

Discussion: Patients should be advised that triggering often takes months to resolve after corticosteroid injection, repeat injections are common, and the overall success rate within 3 months is approximately 60%. Triamcinolone was significantly superior to dexamethasone in terms of Quinnell score and requests for surgery, but not in terms of DASH, satisfaction, repeat injections, or overall cure rate with the numbers available.



FP144

Learning the percutaneous trigger finger release: Tips, trapfalls and procedure

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Although percutaneous trigger finger release is well described since years, it is not overall established and regarded as not safe and difficult to perform. We tried to standardise the procedure and describe a workflow for beginners.

Methods: Since 2005 we perform percutaneous trigger thumb release in a standerdised way to develop a secure learning standard. Marking the A1 pulley is well described and easy to perform. To train the learning surgeon we do a percutaneous surgery prior to the classic open procedure and mark the completeness of release as well as the distances to the nerve bundles in a protocoll.

Together with the potographed markings in advance, the learning surgeon is able to optimize his performance under standardised circumstances without any danger to the patient.

Summary: Under standardised conditions, percutaneous surgers n trigger finger release is safe and easy to learn.Our method, learning curve and its implications is presented.

Literature: Lorthioir, J. Surgical treatment of trigger-finger by a subcutaneous method 1958, J.Bone Joint Surgery; Wang, H.C: and Gau-Tyan, L. Retospective Study of open versus percutaneous Surgery for trigger thumb in children, 2005, PlasReconSurg



FP145

Ten trigger fingers in an adult man

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Trigger finger is a common disease particularly in the middle aged women. A very rare case in which an adult man had 10 trigger fingers was experienced. He was treated with local steroid injections in both thumbs, but trigger finger disease has been aggravated in every digit of both hands. We performed an early operative treatment. Three months after the operation, the patient could perform his work without discomfort in his hands and showed normal range of motion in all fingers. When an adult man works in an occupation requiring the use of vibrating tools with a forceful grip, has a family history of trigger finger and also has Raynaud's disease without secondary causative diseases, the probability of trigger finger in all ten fingers is very high and an earlier operative treatment will be more effective after a development of trigger finger.

Treizes AJ 1988

Weilby A 1970

Bonnici AV 1988



FP146

Is percutaneous trigger thumb release really dangerous?

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Percutaneous release of trigger digits proved to be equal to open technique in all fingers with the exception of the thumb. In this finger percutaneous technique should not be used resumably due to the proximity of the digital nerves and therefore the possibility of their injury during the procedure.

Objective of this prospective study was to see if there is a difference between percutaneous finger release of the thumb and other fingers

One hundred and three patients with triggering grade II, III and IV were treated by percutaneous release under local anesthesia using a 21 gauge needle in the last three years with the minimum follow up of two months and maximum follow up of two and a half years. The technique used in thumbs differed from the one used in the other fingers in strict hyperextension of the thumb during the procedure and careful planning of the spot of the needle puncture. Duration of postoperative pain, finger range of motion, strength and recurrency of triggering were observed.

Among 103 patients with 134 trigger digits 94 (91,2%) had complete relief of their symptoms. One hundred and twenty-five digits (93%) were successfully released: 84 thumbs, 3 index, 20 middle, 21 ring and 6 little fingers. The symptoms recurred in 9 fingers (6,7% of all fingers), that is in 2 thumbs (2,4% of all the thumbs) and 7 other fingers (14% of all the other fingers). There were no lesions of important anatomic structures. All digits with recurrent triggering were successfully released by open technique. Pain after the procedure lasted on average for 17 days.

The results of the percutaneous trigger finger release are even better in thumbs than in other fingers. If the anatomical landmarks are observed it can be safely performed also in trigger thumb.



FP147

Psychological profile of a group of chronic limb pain patients in a hand surgery clinic

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Purpose : To describe the psychological profile of 35 individuals seeking treatment for chronic limb pain.

Methods : Psychological evaluations, (BAPSI, SCL, Oswestry, etc) H&P, sensory motor evaluation, imaging & electrodiagnostic studies, assessment of pain & physical conditioning (FCE, BMI, VS), and work, insurance, & litigation status were evaluated from the records.

Analyses : Descriptive statistics, Chi square (X²), and correlation coefficients, and logistic regression were used to determine predictive value of gender, ethnicity, age, level of education, medical diagnosis, & litigation status.

Findings: Pain associated with hand symptoms was neuropathic in origin ($p < .001$) and significantly associated with depression ($p < .001$) & deconditioning ($p < .001$).

44.4% (16) of patients had serious impairment in social, occupational, or school functioning; 36.1 % (16) had moderate impairment, 16.7% (6) had some impairment, and 2.8% (1) had slight impairment. 86.1% (31) had severe psychosocial stressors, 11. 1% (4) had moderate stressors, and 2.8% (1) had mild psychosocial stressors.

Level of pain was significantly associated with Patient Problem Rating ($r = .477$; $p < .006$).

Level of pain was not associated with gender ($r = -.219$; $p = .282$), age ($r = -.219$; $p = .282$), education ($r = -.189$; $p = .356$), litigation status ($r = -.013$; $p = .475$) Medical diagnosis was not associated with depression ($r = -.126$; $p = .532$).

Discussion : Depression coexists with chronic limb pain and serious impairment and physical, occupational, and social functioning reported at an average of 3 years after the onset of chronic pain. Symptom magnification was associated in 96% of patients. **Conclusion :** The psychological profile of patients with limb pain reflects chronic suffering and is similar to patterns observed in other chronic illnesses. Depression coexists with chronic pain in most individuals. As such, concurrent treatment of depression may increase the likelihood of successful outcomes.



FP148

An alternate nociceptive drive: The role of afferent-efferent proprioceptive system in the maintenance of chronic pain states

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Purpose : To provide an explanatory model of neck, hip, and upper/lower limb pain which often persists following adequate nerve decompression.

Background: A relationship exists between endoneural pressure and abnormal muscle activity. Abnormal activity (EMG) in the scalene muscles is followed by supraspinatus, rhomboid, deltoid, ECRL, and ERCB response as a result of endoneural pressure >40 mm/hg in median/ulnar nerves of goats. Above 100 mm/hg the response was seen in the same muscles on the contralateral side. Subsequently, this phenomenon was observed originating from the radial nerve and noted between the sciatic and tibial nerves and iliopsoas, piriformis, and gluteus muscles of animals and humans. With endoneural pressure exceeding 40mm/hg nociception originates from the ipsilateral peripheral nerve by activation of A-delta and C fibers to dorsal root ganglia and spinal cord to the reticular formation and cerebellum. Above 100 mm/hg, the afferent response crosses the midline (spinal cord, medulla) and triggers abnormal muscle activity in homonymous muscles in the contralateral side indicating origination in the same spinal segment, proprioceptive system involvement, and origination of the efferent activity at subcortical levels as observed under superficial anesthesia in humans and animals.

Conclusion : A reverberating afferent-efferent loop is activated that starts with peripheral receptors (transduction) travels along the spinal cord (transmission) to the midbrain (modulation), cerebellum or sensory cortex (perception) with a motor activity (response). However, prolonged efferent activation generates muscle damage through persistent muscle contraction which in turn induces afferent nociceptive impulses by activating proprioceptive receptors and dorsal horn sensitization. This response induces further muscle activity which triggers further nociception and response. Once the somatic-gamma proprioceptive loop closes, nerve decompression may not resolve the pain state. Thus, the proprioceptive system becomes a nociocceptive drive.



FP149

Treatment of an early complex regional pain syndrome type 1: A longitudinal study of the effectiveness of "Szczecin" protocol

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Introduction: Complex Regional Pain Syndrome Type 1 (CRPS Type 1, formerly RSD, algodystrophy) is considered a rare, but serious complication in hand surgery. Treatments of early CRPS Type 1 include physiotherapy, sympathetic interruption, calcitonin and free radical scavengers. Neither of these methods is widely accepted as method of choice. We propose an original protocol for management of early CRPS Type 1.

Patients and methods: Seventy-five patients (68 women, 7 men, mean age 58 years) with early CRPS Type 1 were identified over the period of past 10 years. The most frequent precipitating injury was fracture of the distal radius – 54 patients (72%). The diagnosis of this condition was made on clinical grounds. The treatment, called "Szczecin" protocol consisted in administration of Mannitol 20% i.v. 2x250 ml/day and dexamethasone i.v., 8 mg/day throughout 7 days, in an in-patient manner. Patients were assessed before the treatment, at 1 week (early outcome), and finally mean at 9 months. The assessments included level of pain (VAS, range 0-10), swelling, loss of finger flexion (distance pulp-distal palmar crease) and total grip strength.

Results: Immediately after the treatment was completed (at 1 week), mean values of VAS score decreased significantly from 6.7 to 2.3, swelling disappeared, and all but two patients achieved full finger flexion (initial mean loss of finger flexion 5.8 cm). Grip strength remained 0 kG, as before treatment. At 9 months 70 patients were available. Mean VAS score was of 1.8, mean loss of finger flexion was of 0.3 cm and mean total grip strength was of 34% of the unaffected hand. No side effects of short period of steroid therapy were observed.

Conclusion: The results of this study show effectiveness of our original method of the treatment of early CRPS Type 1 and these outcomes are significantly better than presented in the literature. This allows us to propose our "Szczecin" protocol as treatment of choice in early CRPS Type 1, particularly complicating fractures of the distal radius.



FP150

Various disorders similar to complex regional pain syndrome (CRPS) type I

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Objective: In CRPS type I, spontaneous pain is disproportionate to the initiating event, and there is evidence of edema or abnormal submotor activity. However, the diagnosis is excluded by the existence of condition that would otherwise account for the degree of pain and dysfunction. The aim of this paper was to review the disorders similar to CRPS type I.

Materials and Methods: Thirteen hands of thirteen patients (female 6, male 7: mean age, 61 years; right hand 10, left 3) had spontaneous pain and edema of the hand, and were diagnosed as the disorders similar to CRPS type I. The prior events were trauma in seven patients and surgery in six. The disorders developed six weeks to eight years (mean, one year) after the prior events. All thirteen patients had spontaneous pain, edema, and restriction of motion of the wrist and/or digits. Allodynia were recognized in eight patients, abnormal perspiration in four, skin atrophy in three, and skin redness in three. The observation periods ranged from two months to two years.

Results: The causative disorders were arthritis in three patients, joint contracture in four, trigger finger contracture type in three, trigger wrist in one, carpal tunnel syndrome (CTS) in one, and remitting seronegative symmetrical synovitis with pitting edema (RS3PE) in one. Local injection of triamcinolone was performed for the treatment of arthritis, trigger finger, and joint contracture, and it provided good results. Splint therapy was effective for trigger wrist. Open release for CTS provided good results. Oral administration of prednisolone was effective for RS3PE.

Conclusion: The causative disorders with spontaneous pain and edema were mainly inflammatory conditions, including arthritis, trigger finger, CTS, and RS3PE. These inflammatory conditions were well treated with steroids. It is important to differentiate trigger finger, arthritis, CTS, and RS3PE from CRPS type I.



FP151

Cervical nerve root compression - One cause for intractable lateral elbow pain

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Objective: To investigate the mechanism of treatment of intractable lateral elbow pain by local block at the neck.

Methods: Local block was done in 14 cases of intractable lateral elbow pain. A combination of 2 ml of 0.5 % marcaine with 2 ml of triamcinolone acetonide acetate (10 g/L) was injected at the intersection of the posterior border of sternocleidomastoid muscle and the external jugular vein in the neck which was the tenderness site, for 3 to 4 consecutive times (once a week). Surgical intervention was performed in 2 patients who complicated thoracic outlet syndrome. All patients were followed for 4 to 14 months.

Results: Excellent result was found in 12 cases, and poor result in 2 cases. The symptoms disappeared after neurolysis of brachial plexus in 2 patients of intractable lateral elbow pain combined with thoracic outlet syndrome.

Conclusions: C5, 6, 7 nerve roots compression may be one of the causes for intractable lateral elbow pain.

Keywords: Nerve compression syndromes, Cervico-brachial neuralgia, Brachial plexus, Tennis elbow



FP152

Normal dermal fibroblasts modulate Dupuytren's cord cells

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Introduction: Recurrence rates of 40% are common following Dupuytren's fasciectomy but can be reduced to approximately 1% by dermofasciectomy. Our hypothesis is that normal dermal fibroblasts can modulate the fibroblasts in Dupuytren's disease. Our aim was to develop an in vitro model of Dupuytren's disease following fasciectomy and compare it with the conditions pertaining following dermofasciectomy.

Methods: Matched specimens of Dupuytren's cord, Dupuytren's skin (overlying the cord) and normal, non-glabrous skin were collected from patients who had undergone dermofasciectomy. Fibroblasts were isolated from all three specimens. The model consisted of a type I collagen matrix populated by Dupuytren's cord fibroblasts. This was overlain either with palmar Dupuytren's skin fibroblasts to emulate the affected hand or with normal skin fibroblasts to mimic the situation following dermofasciectomy. Contraction of the collagen constructs was measured over several time points.

Results: Collagen gels containing Dupuytren's cord fibroblasts contracted less than those overlain with skin fibroblasts. There appeared to be differential contraction when the gels containing Dupuytren's cord fibroblasts were overlain with fibroblasts from normal dermis or palmar skin from patients with Dupuytren's disease.

Conclusions: These data support the concept that dermal fibroblasts can modulate the activity of Dupuytren's cord fibroblasts. The mechanism of action does not appear to involve soluble factors(s).



FP153

Oxidative stress, AT protein and Dupuytren's

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Patients suffering from Ataxia-Telangiectasia (AT) are hypersensitive to radiation due to a mutation of the AT protein (ATM). One function of the AT protein is to protect against oxidative stress.

The aims of this study were to assess whether AT protein is expressed in Dupuytren's Disease and whether its expression is related to a marker for oxidative stress, inducible Nitric Oxide Synthase (iNOS), a pro-inflammatory enzyme that produces the free radical nitric oxide.

Tissue was collected from 12 patients with Dupuytren's Disease undergoing fasciectomy. Control tissue (palmar fascia) was obtained from 12 patients undergoing carpal tunnel release. A cell line known to produce the AT protein was used as a positive control. Tissues were frozen, protein was extracted and western blot analysis performed using anti-AT and anti-iNOS antibodies.

So far, tissue from control patients has expressed iNOS (2/2) and AT protein (1/2). There has been strong iNOS expression by all patients with Dupuytren's Disease (9/9). However, in patients with Dupuytren's Disease the expression of iNOS was weaker in the three patients who also expressed the AT protein.

These preliminary results suggest a lack of expression of AT protein in patients with Dupuytren's Disease. This may play a role in the development of the condition by increasing markers for oxidative stress (iNOS). Manipulation of the AT signal pathway in Dupuytren's Disease may hold therapeutic promise for managing this challenging hand disorder.



FP154

Identification of a marker of clinical activity in Dupuytren's disease: Role of smooth alpha actin

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Background & Aim: Dupuytren's disease is proliferative and progressive fibromatosis characterised by two distinct lesions: nodule and cord. Myofibroblast is the main responsible of the tissue contraction. Still discussed is the correct time of surgery, most recommended treatment. With the aim to define a marker of clinical activity, we have been studying smooth alpha actin (SMA).

Methods: Between October 2003 and September 2005, 80 male patients, within the age of 33 and 88 year, underwent surgical treatment of total fasciectomy. In order to avoid false positives, we adopted some exclusion criteria. Tubiana-Michon scale was used to classify our patients. Furtherly, we share them in two main groups: early (stage 0,1,2) and advanced (stage 3 and 4). The tissue specimens were analysed by histological and immunohistochemical technique. Then, we observed the clinical outcome of the patients included in the early grades with low SMA.

Results: We observed high cellularity in the early stages; in these specimens SMA is expressed with a high rate; in a few cases we noted low expression. Besides we correlate the rate of SMA with an index of cellular proliferation (KI-67) and we noted an increased proliferative activity of the cells. We found that in the few patients with low percentage of SMA, the rate of recurrence was low.

Discussion & Conclusions: At the moment, about Dupuytren's disease is still some way to go. Our results show that SMA increases in the clinical phases of generation of contractile force and let us say that be a good marker of clinical activity. High level of SMA represents a disease still active and aggressive, therefore with a high potential of recurrence. Our next step will be to correlate the rate of SMA with the clinical behaviour of all the patients, into a necessary wider follow-up.



FP155

Indications and limits of Dupuytren's disease percutaneous needle treatment

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Introduction: This paper presents our experience in the treatment of Dupuytren disease by punching with a syringe needle. Proposed by the Americans and French authors, the method consists in percutaneous section of the disease characteristic chords with a 18 G needle, and represents, in our opinion, a very good method with immediate results for well selected cases.

Material and methods: The study refers to 63 cases treated by this method, which consists in the interruption of the chords by percutaneous needle aponeurothomy performed under local or regional anaesthesia. The procedure needs only 15-20 minutes and could be performed also for ambulatory patients.

Results: We had in only 7 patients very small skin wounds because the degree of retraction. In 2 patients it was a little degree of hipoesthesia for 2-3 weeks. The mobilization of the hand and fingers was started in all the cases after 24 hours. Long term surveillance in our series showed a low rate of recurrences if compare with other studies, that proofs the efficiency of this method.

Conclusions: This very simple method has low economical costs and is very well supported by the patients. This non-invasive method can be successfully used in the incipient stages of the disease (I or II), in cases with multiple recurrences or with expected high risk of recurrences and especially in patients with associated pathology as diabetes.



FP156

Long-term efficacy of injectable mixed collagenase for Dupuytren's contracture: recurrence rates within 2 years in phase 3 clinical trials

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Dupuytren's contracture (DC) is a progressive disease that affects the palmar fascia, impairing finger function. Currently, surgery is the only effective treatment; however, recurrence is common in 25%–80% of patients. We evaluated recurrence rates of DC after injection therapy with mixed collagenase subtypes (AA4500, Auxilium Pharmaceuticals, Inc.). In a Phase 3 double-blind, placebo-controlled study, 35 DC patients with flexion deformity ($\geq 20^\circ$; range, 20° – 90°) of the metacarpophalangeal (MP) and/or proximal interphalangeal (PIP) joints were randomized to receive injections (3 max, 4–6 wk apart) of 0.58-mg AA4500 or placebo. Clinical success was defined as joint correction to 0° – 5° of extension after the last injection. 19 patients continued in an open-label study during which they could receive up to 5 injections (4–6 wk apart) for treatment failure or other joint contractures. Recurrence was defined as a return of contracture ($\geq 20^\circ$) in a successfully-treated joint (0° – 5°). At the end of the controlled study, 91% of patients who received AA4500 and 0% who received placebo achieved clinical success (mean, 1.4 injections; median time to success, 8 days). In 70% of AA4500-treated patients, a single injection was sufficient for normalization. In the open label study, 89% of patients achieved clinical success (mean, 1.5 injections; median time to success, 1–29 days). Overall, 58 joints (28 MP, 30 PIP) were treated in 35 patients and 52 (90%) joints (93% MP, 87% PIP) were clinical successes during the controlled and open label studies. Of the 52 successes, all were followed up for 12 months; 28 (54%) were followed up for 24 months after the last injection. Recurrence occurred in 5 joints (1 MP, 4 PIP): 1 before 12 months, 2 at 12 months, and 2 at 24 months. These findings suggest AA4500 is highly effective with a relatively low recurrence rate.



FP157

Does dermofasciectomy prevent recurrent contracture after Dupuytren's contracture surgery: A prospective randomised trial.

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94 patients with Dupuytren's contracture of the proximal interphalangeal joint of 58 degrees (30-94) were randomised to have dermofasciectomy (48) or fasciectomy (46) if after full correction the skin could be easily closed with z plasty. Patients were reviewed at 3, 6 and 12 months after surgery to note complications, stiffness and recurrence. The two groups were similar for age, sex and known factors of bilateral disease, family history, diabetes, smoking and alcohol intake. The degree of contracture of the metacarpophalangeal and interphalangeal joints of the operated fingers was similar before surgery. Fasciectomy and z plasty took 66 minutes (se 3) and dermofasciectomy took 82 minutes (se 3). 3 patients had a recurrent contracture after fasciectomy at a mean of 9 months after surgery and 6 had a recurrence after dermofasciectomy at a mean of 18 months after surgery. The data on PIPJ contracture is demonstrated in the table, there was no identifiable difference between groups.

	Dermofasciectomy		Fasciectomy		
	48		46		
PIP	mean	se	mean	se	p=
Pre	60.2	2.3	57.0	2.6	0.37
Post op	6.2	1.1	6.2	1.2	0.97
3 mth	24.8	2.1	24.5	2.0	0.91
6 mth	25.1	2.6	25.1	2.3	0.99
12 mth	24.7	2.6	24.8	2.8	0.97

There were also no differences in Grip, range or disability measured by the Patient Evaluation Measure (PEM) at each of these intervals. This study did not identify any improvement in correction or contracture recurrence after dermofasciectomy upto 1 year after surgery.



FP158

Ulnar reversed island flap as a salvage procedure in severe Dupuytren's contracture: About three cases

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Purpose: Recurrence of fifth digit localisation with severe proximal interphalangeal joint contracture in Dupuytren's disease has a bad reputation. The treatment still stay a challenge for every hand surgeon. We report three cases of total dermofasciectomy with coverage by a distal based island ulnar flap.

Material and method: The age of the patients was 65 and 72 years old. The three hands had already been operated unless two times. The average lack of extension on MP joint was eighty degrees, and ninety degrees for the PIP joint. We performed a total dermofasciectomy, and a distal based ulnar island flaps under axillary block. No capsuloligamentous release were performed. Physiotherapy beginning 2 days postoperatively.

Results: The average follow-up was two years. The lack of extension of the MP joint was 0°, and under 25° for each PIP joint. No recurrence occurred. No morbidity of the donor site was noted.

Discussion: Radical digital dermofasciectomy is strongly recommended for all cases of recurrent Dupuytren's disease requiring reoperation and as a primary procedure when there is significant skin involvement. Some factors had a negative effect on final results as major involvement of the PIP joint and localization at fifth ray level. Rotation flaps and skin graft seems to be interesting procedure in the treatment of severe Dupuytren contractures but are insufficient in case of major involvement of the skin and after two or three recurrences. An island retrograde ulnar flap allow to perform a total dermofasciectomy, and a good coverage of the nerve and flexor tendon. It's a salvage procedure in case of recurrence of Dupuytren's contracture with severe extension loss of MP and PIP joints



FP159

Does post-operative hand elevation reduce hand swelling?

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Introduction: Elevation of the hand following surgery is thought to reduce hand swelling. Reduced hand swelling may reduce wound tension, reduce pain and aid mobilisation. This study investigated whether hand elevation does reduce hand swelling.

Methods: 120 patients undergoing Dupuytren's fasciectomy or trapeziectomy were studied. Patients were divided into two groups. Group 1 did not elevate their hands post-operatively. Group 2 underwent hand elevation in a Bradford sling post-operatively. Hand volume was measured using the Archimedes principle. The hand was inserted into a container of water to a pre-defined level. The displaced water was collected. The volume of displaced water was calculated and hence the volume of the hand. Hand volume was measured pre-operatively and 24 hours post-operatively.

Results: Analysis of the first 50 patients revealed median swelling following Dupuytren's fasciectomy of 10mls in elevated hands and 8mls in non-elevated hands. Following trapeziectomy, elevated hands swelled 11mls and non-elevated hands 10mls. Analysis of the remaining patients is continuing. Statistical analysis of the data available shows no statistically significant difference in the amount of post-operative swelling of the hand between elevated and non-elevated groups.

Discussion: The results suggest elevation of the hand following Dupuytren's fasciectomy or trapeziectomy may not affect the degree of swelling of the hand. Patients may find simply resting the hand on a pillow post-operatively more comfortable. Strict elevation of the hand post-operatively may not be required to prevent hand swelling in the first 24 hours following surgery.



FP160

112 cases of Ledderhose's disease

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The epidemiologic and clinical facts about plantar fibromatosis or LEDDERHOSE 's disease are still poor. There are only 800 cases of plantar fibromatosis described and most articles only have a small collective of patients.

In the last 10 years we treated 112 patients with LEDDERHOSE 's disease (LD), only 12 underwent operation.

The following facts were documented:

Size, localization (zones), age of onset, pain, other lokal problems, combination with DUPUYTREN 's disease, knuckle pads, PEYRONIE 's disease, smoking, alcohol, trauma, epilepsy, sport activity, diabetes, internal diseases.

16% of our 700 DUPUYTREN-patients also had plantar fibromatosis, in 45% there were both feet involved, 95% of our LD patients also had DUPUYTREN 's contractures, 30% of our LD-patients had at least one knuckle pad, 2% of our LD-patients also had PEYRONIES disease, 1% of our LD-patients had a history of epilepsy, 10 Patients had fibromatosis in the toe area without contractures, 90% had contractures in area no. 6 in our classification, we had 4 girls under the age of 5 years, there was no connection of the grade of DUPUYTREN 's contracture, to diabetes or trauma.

A lot of men had a history of repetitive microtrauma in sports (jumping), a lot of women had often worn high heels, but there was no statistical significance. There was no indication for operative treatment in more than 90%.



FP161

Decompression of ulnar and median nerve in leprosy can prevent the occurrence of the deformities-A retrospective study of 400 hundred cases

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Ulnar and Median nerve entrapment is very common in leprosy .It gives pain

because of compression and further the hand deformities .This is because of nerve inflammation due to the disease. The higher doses of oral steroids may help certain extent in relive of pain and prevention of deformity. We tried the early nerve decompression of these cases and compared our results with only on steroids cases

In 400 hundred Ulnar and Median nerves with follow up of 15 years we fond that

The decompression of early nerve involvement cases can restore the hand functions and

Prevent the deformities in 80% of cases



FP162

Simple decompression of the ulnar nerve in the cubital tunnel syndrome with minimal skin incision

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Introduction: Cubital tunnel syndrome is the most frequently occurring compression neuropathy in the upper limb next to carpal tunnel syndrome. Recent minimal invasive technique has prompted us to gain clinical experience with simple in situ decompression with minimal skin incision. Early surgical outcome has been evaluated with surgical technique.

Materials & Methods: 96 consecutive cubital tunnel syndrome were treated using minimal skin incision technique. The mean age of the patients was 50.9 years and average symptom duration was 14 months (range, 6-72 months). The cause of cubital tunnel syndrome was idiopathic in 59 patients and osteoarthritis(n=20), ganglion(n=10) and deformity(n=7), etc. Clinically, 20 elbows were classified as having McGowan Grade I, 69 as Grade II and 7 as Grade III compression.

Results: All operations were carried out in day surgery unit under local anesthetics. All patients returned to their previous work level in average 2 weeks time. Seven patients had aberrant anconeus epitrochlearis muscle. After a mean follow up of 25 months, results were excellent in 35 (36%), good in 43 (45%), fair in 16(17%), and poor in two patients (2%). Overall satisfactory results were noted over 81% of the patients, which included 83% excellent or good in McGowan stage I & II. However, there were 2 fair results and one poor result in McGowan stage III.

Summary: This procedure is comparably effective alternative which involves less trauma, morbidity and rehabilitation time with good surgical outcomes. The results show that in situ decompression of the ulnar nerve through minimal skin incision is a safe and effective method to treat patients with cubital tunnel syndrome.



FP163

Radiological analysis of the cubital tunnel

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Purpose: The cause of idiopathic cubital tunnel syndrome has not been clearly understood. Bony anatomy of the cubital tunnel may be related to the cause this syndrome. This study is to measure some X-ray parameters of the cubital tunnel which can be used to understand the pathology of the cubital tunnel syndrome.

Methods: Two hundred twenty eight elbows in 114 adults (59 males and 55 females) were recruited on a volunteer basis. All of them had no history of previous surgery, trauma, congenital anomaly, or sign and symptoms suggestive of a disorder of elbows. Their age was average 21.6 (range, 18 – 53) years.

A nteroposterior view with full flexion of the elbow and 20 degree of external rotation, which were devised to view ulnar groove of humerus precisely, were taken. An angle between inferior margin of medial epicondyle of the humerus and medial border of trochlea, Cubital Tunnel Angle (CTA), was measured. Depth of this CTA, Cubital Tunnel Depth (CTD), was also measured. The Student's t-test was used for the statistical analysis.

Results: Mean value and standard deviation of CTA was $93.40 \pm 8.89^\circ$ (overall), $91.20 \pm 7.46^\circ$ (male), and $95.76 \pm 9.69^\circ$ (female). Mean value and standard deviation of CTD was 5.48 ± 0.97 mm (overall), 6.00 ± 0.87 mm (male), and 4.93 ± 0.76 mm (female). The differences for two parameters between male and female were statistically significant ($p < 0.0001$ for CTD and CTA).

Conclusion: We may assume geometry of cubital tunnel is related to pathology of entrapment of ulnar nerve. We can carefully speculate possibility of compression of ulnar nerve at cubital groove would be higher with increasing CTD and decreasing CTA.

Keywords: Elbow, cubital tunnel syndrome, cubital tunnel depth, cubital tunnel angle



FP164

Cubital tunnel syndrome in young generation

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Introduction: Cubital tunnel syndrome is rare in the young generation. We investigated operated cases of cubital tunnel syndrome in patients less than 20 years old to clarify the features of cubital tunnel syndrome in this age group.

Materials and Methods: Ninety cases of cubital tunnel syndrome aged from 14 to 84 years old (mean 50.4 years old) were operated on from 1998 to 2005. There were 5 cases (5.6%) less than 20 years old, mean 16.2 years (range 14-19 years). There were 4 male and 1 female. All patients were frequently doing activities involving flexion of the elbow (baseball, Japanese archery, Kendo, playing the guitar and motor-bike touring). The period from onset to operation averaged 6.8 months (range 1-11 months). According to the preoperative McGowan score, 1 case was Grade I, 3 cases were Grade IIA, and 1 case was Grade IIB. All cases underwent modified King's procedure and had mean follow-up period of 11.8 months (range 4-24 months).

Results: According to the postoperative Wilson and Krout score, 4 cases had an excellent outcome and 1 case a good outcome. All but 1 case with thoracic outlet syndrome returned to their previous activities.

Conclusion : All cases of cubital tunnel syndrome in the young generation were doing activities involving flexion of the elbow and had a prominent medial epicondyle. We believe long-term and/or frequent activities involving elbow flexion associated with fixation of the ulnar nerve by the prominent epicondyle participated in the onset in this series of cubital tunnel syndrome in the young generation.



FP165

Multifocal compression of the ulnar nerve in cubital tunnel syndrome

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Most surgeons perform either open decompression or transposition of the ulnar nerve in cubital tunnel syndrome (CubTS). Many surgeons remain unhappy with their results irrespective of the surgical method used. The patient satisfaction is reported to be approximately 85%. The senior author, however, reported around 95% using a long distance in-situ decompression (up to 12 cm measured from the middle of the retrocondylar fossa) with an endoscopic technique. The diagnosis of nerve entrapment has been traditionally based on the clinical and electrodiagnostic examinations. Neurosonography has undergone development in the past decades and shows high resolution capabilities. The purpose of the present study was to evaluate 21 patients with CubTS preoperatively with neurosonography and electrodiagnostic testing using the inching method. All patients were operated using the same in-situ long distance endoscopic decompression. Eighty-six percent of patients were classified as Dellon II or III. Ultrasound showed compression of the ulnar nerve outside the ulnar sulcus in 33%. In 10 respectively 9 out of 21 patients with clinical findings of CubTS no abnormalities were found in ultrasound and electrophysiology. In 6 patients both the ultrasound and electrophysiologic findings were negative. Seven patients had ultrasound proven subluxation of the ulnar nerve during movement of the elbow. Five of these patients had, however, no compression. Peroperatively compression sites could be found up to 12 cm distally from the retrocondylar groove. Postoperatively, subluxation of the nerve could not be reconfirmed, and suggests that subluxation of the ulnar nerve does not necessarily have to be treated with extensive open transposition methods. We think CubTS may be a multifocal compression syndrome. In most patients a simple short traject decompression may be enough, however, one should be aware of compression sites outside the ulnar sulcus. Therefore, we suggest decompression over a longer distance.



FP166

Endoscopic management of cubital tunnel syndrome – Long term results

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Surgical treatment in cubital tunnel syndrome remains controversial. In situ decompression is a reliable method but less effective due to the limited exposure of the nerve. Anterior transposition is also a commonly performed procedure, but it requires a longer incision and may devascularize the nerve or result in a painful neuroma.

Endoscopic release offers the best of both worlds; small incision yet complete exposure and release of the nerve over a distance of up to 30cm.

Using a two cm incision, the nerve is visualized proximal to the medial epicondyle. A space is created subcutaneously using tunnelling forceps. Next, an illuminated speculum is introduced in the incision for the initial dissection followed by an endoscope fitted with a retractor, the ulnar nerve is exposed 10cm. proximal to the elbow, and up to 15cm distal directly visualizing on a television monitor any potential sites of compression of the nerve and releasing them.

Anatomic dissections (30 cadavers) in our laboratory revealed thickening of the submuscular fascia of the flexor carpi ulnaris 3, 5, and 7 cm from the elbow. Each may constitute a compression site in addition to Osborne's ligament. Ultrasound studies localized multiple compressions in 20 % of cases. On the basis of these findings we believe that cubital tunnel syndrome is a multifocal neuropathy requiring at least 9cm of distal release to assure adequate decompression. In our series of 194 patients, we found 95 % good or excellent results. Sensory and motor symptoms improved in > 90 % of patients within 3 days of surgery and 95 % of the patients regained full elbow movement within 2 days.

We conclude that the endoscopic cubital tunnel release is a safe procedure and a reliable alternative to other surgical procedures.



FP167

A 10 year experience of subcutaneous anterior transposition of the ulnar nerve for cubital tunnel syndrome

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Introduction: Cubital tunnel syndrome is a peripheral compression neuropathy affecting the ulnar nerve at the elbow. Compression occurs as the nerve passes from extensor to flexor compartments, posterior to the medial epicondyle. Symptoms include pain / sensory disturbance in the ulnar one and one-half fingers, and weakness affecting the intrinsic muscles of the hand.

Method: We performed a retrospective review of all patients undergoing subcutaneous anterior transposition of the ulnar nerve under a single surgeon between 1992 and 2002. Data recorded included pre-operative clinical findings, investigation, conservative treatment, the operative findings and outcome.

Results: Twenty-two patients underwent 24 primary subcutaneous anterior transpositions. Symptoms experienced pre-operatively included pain (54%), numbness / paraesthesia (92%), and weakness / clawing / loss of dexterity (85%) in the ulnar nerve distribution of the hand. Tinel's test (percussion) was the most reliable clinical sign (75% positive) although all patients underwent pre-operative electrodiagnostic investigation (85% positive).

Recovery was variable, 82% achieving enhanced sensation, although only 17% motor improvement.

Conclusions: Correct identification of the elbow as the site of compression in cases of ulnar neuropathy can be difficult, recovery post-operatively being unpredictable even with electrodiagnostic confirmation and timely surgical intervention.



FP168

Transposition of the FCU humeral head to secure anterior translocation of the ulnar nerve for cubital tunnel syndrome

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Purpose: Subcutaneous anterior translocation of the ulnar nerve for cubital tunnel syndrome has a few drawbacks such as cutting off the segmental vascular supply by neurolysis and poor sitting on the medial humeral condyle. The purpose of this presentation is to describe our own method of subcutaneous anterior translocation intending to overcome those drawbacks.

Operative Procedure: The ulnar nerve is dissected with the ulnar collateral a. and vv. attached to it as far as the deep surface of FCU, the exit of the cubital tunnel. The humeral head of FCU is separated from the common origin of finger flexors and detached off the medial epicondyle, and then the ulnar nerve is placed anteriorly over the medial humeral condyle. The nerve shifts more laterally in the proximal forearm and takes such a straight course to the supracondylar region as it stays at the anterior surface of the medial condyle without any restraining procedures. The FCU humeral head is transposed posteriorly over the ulnar nerve and sutured with its own ulnar head.

Materials and Methods : Materials are 21 limbs of 19 cases (12 males, 7females) with the mean age of 48.9 years. Severity of paralysis was evaluated by the nerve conduction velocity, Semmes-Weinstein aesthesiometry besides clinical findings and rated according to Akabori's staging system before and after the operation periodically.

Results: Preoperative rating included stage I in 5 limbs, stage II in 4, stage III in 4, stage IV in 6, and stage V in 2. Each case showed progressive recovery up to normal in 5 limbs, stage I in 10 and stage II in 6 during the follow up period from 3 to 24 months.

Conclusion: Transposition of the FCU humeral head facilitates to release constriction of the ulnar nerve along the entire course of the cubital tunnel and secures to place it at the anterior aspect of the medial humeral condyle. Allcases showed good nerve recovery.



FP169

Combined snapping of ulnar nerve and medial head of triceps muscle

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Introduction: Ulnar nerve snapping is occasionally associated with ulnar nerve entrapment at the elbow. In medial triceps snapping a portion of the distal triceps snaps over the medial epicondyle as the elbow is flexed, or extended from a flexed condition. We present two cases of combined snapping of the ulnar nerve and medial triceps.

Patients:

Case 1: A 16-year-old boy with pain in the medial side of his elbows, and intermittent paresthesias. He had normal carrying angle. Two sequential palpable and visible painful snaps were elicited at 90° and 115° of flexion. He had positive Tinel sign and negative elbow test. He underwent sequential bilateral medial epicondylectomy.

Case 2: A 54-year-old carpenter who underwent an anterior transposition of the ulnar nerve elsewhere due to cubital tunnel syndrome. Ulnar symptoms has improved, yet he had persistent medial elbow pain and perceptible snapping, which were aggravated by physical activities. On surgical exploration the ulnar nerve was found well-transposed, a hypertrophic portion of the medial head of the triceps which repeatedly dislocated over the epicondyle upon flexion was resected.

Results: At 1-year follow-up both patients had no pain or snapping, neurological examination, extension mechanism, and elbow stability were intact.

Conclusions: Snapping of ulnar nerve and triceps may coexist. Triceps snapping is often subtle; and perceptible snapping or ulnar nerve symptoms may persist following an otherwise technically successful ulnar nerve transposition. Patients scheduled for ulnar nerve transposition should be carefully evaluated, both pre-operatively and intra-operatively, for concomitant triceps snapping. Surgical management should address simultaneously both interrelated pathologies.



FP170

Indication of non-bridging external fixation for distal radius fractures: A review of delayed united fractures

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External fixation is one of the essential procedures for a treatment of unstable distal radius fractures. In previous IFSSH meeting, we have introduced a new concept nonbridging external fixator (Compack; 4S medical, Chiba, Japan) and good short time result using the device. The device is made of titan, light weight (48g) and compact (109 mm in minimum length). The thin threaded pin for a distal fragment (1.8 or 2.0 mm in diameter) enables fixation of small fragments which can not be held by the thick pins of the conventional fixators. But we have also a few poor results in many cases. In order to consider appropriate indications for non-bridging external fixation as a treatment for distal radius fractures, we reviewed 75 cases of unstable distal radius fractures, which were treated with the non-bridging external fixator. We defined "delayed union" case as the case required for bone union over 10weeks. 18 cases were defined as delayed union and the causes for delayed union were investigated individually. The rates of delayed union were high in open fractures, fractures with severe bone defect and severe osteoporosis, and comminuted fractures. Malpositioning of the distal fixation pins and inadequate reduction at the operation were the leading causes of delayed union. While the rate of delayed union fell with increasing experience, proper positioning of the distal pins in severe osteoporotic distal radius and accurate reduction of comminuted fracture is a technically demanding procedure that may be associated with higher rates of delayed union.



FP171

A new external non-bridging fixator: mini-radius

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A non bridging Fixator is a better solution, when possible, for the external fixation of the Distal Radius Fractures (DRF), because it does not block the wrist: so, the rehabilitation can begin immediately and a Neuro-Algo Dystrophy becomes rare.

This Mini-Radius Fixator has many possibilities: a three degrees of freedom linkage so as to correct the malpositions of the distal fragment, and over all, the possibility of lengthening and shortening to adapt perfectly the radius length according to the ulna.

The Mini-Radius Fixator is easy to set on a fracture already approximatively reduced, then the reduction can be perfectly completed. No cast is needed, and thanks to its « low profile » the wrist can be put into a jacket sleeve, allowing an early rehabilitation, and a fast return to activity. The Fixator may be taken off after six weeks. The recovery of supination is total. This Fixator can be used in almost all types of DFR, the comminution of the distal radius being the only exception. Four cases have been treated with an excellent result.

The malunions osteotomies is an excellent opportunity of using it. It works in four stages: first, through a lateral way, the Mini-Radius Fixator is set before any osteotomy, which is done in a second time. Then the Fixator, working in lengthening draws apart the diaphysis from the epiphysis, which can be set in its anatomical position, thanks to the three degrees of freedom of the distal fixator component. Thirdly, a graft is harvested after defining its exact dimensions, according to the bony gap. Finally, after inserting the graft into the gap, the Fixator is shortened, so as to block the graft between the two parts of the radius.

Therefore, this new Mini-Radius Fixator is a good solution not only in fresh DRF but also in the correction of the malunions



FP172

Distal radius fracture osteosynthesis – Volar or dorsal?

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The aim of this study was to determine the functional outcome and the complication rate of fracture fixation of the distal radius.

175 patients with wrist fractures needing open reduction and internal fixation were prospectively studied and followed up for 12 months. The fractures were classified using the AO classification and the radial inclination, dorsal tilt and radial length were measured roentgenographically. The patients were reviewed at 6 weeks, 3, 6 and 12 months by using a visual analogue score for pain, a full DASH score and measuring the angular range of movement.

137 wrists were fixed from the volar side and 38 were fixed dorsally. For those patients with volar plating the mean DASH score and mean total range of movement at the wrist was 35/263 o, 25/297 o, 20/319 o, 17/332 o at 6 weeks, 3, 6 and 12 months respectively. For those patients with dorsal plating the mean DASH score and mean total range of movement at the wrist was 31/212 o, 29/274 o, 20/ 321 o, 16/325 o at 6 weeks, 3, 6 and 12 months respectively.

8 patients from the 38 who had dorsal fixation developed tendon irritation. This led to the removal of metalwork in 6 patients. 3 out of the 137 patients who had volar fixation had extensor tendon rupture, one needed plate removal for tendon irritation and 3 developed mild CRPS.

We conclude that both methods of fixation led to similar functional results, however with volar fixation, patients had relatively fewer complications.



FP173

Multidirectional fixed-angle plate fixation of unstable distal radial fractures based on a new locking principle

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Introduction : The preferred treatment of unstable distal radius fractures nowadays has changed to palmar plating with fixed angle devices. Easier reduction of the fracture from the palmar view, no need for bone graft, no risk of tendon interference and mostly no need for hardware removal are obvious advantages. Distal radius fractures occur in many different ways and to adjust the implant according to the fracture type seems preferable. By unidirectional screw placement however based on the normal anatomy the surgeon is limited.

Methods : Based on a new locking principle (Trilock*) different plate devices were developed with screw placement by 15° of freedom in all directions (Medartis*). As the multidirectional angular stability is not realized by means of distortion of the plate hole (thread forming) but by means of force and friction, the material can be produced of high grade titanium in combination with a low profile design. Depending on the fracture type – comminuted, ulnar, radial - the screw placement with sufficient subchondral bone support can be individually chosen avoiding safely intraarticular position.

Material : 55 patients with a mean age of 54years were treated using this device without bone graft. The majority demonstrated intraarticular patterns of the C-type according to the AO classification. Follow up examination showed no relevant secondary loss of reduction. X-rays revealed 8° of palmar inclination and an ulnar variance of +0,2mm. Wrist motion averaged 58° of extension, 61° of flexion, 36° of ulnar and 20° of radial deviation, 89° of pronation and 88° of supination. Patients regained good function represented in a mean DASH score of 14 and modified Cooney wrist score of 82 points

Conclusion : Multidirectional fixed-angle plate fixation offers the possibility to adjust plate and screws precisely according to the fracture type. The stability of the locked screw is sufficient till refilling of the bone defect has occurred and by the anatomical healing is achieved.

* Medartis Basel Switzerland



FP174

Severe distal radius fractures in the elderly treated with low profile dorsal plates and bone allografts

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Multifragmented, severely displaced fractures of the distal Radius in the elderly population are challenging because there is often a dorsal defect between the proximal and distal fragments. This study contains a retrospective analysis of 30 patients treated a dorsal approach employing bone allograft to fill the defect and fixation with a low profile plate.

Methods: 30 patients between the ages of 65 and 87 (mean 72.4) were treated as outpatients in our institution. Inclusion criteria included 2 or more of the following: Displacement of 20 °, multi-fragmented, shortening of more than 5 mm, intra-articular, non-reducible, osteoporosis and bone defect on X-ray. They were analyzed at 3 months and 3 years as to function, range of motion, maintenance of reduction and residual pain. All of them were treated with a low-profile non-locking plate (Locon-T, Wright Medical).

Results: At 3 months they had acquired range of motion similar to others studies with longer follow up: 50.7 ° of flexion; 54.6 ° of extension; 85.4 ° of pronation and 72.6 ° of supination. At 3 years, the flexion increased by 9.2 °, extension by 6.7 ° and supination by 4.1 °. Pronation did not change significantly. Complications included 1 case of partial collapse, 2 with screw loosening and one with mild tendonitis (13.3%).

Conclusion: Dorsal plating with bone allograft for treatment of distal radius fractures in the elderly is the authors' preferred method because it allows for better visualization of the fracture, correction of the bone defect, early range of motion and increase of the bone stock. The results are better than comparable fractures treated via volar approach at 3 years of follow up. Complications were not significant. Screw loosening could be solved with locking screw plates.



FP175

Dorsal fixed-angle plate fixation of distal radius fractures in extension: About 26 cases

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Purpose: Increased incidence of falls and osteoporosis combine to make distal radius fractures a major cause of morbidity in traumatology. This report presents our experience treating distal radius fractures using a dorsal fixed angle plate through a minimally invasive dorsal approach.

Methods: A prospective study was conducted between January and May 2006. Twenty six fractures with dorsally displaced distal radius fractures were treated with a dorsal fixed-angle plate, with an average age of 70 years. Radiographic parameters on preoperative, postoperative, and final follow-up radiographs are compared. Final follow-up ranges of motion and complications are reported.

Results: At last follow up, average loss of reduction from initial postoperative to final follow up radiographs was 1 degree of dorsal tilt, 1 degree of radial inclination, and 0,05 mm of radial length. Active wrist and forearm ranges of motion were initiated at an average of 10 days after surgery. The average final dorsiflexion was 50° degrees, volar flexion 55 degrees, pronation 80 degrees, and supination 85 degrees. Grip strength was 82% of the contralateral side. At last follow-up, no implant had been removed and no tendinous rupture occurred.

Conclusion: These implants use distal screw divergence for subchondral support, fixed-angle screws locked to the implant, and minimally dorsal approach to allow early patient rehabilitation. Furthermore, this technique minimized morbidity in the elderly population by successfully handling osteopenic bone and provided good final results at last follow-up. A decrease in soft tissue complication (tendon attrition, rupture) is expected. Early results are promising but require longer follow-up.



FP176

Combined fractures of the distal radius and scaphoid

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Combined fractures of the distal radius and scaphoid are rare, and no consensus exists regarding the optimal management of this combined injury. We present our experiences and review characteristics, surgical treatment and outcome of this unusual injury.

A retrospective review was performed on 10 consecutive patients between 1993 and 2005 with combined fractures of the distal radius and scaphoid. Outcome was measured in terms of ROM, pain, and radiographic signs of healing.

Mean follow-up was 28 months. There was 1 extra-articular distal radius fracture (type A) and 9 intra-articular fractures (1 type B; 8 type C). There were 4 nondisplaced and 6 displaced fractures of the scaphoid. The extra-articular distal radius fracture was treated non-operatively in a cast with a good outcome in terms of ROM and radiographic healing. ORIF was performed in 6 of the intra-articular fractures of the distal radius. 1 was treated with percutaneous pinning, 1 with percutaneous screw fixation and 1 in a cast. At final follow-up, all fractures were radiographically healed. Average ROM was 55 degrees of wrist flexion and 70 degrees of wrist extension. Complications included avascular necrosis of the scaphoid (1 patient) and limitation of ROM (2 patients).

In treating combined fractures of the distal radius and scaphoid, emphasis should be placed on treatment of the distal radius fracture. Restoration of articular congruity and radial length is paramount and ORIF is indicated in most cases. External fixation of the distal radius fracture is infrequently utilized, and is not recommended unless scaphoid fracture fixation takes precedence. Selected nondisplaced fractures of the distal radius and scaphoid can be treated non-operatively with good outcomes.



FP177

Distal radius osteotomy with tricalcium phosphate ceramic bone graft substitute

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Purpose: We implanted tricalcium phosphate ceramic (Cerasorb) as a substitute for autogenous bone graft to fill the defect of a corrective distal radius osteotomy. The purpose is to report the outcomes with this material, complications associated with its use and the efficacy in healing the osteotomy.

Methods: Prospective study. 36 malunited distal radius fractures were treated by a single surgeon with a corrective osteotomy. 18 cases we use bone graft substitute (tricalcium phosphate), these cases were clinical, radiographic and histological compared with another 18 cases group where cancellous bone graft from the iliac crest was used. The intraoperative time, post op discomfort, time to heal, infection rate, non union cases, allergy reactions, were compared between the groups. At the time the plates were removed a sample was taken from the new bone in both groups, histological aspects were compared. 14 female and 4 male with average of 43 yrs (15-67). Along with pain scales, wrist motion, grip strength, pre and post osteotomy radiographs were evaluated. Results: The patients were followed on average 11 months. All osteotomies, except one in both groups, healed. There was no statistically significant difference ($P > 0.001$) outcome with regard to pain, forearm rotation, wrist flexo-extension, grip strength, time to heal, allergy reaction, infection rate, patient age or time to surgery between the 2 groups. No differences regarding the histological bone aspects between the groups. We found a difference with statistical significance in the operating time, which was lower for the group with bone graft substitute.

Conclusions: tricalcium phosphate ceramic, as bone graft substitute was effective, as autologous bone, to heal the osteotomy. The use of a synthetic bone graft has the same union rate as spongy bone from iliac crest.

Significance: Knowledge of these results will help advise patients of expected outcomes, and advances of using synthetic bone graft.



FP178

A biomechanical comparison of two plating techniques for distal radius fractures

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Objectives: To compare the stability of volar plate fixation to dorsal plate fixation of an unstable distal radius fracture subjected to cyclic axial loading in a cadaver model

Methods: Simulated unstable, dorsally comminuted extraarticular distal radius fractures were created in 9 paired cadaver radii (age 72 ± 15). Bone mineral density was measured using DEXA ($BMD = .45 \pm .08 \text{ g/cm}^2$). Fractures were stabilized by volar fixation with an AO/ASIF stainless steel buttress plate in one radius of each pair and by dorsal fixation with two 2.0-millimeter AO/ASIF titanium dynamic compression plates in the contralateral. Fracture site motion was measured by a linear variable displacement transducer (LVDT) placed across the fracture on the dorsal and radial aspect of the radius. Specimens were subjected to cyclic axial loading from 0-200 Newton, at 1 Hz, for 7000 cycles. Failure was defined as 2 mm of fragment displacement or 2 degrees of radial inclination.

Results: All specimens withstood loading to 7000 cycles without failure. No significant difference was found in mean gross axial displacement between specimens in the dorsal plate group ($-0.29 \pm 0.41 \text{ mm}$) and in the volar plate group ($-0.26 \pm 0.22 \text{ mm}$) or in mean displacement on the dorsal surface between specimens ($-0.10 \pm 0.39 \text{ mm}$ and $-0.30 \pm 0.24 \text{ mm}$ respectively) or in mean displacement on the radial surface ($-0.16 \pm 0.14 \text{ mm}$ and $-0.19 \pm 0.33 \text{ mm}$, respectively). While the power of the study was low, on the order of 10%, the displacements were so small that even if they were significantly different between plating techniques, the difference would likely be deemed clinically irrelevant.

Conclusions: Volar plate fixation of a dorsally comminuted, unstable distal radius fracture withstood cyclic axial loading in a manner similar to dorsal plate fixation and may provide adequate stabilization of these fractures under expected physiologic loading in the early postoperative period.



FP179

The treatment of articular fractures of the distal radius using LCP plate

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Introduction: The aim of this work is to analyze the efficiency of L.C.P. plate for the treatment of intrarticular fractures of the distal radius type B and C according to A.O. classification.

Material and Methods:

Seventy two distal radius articular fractures were treated, 26 were of type B and 46 of type C (42 male and 30 female). Fifty three patients were seen at follow up on average 15 months after surgery. Mean age was 49 years, varying between 19 and 87 years old. Volar incision was used in 42 cases, dorsal incision was used in 6 cases and double access was performed in 5 subjects. Preoperative TC was used in 40 patients.

Results: Range of motion measures and "Mayo modified wrist score" were used to evaluate patients at the follow up. Mean active wrist extension was 57°(range 30°-70°) while active flexion was 60° (range 25°-90°) with T.A.M. of 116,5. Type B fractures had mean ROM of 136.6 while C type fracture had a mean of 104,6. The final wrist score were: excellent in 22 cases, good in 15, fair in 9 cases and poor in 7 cases. The results were excellent/good in 76% of patients while it was fair/poor in 24%.

Discussion: In our series the volar approach was mostly used in type B3 e C distal radius fractures with volar angulation of fragment. The dorsal approach should be used for patients in which the distal fragment is dorsally angulated. Preoperative TC investigation is recommended for type B3 e C distal wrist fractures for optimal surgical treatment.

Conclusions: The type B fractures had a better outcome in term of wrist range motion and pain. Early surgical treatment and correct use of CT investigation also allow to obtain good results in type C wrist fractures.



FP180

Midterm results of patients with distal radius intraarticular fractures treated with volar locking plates

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Objectives: Distal radius fractures make up 14% of all extremity injuries and are the most common fracture of upper extremity. Many methods have been used in the treatment of these fractures like closed reduction, splint application, percutaneous pinning, focal pinning (Kapandji method) and open reduction and internal fixation. There is still no consensus among these treatment methods. The aim of this study is to present midterm results of 30 patients with distal intraarticular radius fractures treated with volar approached open reduction and fixation with distal locking plates.

Materials and Methods: Between 2004 and 2006 thirty patients were operated for the distal radius intraarticular fracture. The median age of the patients was 28.2 (22-82). Preoperative evaluation criteria contained patients history , physical examination and radiologic findings. The median follow up period was 8 months. Radiologic parameters included radial height , volar tilt , radial inclination angle and articular congruity. The operations were performed under general anesthesia and by the same surgeon.(CT) The fracture site was exposed through volar approach between FCR and FPL tendons and finally after detaching pronator quadratus muscle. After reduction and appropriate articular restoration , locking distal radius plates according to fracture configuration were used.

Results: All patients had fracture union. The patient outcome was evaluated with Mayo-wrist score system. According to this scoring system the result was excellent in 14 patients, good in 9 patients, average in 4 patients and bad in 3 patients.

Discussion: For the treatment of distal radius intraarticular fractures our main effort is to regain normal joint function as early as possible and to limit certain complications like posttraumatic arthritis. In the recent years locking plates and screws have gained great popularity for the treatment of all extremity fractures. We have also obtained promising midterm results in these patients by using this treatment method.



FP181

Complex unstable distal radial fracture management with locking plates and injectable bone graft

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Distal radial fractures remain among the most common to require orthopaedic surgery. A renewed interest in these injuries underpins the problems with traditional treatment options, often leading to unpredictable results and poor function. This study aimed to assess outcomes of a study cohort with displaced, comminuted and unstable distal radial fractures treated with volar locking plates +/- injectable bone graft. Over an 18-month period a consecutive series of 46 patients with unstable displaced distal radial fractures required reduction and fixation, the majority with AO type C fractures. Fixation was with volar locking plates via an FCR bed approach, a sub-group of 15 patients were augmented with injectable calcium sulfate bone graft due to dorsal fragmentation and associated metaphyseal bone void. The cohort had prospective clinical, radiological and functional evaluation. A standardized rehabilitation protocol was used with two weeks volar immobilisation, followed by hand therapy instruction and application of a removable, supportive volar splint until 4-6weeks according to resolution of hand function. Final x-rays were taken at a minimum of 3 months. Of the total 46 patients, 82% had complete data available for evaluation. The average age of the patients was 51.7 years (19-81 years) with a mean follow-up of 9.5 months (3-20 months). All patients had prospective evaluation using the Patient Rated Wrist Evaluation (PRWE)¹ form at a minimum of 3 months and again at 6 and 12 months after fixation. All fractures united within 6 -12 weeks with restoration of anatomical position in a high percentage. The return to functional activities using the wrist was highlighted in the PRWE Scores. Three patients required plate removal for flexor compartment irritation. In summary volar locking plates reliably maintain reduction of the distal radius, but fixation may require graft augmentation in more complex, unstable fracture patterns.

¹MacDermid JC *et al.* 1998



FP182

The T-approximator: A new design to avoid pressure-related endothelial damage in microsurgical procedures

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In replantations and free tissue transfers, endothelial damage is an important reason of anastomotic failure even when microsurgical principles are orthodoxly observed. It is not uncommon for microsurgical equipment, such as forceps, clamps and approximators to inflict such damage, and means to prevent this drawback are discussed in the literature.

We have developed a new approximator design in order to minimize endothelial damage inflicted by approximator clamps. It is consisted of two pressure-adjustable clamps attached to a screw-action, crescent shaped, single hinged chassis. The uniqueness of the device is on the tip of the clamps; they are broadened sideways to disperse the pressure, resembling its namesake, an uppercase letter "T". Also, the clamps are fitted with silicone padding on the facets in order ensure even pressure distribution throughout the length and width of the clamped area. The device was tried on right femoral arteries and veins of 10 white New Zealand rabbits. The fellow vessels served as controls to be tried with a standard Ikuta approximator. Each device was placed with their clamps 10 mm apart, and approximated by 5 mm afterwards, in order to mimic stretch-related damage. Then, the devices were kept in place for 30 minutes. Once the clamps were released, another 20 minutes were allowed for reperfusion in order to give space for platelet adhesion. Afterwards, areas subjected to pressure by the clamps were harvested for light and electron microscopy analysis. The work of Durand et al. (2000) is emulated as the basis of comparison.

The analysis revealed that, in both arteries and veins, pressure related damage inflicted by the clamps were significantly lower with the T approximator.

We believe that, we are introducing a useful device which will serve to reduce endothelial damage-related complications of already expensive and technically challenging microsurgical procedures.



FP183

Impact of fibrin adhesive application in microvascular anastomosis: A comparative experimental study

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Background: The conventional suture is still considered the gold standard technique. However, it presents some problems for being technically difficult, time consuming, and traumatic to the vessel wall. The aim of this study was to evaluate the impact of fibrin adhesive application in microvascular anastomosis.

Methods: Sixty eight wistar rats were used in this study. Eight animals were used in a pilot study to determine the minimum amount of sutures stitches required per anastomosis, when the fibrin adhesive was applied. In the definitive study, we performed 30 anastomosis in the femoral artery and 30 anastomosis in the carotid artery. In each artery, half of the anastomosis were performed using interrupted sutures, without fibrin adhesive (control groups), and the other half were performed using fibrin adhesive and fewer sutures (experimental groups).

Results: The application of fibrin adhesive significantly reduced the number of sutures and the time taken to perform the anastomosis. The immediate and late patency rates were not compromised by the fibrin glue application.

New and Unpublished data: Since the last reports by. Drake, DB 2000 and Frost-Arner, L 2001, the current study is the most up-to-date experimental study with fibrin adhesive application in microvascular anastomosis (accepted for publication in the *Plast Reconstr Surg* in 06-30-2005). The current authors have also gained considerable clinical experience with fibrin adhesive application in free flap transfers, 15 cases in the last 14 months (unpublished).

Conclusions: The application of fibrin adhesive didn't show any harmful effects in the microvascular anastomosis. The authors encourage the clinical application of the fibrin adhesive in more complex cases, when more than one microvascular anastomosis is required.

References: Pearl, RP 1977; Matras, H 1977; Isogai, N 1996; Han, SK 1998



FP184

The effects of L-arginine on intimal hyperplasia and patency in cold-stored rabbit arterial allografts

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The search for an "off the shelf" prosthesis that can be used as a microvascular conduit has been elusive. Cold-stored arterial allografts (CSAA) kept at 4 deg C for 4 weeks lose their antigenicity but maintain structural integrity. However there is a failure rate partly due to intimal hyperplasia at the anastomosis. L-arginine, a precursor to nitric oxide formation, may decrease the formation of intimal hyperplasia at the anastomosis and therefore increase the patency rate of the CSAA.

Purpose: We investigated the possible use of these grafts by implanting interpositional CSAA between groups of New Zealand White and Dutch rabbits.

Methods: 14 rabbits received s/c injections of saline (0.5mg/kg bd) and 11 rabbits 0.25mg/kg bd of L-arginine after 4 week old CSAA were inserted into the femoral artery proximal to the inferior epigastric artery (IEA). The femoral artery was then ligated distal to the IEA. An island flap on the lower abdominal wall was created based on the IEA. Grafts were harvested at 4 weeks. Data collected included patency rates, percentage stenosis, L-arginine levels, intimal and media heights and areas, graft radius, blood pressure, prothrombin time and immunohistochemistry.

Results: Patency rate increased from 57% to 82% ($p=0.38$). Blood pressure, pro-thrombin time, graft radius and the dimensions of the media were not statistically different. The mean intimal height was reduced by 61% in the proximal anastomosis from 0.23 to 0.09 mm ($p=0.005$). Graft stenosis was reduced by 47% proximally from 38% to 20% ($p=0.04$).

Conclusions: L-arginine significantly reduces intimal hyperplasia and graft stenosis in this model. Graft patency rates were increased but not in a statistically significant way. Aneurysm did not occur at the anastomosis site. High resolution ultra-sound is a useful investigation to determine patency of small vessels (1mm diameter).



FP185

Aging and the ideal aesthetic of the hand. Results of a study to evaluate aging of the male and female hand in the caucasian population

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Background: Hand aesthetics have been poorly described in the past. Increasingly, patients request rejuvenation as hands are believed to belie true age. Hands surgeons who traditionally focus on function are likely to be consulted for rejuvenation. Knowing the ideal aesthetic of the hand and its changes with aging are important for the surgeon. As even minor interventions may cause significant functional deficits, rejuvenation should be performed by experienced hand and plastic surgeons only.

Material and Methods: 70 male and 70 female volunteers were recruited, 10 in each decade starting at the age of 10 up to 90. Standardized photographs of both hands were obtained and evaluated by the same observer in regard to wrinkling pattern, volume changes, signs of extrinsic aging and visibility of subcutaneous structures.

Results: Specific wrinkling patterns can be detected during aging. Interestingly the number of visible veins does not increase significantly. Volume loss is detected between the metacarpals especially in the first webspace. The extrinsic factors cause significant soft tissue loss that results in the brittle appearance of the skin. Wrinkling starts ulnarly and advances radially. In the aging hand this is altered by both tissue loss as well as bony changes.

Conclusion: Aging changes the appearance of the hand and warrants increased attention. The aging process involves both dermal and subdermal level causing significant soft tissue atrophy as well as visible dermal changes known as extrinsic aging. As hand surgeons are likely to pioneer aesthetic hand surgery, knowing the ideal aesthetic of the hand is required to achieve satisfying and long lasting results without sacrificing function.



FP186

Anatomical study and clinical application of anatomic snuffbox flap

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A new flap, the anatomic snuffbox flap, is designed and discussed. Anatomic snuffbox flap is supplied by a cutaneous branch of radial artery in the anatomic snuffbox. Our anatomic study shows radial artery gives off a constant cutaneous branch 4.63 ± 0.42 mm distal to radial styloid process. The diameter of the branch is about 0.5mm. The pedicle length is 4.18 ± 0.25 mm. The branch runs proximally and supplies distal and radial skin of forearm. The branch has two venae comitantes. In the anatomic snuffbox, superficial branch of radial nerve is located deep to deep fascia of wrist, and runs distally and gives off 4-5 branches to radial dorsum of hand. When the flap is harvested, the superficial branch of radial nerve can be kept in its original position and is not damaged. The midpoint of the anatomic snuffbox is the origin of the cutaneous branch, and also rotation point of the flap. The axis of the flap is junction line between radial styloid process and head of radius. The flap is raised under deep fascia. The harvestable area of the flap is about 10x5cm. The flap can be used to cover dorsal or volar skin defects of wrist, and skin defects of radial dorsum of hand or dorsum of proximal phalange of thumb. If the width of the flap is over 3cm, the secondary skin defects of donor area need skin grafting. Since 1991, 39 anatomic snuffbox flaps have been completed. Except 2 partial necroses, all other flaps survived completely after operation. Therefore, we think this flap is a good choice in repairing skin defects in radial hand.



FP187

The keystone flap in hand surgery

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We report on our experience of using the Keystone Design Perforator Island Flap (KDPIF) in reconstruction of soft tissue defects in Hand Surgery.

The flap is oriented along the long axis of the defect based on randomly located vascular perforators. Blunt dissection is used to raise these flaps as it preserves the vascular perforators together with venous and neural connections. The wound is closed directly, by V-Y advancement of each end of the flap and exploiting the mobility of the adjacent surrounding tissue. The keystone flap minimizes the need for skin grafting in the majority of cases and produces excellent aesthetic results. The patient is almost pain free in the postoperative phase. Early mobilization is possible, allowing this technique to be used in short stay patients.

Four types of flaps are described: Type I (direct closure), Type II (with or without grafting), Type III (employs a double island flap technique), and Type IV (involves rotation and advancement with or without grafting).

Results: In a series of 300 patients with flaps situated over the extremities excellent healing and early functional restoration has been observed.

Conclusions: The technique described in the present article offers a simple and effective method of wound closure in situations that would otherwise have required complex flap closure or skin grafting. It can be used in trauma, burn contractures and cutaneous malignancies.



FP188

Newer flaps and indications in upper limb burn scar contractures

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Methods of reconstruction of Post burn contracture remains a debate till date. Skin grafting is the commonest option and it has the advantages of being an easier procedure and less costlier. But it requires immobilization for a prolonged period, careful follow up with compression and massage and it has a tendency for recurrence. Flaps on the hand were considered to be bulky, result in unacceptable aesthetic appearance of the donor or recipient site, may undergo partial or total necrosis and may result in patient dissatisfaction. With the improvement in the knowledge of vascular anatomy newer flaps have been developed. We have performed 108 flaps for post burn contracture release of the upper limb over the period of last 5 years. Mean follow up period is 18 months. Based upon our results, we have classified the contractures into edge contractures, median contractures, strip contractures and global contractures. The ideal flap for each type of contracture in a given area of contracture was defined. In addition to the conventional flaps, we have also used newer flaps like square flap, propeller flap, pin wheel flap, scar band rotation flap, perforator free flap and super thin flap. We have found a square flap yields more lengthening than a serial Z plasty. Propeller flaps can be rotated either on a subcutaneous pedicle or islanded on the vascular pedicle. These are especially useful in axilla and elbow, where the central pit of skin escapes burn injury and remains intact. Scar rotation flaps can be used when normal skin is not available in the adjacent areas. These newer flaps further improved the aesthetic quality of donor as well as recipient areas. Though grafts save many a lives in major burns, flaps definitely improve the quality of life in selected patients.



FP189

Architectural scrutiny of dorsal cutaneous flap design in the hand and digits

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Introduction: The reverse dorsal metacarpal artery, reverse cross finger and the reverse dorsal digital artery ('flag') flap are commonly employed examples of local tissue transfer, although the justification for inclusion of the term 'reverse' is different for each described.

In 1990, Taylor introduced the concept of angiosomes, declaring the blood supply to the hand as having two distinct source vessels. This simplifies a very complex interconnection between palmar, dorsal, radial and ulnar systems on which numerous cutaneous flaps can be based. This architecture has been applied in the clinical arena when planning local cutaneous transposition flaps.

Vascular territories based on perforators from the palmar phalangeal arches, supply skin around the interphalangeal joints that can be manipulated to cover homodigital defects, as well as those on neighbouring digits. Elevation, based on a supplying pedicle, can initiate reverse blood flow in the artery, vein or both vessels. When including tissue across the midline, we also make use of blood flow between adjacent zones, through choke vessels, to allow safe movement.

Conclusions: Understanding the pedicle has aided surgeons deciding treatment options in other areas of reconstructive surgery. Having reviewed the literature, it is clear that the nomenclature of dorsal cutaneous flaps is confusing. We discuss the evidence for design of dorsal cutaneous flaps and propose distinct principles of safe local tissue transfer based on anatomically consistent blood vessels.



FP190

Dorsal hand reconstruction: An algorithm of treatment

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Purpose: The dorsum of the hand has thin, fragile skin and poor subcutaneous tissue covering tendons, bones and muscles. The connection between the skin and subcutaneous tissue is very loose and unstable. These characteristics affect the possibilities for reconstruction of defects occurring in this area. The purpose of this study is to review the patients with extensive dorsal soft tissue defects treated with different pedicle flap or free tissue transfer and to define an algorithm of treatment of this type of injury.

Material: Between 1990-2004 twenty six patients were treated for large soft tissue defects located on the dorsum of the hand. In fifteen patients the injury interested skin and tendons and surgical approach includes the use of tendon graft in conjunction with pedicle flap (posterior interosseous flap) or employing a completely vascularized single-stage reconstruction (using the dorsalis pedis or the radial cutaneous tendinous flaps). The management of pure cutaneous defects includes different type of pedicle fascial or cutaneous flaps, rarely reconstruction was perform using a free tissue transfer (groin flap and ALTF).

Results: All flaps survived completely. Tendon adhesion were seen in two cases in whom tenolysis was done.

Discussion: Cutaneous and fascial flap showed a good functional and aesthetic results, donor site was better in fascial flaps. The replacement of combined loss of skin and tendons in only one stage gives the best opportunity for functional recovery, and can allows patients a relatively rapid return to a productive life.

Conclusion: The approach to the patient with a dorsal hand injury requires the surgeon to be aware of a variety of treatment options. Techniques that most closely replace that which has been injured are the most successfully.



FP191

Immediate reconstruction of large composite dorsal finger defects using the reverse extended cross finger flap (RECF)

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The reverse "extended" cross finger flap (RECF) allows immediate reconstruction of large composite tissue defects of the entire dorsum of the digit due to its robust blood supply. This encourages revascularization of tendon or bone grafts used to reconstruct defects under the flap and provides safe cover of open joints and metalwork at the time of initial debridement and fracture fixation. The advantages compared to homodigital, regional and free flaps are that the RECF is user friendly to the less experienced operator. An oblique flap orientation allows coverage of the dorsal digital surface. The flap may cross the interphalangeal joints. The syndactylised fingers may then be immediately rehabilitated avoiding any joint stiffness and excessive oedema and separated after two weeks.

The RECF was used to reconstruct digital composite tissue defects extending beyond two interphalangeal joints in ten patients. The follow up period was between six months to two years.

The RECF was successfully used to reconstruct ten fingers with loss of the extensor tendon, bone and interphalangeal joint capsule. There were no flap failures.

We advocate the use of the RECF in the reconstruction of composite tissue defects of the entire dorsum of the finger at the time of initial debridement.



FP192

Anatomical bases of the 2nd toe composite dorsal flap for simultaneous cutaneous and tendinous reconstruction of the dorsal aspect of the fingers

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Coverage of the dorsal aspect of the fingers is difficult, especially when the soft tissue defect is large and involves extensor apparatus and joints. Tendinous and/or articular reconstruction is not usually performed simultaneously with cutaneous repair.

The aim of this study were 1) to precise the proper territory of the 1 st common dorsal metatarsal artery of the 1 st web space the medial dorsal digital artery, and 2) to enumerate the anatomical structures, which could be harvested "en-bloc" in order to design composite flaps.

The proper territory of the 1 st common dorsal metatarsal artery was studied from 22 anatomical specimens after selective injection of the arterial (and sometimes venous) network.

Its cutaneous area measured 75mm x 40mm in average. The extensor apparatus of the 2 nd toe was supplied by 1 st common dorsal metatarsal artery and its lateral branch to the 2 nd toe on about 75mm, by 2.7 branches in average. The medial dorsal digital artery was the main source of blood supply to the PIP joint, capsule, ligaments, head of proximal phalanx and base of middle phalanx.

It is then possible to design composite flaps including both skin and extensor apparatus, and total or partial PIP joint, if necessary, based on the 1 st common dorsal metatarsal artery and the medial dorsal digital artery, without important prejudice to the 2 nd toe. The average length of the arterial pedicle (60mm) makes easy its suture to the dorsal tarsal arch or the dorsalis pedis artery. Harvesting technique of such a flap is described; it has to be adapted to both the type and the extent of the defect.

Its use is conform to the nowadays classical principle of "All in one stage with early mobilization", thanks to adequate coverage whose vascularization does not depend on local vascularization, and which brings its own vascular supply.



FP193

Results after degloving injury of the hand

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Background: Total or subtotal skin loss at the hand presents one of the most severe functional impairment.

Patients and Methods: In a retrospective clinical study 11 patients who underwent reconstruction for subtotal or total skin loss were reviewed. All patients were males and manual workers. The age ranged from 18 – 53 years. Primary treatment consisted of a pocket graft according to Marino in 8 patients and primary skin grafting followed by early (within 6 months after injury) microsurgical toe transfer in 3 patients. Study criterias were 1) functional result (perfusion, sensibility, active and passive ROM), 2) donor site morbidity, and 3) complications.

Results: There was protective sensibility in all patients. In the patients with the pocket graft active ROM of the MP II – V joints was Ex/Flex: 0-15-60° and there was significantly reduced thumb mobility because of first web space contracture. In the patients with early microsurgical reconstruction active ROM of the MP II – V joints was Ex/Flex: 0-0-70° and there was no first web space contracture. Static 2PD after modified wrap-around transfer showed 6 mm. Regardless the cocept chosen, 4 – 6 operations were needed in every patient in order to reconstruct a „basic-hand“ according to ENTIN. Patients with free toe transfer showed better results at the Moberg pick-up test. Inspite of the hugh donor site defect at the abdomen, all patients would prefere reconstruction to amputation and prosthesis. Two patient do wear an esthetic prosthesis of PILLET for social events.

Conclusion: The following principles of treatment should be applied for the reconstruction of subtotal or total degloving injuries: 1) The thumb is best reconstructed with free toe transfer, 2) If P3 are still present, they should be amputated at the day of injury as almost all of them are lost later on, 3) Joint capsule tissue should be preserved as it provides some useful protective sensibility at the finger stumps.



FP194

History of tendon suture techniques

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The majority of published tendon suture techniques are quoted in a wrong way.

In an extensive literature review of the European and American Literature between 1600 and 2005 all different tendon suture techniques were collected (if possible with a portrait of the author) and painted in a standardized style to be able to compare these techniques.

80 different core-suture techniques and 8 different running sutures were found. Most different techniques were developed and published between 1880 and 1940. Identical suture techniques are found with different names. KESSLER (1969) quoted LANGE (1954) with the nearly identical picture and LANGE quoted himself (1929), where he quoted KIRCHMAYR (1917). The modern 4-strand and 6-strand techniques are often a combination of two older techniques, eg. STRICKLAND (1993) is a combination of NICOLADONI (1880) and GELDMACHER (1981). The first 6-strand technique was introduced by JUST in 1923. A looped suture was used by TSUGE (1975) and before by MÜLLER in 1919.

The development of tendon suture techniques in the last 100 years shows not only the birth, the death and rebirth of techniques. We – on the shoulders of giants - can now see the trend and should not forget techniques, which failed because the lack of antibiotics and non sufficient suture materials.



FP195

Certain tension during tendon suturing favors gap resistance of the repairs

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Purpose: Prevention of gap formation at the repair site is critical to satisfactory healing of intrasynovial tendon segments. However, little is known about relationship between initial tension of the repair and its gap resistance. We evaluated gap resistance of surgically repaired intrasynovial tendons under varying initial tension conditions.

Methods: Twenty-seven fresh flexor profundus tendons were harvested from zone II of adult pig toes and were equally divided into three groups. The tendons were completely cut and repaired with the modified Kessler method using a 4-0 Ethilon suture (purchase of the core suture was 10 mm uniformly) . These tendons were repaired under following tension status: Group 1, no shortening. The entire tendon segment with sutures was 20 mm; Group 2, 10% shortening. The sutured tendon segment was 18 mm ; Group 3, 20% shortening, The sutured tendon segment was 16 mm. A simple running peripheral suture with 6-0 Ethilon was added to each repair. All the tendons were pulled until complete failure in an Instron tensile testing machine. 2-mm gap force, failure load, stiffness, and energy to failure were recorded and compared statistically.

Results: Shortening of the sutured tendon segment by 10% or 20% significantly increased gap formation force over tendons without shortening. The initial gap force was doubled in the tendons initially shortened by 10% or 20% compared with that without shortening. The 2 mm gap force after 10% shortening increased to 125% of that without shortening. The stiffness of the shortened tendon was also significantly increased. No statistical difference in these parameters was found in the tendons shortened by 10% or 20%.

Conclusions: Certain initial tension during tendon repair favors gap resistance of the repair. We recommend 10% shortening of the sutured tendon segment during surgery. Excessive tension that leads to 20% tendon shortening is unnecessary.



FP196

Biomechanical analysis of four-strand suture methods with three different configurations for tendon repair

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Purpose: Clinically, early mobilization of repaired flexor tendons needs sufficient repair strength. U-shaped four-strand modified Tang method with a single looped nylon suture has been reported to have sufficient strength. We investigated the gap formation and ultimate strength of two other four-strand repair methods with different configurations using looped suture lines as compared to the U-shaped suture.

Materials and Methods: Twenty-one fresh pig flexor digitorum profundus tendons were randomly assigned to three groups of seven each. These tendons were repaired with the U-shaped modified Tang and two new configurations with looped nylon suture, one with 2 opposite knots on tendon surface, another with 2 separate knots between tendon cut. The tendons were subjected to a linear noncyclic load-to-failure test using an Instron machine. The initial gap force, 2-mm gap force, and ultimate strength were measured. The data were analyzed with ANOVA followed by Tukey test.

Results: Statistically, the initial gap force, 2-mm gap force, and ultimate strength of the repair with the U-shaped configuration were significantly higher than those of the repairs with 2 rectangular configurations. No statistical difference was noted in gap formation and ultimate strength between the 2 new configurations.

Discussion: Among three 4-strand repairs with different suture configurations, the repair with the U-shaped configuration has the greatest strength. The repairs with 2 tested rectangular configurations did not show strength equal to the U-shaped suture. Based on this study, we recommend the U-shaped modified Tang method rather than the rectangular configurations for clinical use because of its sufficient strength and simple manipulation.



FP198

Three dimensional models for the investigation of flexor tendon healing and repair in the mouse

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Background: The scientific investigation of flexor tendon healing and repair has involved a range of animal models including canine, chicken and rabbit models. The development of genetically tractable models for flexor tendon healing is important to progress our understanding of the healing and repair processes. We have performed a detailed anatomical description of the mouse hindpaw digit and illustrate how different interventions in this model can be used to investigate tendon healing and repair.

Method: Using aged 8-12 week old C57/BL6 mice a detailed anatomical dissection was performed of the mouse digit. Serial histological sections were reconstructed into computer generated three dimensional images. Following the demonstration of the mouse digital anatomy we developed a single suture model to mimic the grasping component of tendon repair and a partial laceration model as a model for tendon healing and a immobilisation model as a model for adhesion formation.

Findings:

The mouse hindpaw has a digital flexor tendon arrangement similar to that found the human hand with two tendons gliding within a flexor tendon sheath. A single grasping suture model forms an acellular zone in tendon tissue, whereas a partial laceration model causes elongation of the intact tendon but eventual healing and the immobilisation of the injured tendon results in adhesion formation.

Conclusion: The three dimensional injury models demonstrate different healing in response to different injuries which can be used to investigate the cellular mechanisms of tendon repair and adhesion formation using transgenic species.



FP199

The longterm fate of the suture induced acellular zones in tendon repair

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Background: Previously we have reported on the formation of acellular zones in tendon following a single grasping suture (Wong *et al.* 2006). The repair of tendons with complex suturing methods have been extensively examined biomechanically in cadaveric models, but few studies have investigated the biological effect of suturing tendon. Through further examination in a rodent model we have further characterised the acellular zone formation using time lapse confocal microscopy and immunohistochemical techniques.

Method: In our study we have evaluated the acellular zone in our single stitch model *ex vivo* and imaged the cellular changes of placing a suture in tendon over the course of 24 hours. We have also examined the formation of the acellular zone *in vivo* with a range of immunohistochemical markers for inflammation, apoptosis, proliferation, and synthesis. Finally we have performed modified Kessler repairs *in vivo* to evaluate how these acellular zones relate to clinically relevant repairs.

Findings: The acellular zone forms within 24 hours and persists for over 3 months with little evidence of Caspase 3 and Bcl-2 family activation of apoptosis. Time lapse microscopy reveals that the formation is a result of cell migration and local cell necrosis that forms as a result of tension applied through the tendon.

Conclusion: Acellular zones in tendon potentially may be a cause of early tendon failures. We have shown acellular zones persist for a significant duration following repair and that maintained tension in repairs cause their formation. Evidence suggests they form by both cell migration and localised necrosis.



FP200

Flexion of the digits by the vincula breve

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Introduction: The vincula are specialised mesotendinous structures attaching to the flexor tendons of the hand within the flexor sheath. In addition to providing vascular supply to the tendons, the vincula are also strong structures which can in certain circumstances become mechanically important. We set out to quantify the altered mechanics of finger movement present in the situation of finger flexion via the vincula after division of the tendons proper, and relate these findings to clinical scenarios

Methods: The index, middle and ring fingers of twelve fresh frozen cadaveric fingers were dissected free at the level of the metacarpophalangeal joint (MCPJ) with at least 10cm of the flexor and extensor tendons. A 10N load was applied to each flexor tendon and degree of flexion at each joint and excursion of tendons proximal to the MCPJ before and after tendon transection at the insertion site was noted. Uniaxial mechanical testing was also performed and load to failure and stiffness was calculated

Results: Range of flexion at the PIPJ by the divided FDS was 93% of normal, and flexion at the DIPJ by divided FDP was 69%. The increased excursion of transected tendons compared testing before division was 3.8mm for FDS and 1.8mm for FDP. Load to failure was 27.2N, and stiffness was 5.7N/mm.

Conclusions: The vincula breve become mechanically active after distal tendon transection. In the case of the vincula breve profundus it has the potential to hold the tendon in a position where healing without surgical intervention can occur. Flexion of the digits by the vincula breve may therefore be much more common than is currently appreciated, as those injuries which are missed would not represent. We propose that in addition to vascular supply the vincula have evolved for the additional function of 'safety net' for FDP injuries



FP201

A mechanical study of different suture materials used in flexor tendon repairs; In relation to the type of knot used and number of throws

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There is a multitude of experiments, investigations and papers on the different techniques available and materials used for flexor tendon repair. A braided suture (Ethibond) may generate more friction and deform the tendon more than monofilament suture (Proline). While a monofilament is prone to an increased stretch creating more "gapping". What has not been investigated is the difference between the type of knot and the number of throws used. The aim of this study was to investigate the mechanical differences between the traditional surgical knot and the standard square knot and the differences created by the number of throws in the knot. This study was carried out in the Engineering Department at University College Dublin, Ireland. We compared the traditional surgical knot to the standard square knot; investigating the tensile strength (constant speed of 2 mm/min), of two suture materials, *Ethibond 3/0* and *Proline 3/0*. We included four throw and five throw knots in each suture group, studying the "load to failure" and "cyclic testing". *Load to failure* When we compare these groups together, the ethibond square knot with five throws has the maximum breaking strength at 39 N and is statistical significant to most other groups. *Cyclic testing* When we studied cyclic testing; the square knot ethibond suture with both 4 and 5 throws produced the strongest knot ($p=0.05$) with the least excursion ($p=0.05$). The results are very interesting; there is a marked difference in the elastic properties, in terms of suture rupture and excursion to force. The suture of choice in terms of material, type of knot and number of throws; is an ethibond suture, a square knot with at least four throws.



FP202

Inverting epitendonous suture repair

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Aim: Adhesion formation with flexor tendon repair causes significant morbidity and no proven prevention strategy exists. We propose that a novel epitendonous suture can create a smooth inverted junction with high strength.

Method: 142 freshly harvested porcine flexor tendons were divided, assigned to 17 groups. Each was repaired with none, two and four strand core sutures (braided 3/0 polyester). 4 peripheral suture (6/0 nylon) groups (simple continuous, locked continuous, 2mm and 4mm bite Silfverskiold) were used in comparison with the inverting repair, sutured with. We tested load to 2mm gap formation and load to complete failure. Repair bulk was calculated with tendon area measurements before and after repair.

Results: Statistics used ANOVA, Levene's and Tukey's tests. Without cores, the inverting repair had the highest load to failure 32.25N (+/-1.961). With core sutures the 4mm Silfverskiold 105.55N (+/- 1.542) was significantly stronger than others but not against the inverting repair 96.45N (+/-2.598) ($p=0.2927$). There was no difference in percentage or absolute bulk between tendons with cores repairs ($p>0.0552$, $p>0.0738$, respectively). In groups that had no core sutures, the mean load to 2mm gap formation, demonstrates that the 4mm Silfverskiold 19.99N (+/-1.231) performs best with significance against the inverting repairs 11.44N (+/-1.186) ($p<0.0001$). When combined with a two or four core repairs the 4mm Silfverskiold 42.66N/61.48N (+/- 2.37/2.058) resists gapping best to significance compared to inverting with two 28.84N ($p=0.0015$) or four cores 46.55N ($p=0.0008$). Overall, the simple and locking peripheral repairs are more likely to pull-out, the 4mm Silfverskiold and inverting to break mid-suture or at the knot and 2mm Silfverskiold pulls-out or breaks equally.

Conclusion: The inverting suture gives equal strength to four core and Silfverskiold repairs and creates a streamlined junction without increasing bulk. This technique could facilitate tendon excursion and decrease adhesion formation.



FP203

Active mobilization programme after flexor tendon repair in children

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Hypothesis: active motion programme after multistrand flexor tendon repair in children results in good final outcome.

Patients: 25 flexor tendon lacerations involving 17 fingers in 10 consecutive children (7-14 years of age) were repaired. Repair was performed with pull-out sutures in two zone 1 injuries. In eight zone 2, two zone 3 and eleven zone 5 tendon injuries a four- or six-strand core suture was used. A thermoplastic splint was applied 1-3 days post-operatively for 6 weeks. Active exercises were performed four times a day without the splint. An ergo therapist followed up all patients at 1, 3, 5 and 7 weeks. Range of motion (ROM) of the wrist and finger joints as well as grip strength were recorded at a mean 38 months (12-53) after the injury.

Results: There were no infections nor failures of the tendon repairs. Mean ROM of the DIP-joint (60° , range 40° - 90°) after zone 2 injuries was lower compared to injuries outside zone 2 (82° , range 65° - 90°). ROM of PIP-, MP- and wrist joints were restored to normal. Functional outcome was good or excellent in all fingers using ASSH (5/17 excellent), Buck-Gramcko (13/17 excellent), and revised Strickland (16/17 excellent) evaluation systems. Mean grip strength ratio of the injured vs. uninjured hand was 1 (0.9-1.2).

Conclusions: active mobilization programme is an effective, simple, patient- and therapist friendly technique for mobilization after multistrand flexor tendon repair at all levels in children over 6 years of age.



FP204

Comparative clinical study between conventional flexor tenolysis in zone II and with intra-operative wake-up technique

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Introduction : Tendon adhesion is one of the more common complications of tendon surgeries. Tenolysis is the technique indicated to treat this complication. The authors performed a prospective randomized study to compare conventional tenolysis and tenolysis with intra operative wake-up technique. All tenolysis were performed between 3 to 6 months after tendon suture.

Material and Methods : Twelve patients (20 injured fingers) were treated by conventional tenolysis (Group 1) - 8 male and 4 female, with a mean age of 37 years old. Eleven patients (20 injured fingers) were treated by tenolysis with intra-operative wake-up technique (Group 2) - 8 male and 3 female, with a mean age of 36 years old. Tenolysis with intra-operative wake up technique were performed with anesthetics distal blocks (wrist level) with lidocain, including median and ulnar nerves, associate with sedation with midazolam. After tendon release flumazenil was injected to wake up the patient that was asked to move the injured fingers. Functional results were evaluated by TAMs (Total active motion modified by Strickland)

Results: The average of pre-operative TAMs of the group 1 was 80,33 and after surgery 140 ($p < 0,05$). The average of pre-operative TAMs of the group 2 was 72,67 and after surgery 170 ($p < 0,05$). The analysis of pre-operative TAMs in Group 1 and 2 demonstrated that these two groups were homogeneous ($p = 0,104$). After 31 months of follow-up after surgery it was possible to observe that Group 2 achieved better results ($p < 0,05$).

Discussion and Conclusion: tenolysis with wake up technique is related to better results than conventional surgery. It is possible that this technique permits more precise interpretation by the surgeon about the efficacy of tendon release. The positive motivation to see the result of the surgery under regional anesthesia could maintain a more intense dedication from patient to the hand therapy.



FP205

The protection of the flexor tendon graft in zone 2 with a cleft silicone tube: Results at 4 years about 16 cases

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Introduction: The protection of the flexor tendon graft in zone 2 by a cleft silicone tube appears interesting because a normal tendon healing can be obtained without harmful peritendinous adhesions and their consequences for the mobility of these tendon grafts.

Material and methods: From December 2001 to June 2006, 16 protected tendon grafts with the palmaris longus tendon were carried out: 7 on the digits and 9 on the thumb. The cleft silicone tube has protected these tendon grafts from their proximal suture to the motor tendon (Pulvertaft technique), to their distal fixation on the digit (Littler technique) after a classical adjustment of the tension in the tendon graft. This tube was introduced under the pulleys; its slot was directed toward the skeleton. In 3 cases, the A4 pulley was reconstructed. The two collateral nerves of 3 digits and 2 thumbs were grafted simultaneously. After 5 weeks of strict immobilization in an intrinsic plus position, the tube was withdrawn and the patients began an active mobilization of their interphalangeal joints.

Results: The interphalangeal joints mobility appeared 2 weeks after the tube withdrawal and regularly progressed until the eighth week; At this date the comparison of results with the opposite normal hand showed: - Normal extension in all cases – Flexion deficit of 15° in the thumb interphalangeal joint – Flexion deficit of 20° in the proximal interphalangeal joints and 25° in the distal interphalangeal joints. No complications were reported. With a mean follow up of 40 months these results were stable.

Conclusion: This technique seems attractive: - it is easy to done – the postoperative rehabilitation is simple – the mobility of the interphalangeal joints is satisfying. Its indication can be interesting when the tendon graft in zone 2 is associated with another surgery making the immobilization of the digit mandatory.



FP206

Immunohistochemical analysis of wrist ligament innervation and structural composition reveal differences in sensory and biomechanical wrist functions

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Purpose : The purpose of our study was to investigate the potential proprioceptive and biomechanical functions of wrist ligaments by analyzing ligament innervation and structural composition.

Methods : The dorsal radiocarpal (DRC), dorsal intercarpal (DIC), scaphotriquetral (STq), dorsal scapholunate interosseous (dSLI), scaphotrapeziotrapezoid (STT), radioscapoid (RS), scaphocapitate (SC), radioscapocapitate (RSC), long radiolunate (LRL), short radiolunate (SRL), ulnolunate (UL), palmar lunotriquetral interosseous (pLTqI), triquetrocapitate (TqC) and triquetrohamate (TqH) ligaments were sampled from five cadaveric, fresh-frozen specimens. The immunohistochemical markers p75, PGP 9.5 and S100 were used to identify mechanoreceptors and nerve endings.

Results : The innervation pattern was found to vary distinctly, with a pronounced innervation in the dorsal wrist ligaments, an intermediate innervation in the volar triquetral ligaments and only limited innervation in the remaining volar wrist ligaments. The innervation pattern was also reflected in structural differences. Hence, ligaments with limited innervation consisted mostly of densely packed collagen fibers, as compared to the ligaments with abundant innervation, which had large epifascicular regions containing neurovascular bundles.

Conclusions : We propose that wrist ligaments are not equal with regard to sensory and biomechanical functions. The radial wrist ligaments are primarily dense collagenous structures, which appear designed for a kinetic, force-bearing function. The dorsal wrist ligament complex, in association with the triquetral ligaments, however, are richly innervated ligaments albeit less dense in connective tissue composition. The triquetrum and associated ligaments are proposed to be regarded as important elements in both the proprioceptive and kinematic stability of the wrist joint.



FP207

Influence of lunate type on scaphoid kinematics

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Purpose : To assess lunate type and its effect on scaphoid kinematics, with particular reference to the row and column theory.

Methods : 100 volunteers underwent two-dimensional fluoroscopic assessment of the wrist in maximal radial, neutral and ulnar inclination. The wrist views were identified as either a type I lunate (18), intermediate (19) or type II lunate (63). Radiological parameters as published by Craigen and Stanley (J Hand Surg 1995), and Garcia Elias et al (J Hand Surg 1995) were measured. This included the distance from the most proximal and ulnar point on the scaphoid to the central crest on the distal pole (scaphoid length) was measured and recorded in ulnar and radial inclination. Scaphoid translation was measured and recorded between a vertical line, which was dropped from the radial styloid parallel to the axis of the radius, and the most ulnar point on the scaphoid, in radial and ulnar inclination. Calculations and statistical analysis comparing the types of lunate with the various radiological parameters was made.

Results : From radial to ulnar inclination, the degree of scaphoid shortening and ulnar translation varied in a normal distribution. The scaphoid of a type I lunate had a significantly greater translation than a type II lunate, and less flexion/extension. The scaphoid of a type II lunate had a significantly greater movement in the flexion/extension plane. The intermediate type of lunate lay between the type I and type II lunate.

Conclusions : This study demonstrates that the scaphoid of a type I lunate had a significant correlation with a row type of wrist; and the scaphoid associated with a type II behaved as a column wrist. The midcarpal lunate articulation may determine whether it is a row or column wrist. The surgeon can now identify a row or column wrist pattern with a single wrist plain radiograph.



FP208

The role of the dorsal radiocarpal and dorsal intercarpal ligaments in stabilizing the scaphoid and lunate

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The purpose of this study was to determine the importance of the scapholunate interosseous ligament (SLIL), the dorsal radiocarpal (DRC) ligament and the dorsal intercarpal (DIC) ligament in stabilizing the scapholunate joint.

Sixteen cadaver forearms were physiologically moved using a wrist motion simulator. Carpal bone motion data were recorded for the intact specimens; after sequential sectioning of the DRC, DIC and SLIL (8 arms); and after sequential sectioning of the DIC, SLIL and DRC (8 arms). Data were also collected after 1000 cycles of motion following complete ligament sectioning. Statistical changes were determined using a repeated measures ANOVA.

Sectioning of the DRC alone caused slight changes in lunate position. A further increase in lunate motion occurred only after the SLIL was sectioned. Scaphoid motion was not affected by sectioning of the DRC. Sectioning of the DIC alone did not statistically alter carpal motion. Sectioning of the SLIL was required to statistically observe an increase in scaphoid flexion, scaphoid ulnar deviation, and lunate extension from the intact condition. 1000 cycles of cyclic motion caused additional statistical increases in carpal motion.

The minimum distance between the scaphoid and lunate increased only after the SLIL was sectioned and was greater in wrist flexion or ulnar deviation.

These results shows that the SLIL is the primary stabilizer of the scapholunate joint. The DRC and DIC are secondary structures, with the DRC probably being more important than the DIC. This study demonstrates the value of early diagnosis of ligament injury following the initial injury. The DRC and DIC may be safe to sacrifice for ligament augmentation in surgical repairs for treatment of scapholunate (SL) instability. Repair of the SLIL alone would probably result in restoration of normal SL kinematics.



FP209

Ultrasound in the diagnosis of dynamic scapholunate instability

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Introduction: Establishing the diagnosis of dynamic scapholunate instability in patients with chronic wrist pain while avoiding the invasive procedure of arthroscopy has long been problematic. Imaging techniques such as stress radiography, triple phase arthrography and MRI all have reported low sensitivity for the diagnosis of scapholunate ligament tears, particularly partial tears, when compared with arthroscopy.

Methods: Ultrasound has previously had documented low sensitivity when examining the scapholunate ligament and widening of the scapholunate interval, however advancing ultrasound technology is providing improved resolution and the opportunity to scan the wrist in different planes, including the sagittal plane. The proximal pole of the scaphoid and its relationship to the scaphoid fossa of the radius can be seen, and hence dorsal subluxation of the scaphoid can be documented.

Discussion: A preliminary study is presented comparing plain xray, dynamic ultrasound and MRI in the diagnosis of dynamic scapholunate instability. Small dorsal osteophytes adjacent to the SLL, 'buckling' of the SLL in radial-ulnar deviation and an effusion are ultrasound signs suggesting subtle scaphoid instability.



FP210

Results of treatment of the dynamic scapholunate carpal instability

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Dynamic scapholunate (SL) instabilities are problematic for diagnosis and treatment. Treatment methods published in studies restrain carpal movement, which bothers many patients.

Goal of this study is to evaluate results of 13 patients with dynamic scapholunate carpal instability treated by one's own method of dorsal capsuloplastic in 2000-2002 years. Arthroscopy examination was used to confirm the damage of scapholunate ligament for all patients and proved that dorsal part of SL ligament was not broken.

Surgery work flow:

From dorsal incision before 4. compartment of the extensor the joint capsule is opened in the shape of turned letter 'T' with basis about 3 mm from the distal edge of radius. After revision of SL ligament the extension of scaphoid by K-wire is performed and transfixation by 3 K-wires is made, when 2 of them fixate SL joint and one is feed through (scaphocaputa). Rooflike alteration of the joint capsule's tips follows, which tension the dorsal intercarpal ligament. After suture the gypsum splint with fixation of thumb is attached to for 8 weeks, when K-wires are extracted.

WHWS methodology was used for classification of patients 3 years after the surgery. 7 of them were rated as excellent, 5 as good and 1 satisfactory when evaluating pain. None of them was rated as bad. When evaluating functionality 8 were rated as excellent and 5 as good, none satisfactory or bad. Squeeze strength was evaluated as excellent in 8 cases and good in 5 cases, none satisfactory or bad. Overall evaluation of the results rated 11 cases as excellent and 2 as good. No satisfactory or bad ratings were evaluated.



FP211

Results of tri-ligament tenodesis: A modified Brunelli procedure in the management of scapholunate instability

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One hundred and sixty-two patients with a diagnosis of scapholunate instability underwent a modified Brunelli procedure over a 7-year period. One hundred and seventeen were assessed with the help of a questionnaire and, of these, 55 patients attended for clinical evaluation. The mean follow-up was 4 (1-8) years. There were 72 patients with dynamic scapholunate instability and 45 patients with static instability. The average age was 38 years. There were 50 males and 67 females. A total of 77 (62%) patients had no to mild pain with a mean visual analogue score of 3.67 (SD = 2.5). The loss in the arc of flexion-extension was due to a reduced range of flexion (mean loss 31%), while 80% of extension was maintained, compared with the contralateral side. The grip strength on the operated side was reduced by 20% of the non-operated side. There was no statistically significant difference ($P>0.05$) in the range of movement or the grip strength between the static and dynamic group and patients with or without legal claims. Ninety (79%) patients were satisfied with the result of the surgery (good to excellent) and 88% of the patients felt that they would have the same surgery again. We feel that these results compare favourably with the early results published from this unit and recommend this procedure for dynamic and static scapholunate instability.



FP212

Reconstruction of scapholunate instability

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Management of the unstable wrist remains a subject with incomplete understanding and ongoing controversy. This author has altered his method of managing one type of wrist instability with hopes of delivering a predictable outcome.

Subjects considered all suffered an identifiable injury. All were skeletally mature. All showed some degree of widening between the scaphoid and lunate on plain x-ray and none showed signs of either a fixed deformity or early arthritis. Examination revealed a painful response to "Watson's maneuver" on only the affected side. In some cases, arthroscopy was used to further refine the diagnosis, but all actual ligament substitutions were performed with 2 open incisions and re-enforced with S-L pin fixation (8-12 weeks). The method proposed is best described as a partial S-L ligament substitution. It follows portions methods previously described by Linscheid and separately by Brunelli. The method employs the ulnar half of the Flexor Carpi Radialis which is left attached distally and draped across the ST joint after which it is passed thru the scaphoid exiting immediately lateral to the dorsal edge of the S-L articulation. The future ligament is then passed below the L-T ligament tissue and returned onto itself. It is sewn in a Pulvertaft-like manner and further secured with a suture anchor. Prior to tightening the future ligament, the S-L space is reduced and pinned from the radial side with 2-3 K-wires.

The method as described has been employed to treat 3 women (avg. age 35.3) and 11 men (avg. age 43.4) with a follow-up range of 4 to 36 months (avg. 18). To date, no patient has suffered a treatment related adverse event and no patient has had a second surgery for the original condition. All patients have returned to original activity (including one high performance athlete). The most common dissatisfaction with the current treatment continues to be reduced wrist flexion. In the author's opinion, the primary reason to consider this method is reproducibility.

A prospective multi-center observational study of this diagnosis is planned.



FP213

Wrist instability is controlled by wrist geometry

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Cadaver dissection has shown that 28% of the elderly population have incidental tears of the scapholunate interosseous ligament (SLIL). This suggests that some factor may minimize pain or instability in the presence of an SLIL tear. The purpose of this study was to investigate whether the bony architecture of the distal radius and scaphoid has a role in preventing or limiting scapholunate (SL) instability following SLIL sectioning.

29 cadaver wrists were moved in a wrist joint simulator through ranges of wrist flexion/extension and radial/ulnar deviation, with the wrist intact and after sectioning the SLIL and 2 other major wrist ligaments. Three levels of SL instability were determined following ligament sectioning: minimally unstable = little or no SL gap and no scaphoid clunk; intermediate = SL gap and no scaphoid clunk; grossly unstable = SL gap, and scaphoid either subluxed or dislocated. The interaction between the level of instability and nine radiographic and 3D geometry measurements was evaluated using a mathematical model based upon neural networks software. The sagittal and coronal curvatures of the articulating scaphoid were computed at two flexion positions, the sagittal and coronal curvatures of the radioscapoid fossa computed, and the volar tilt, lateral tilt and radial styloid height measured. The interaction between instability and geometry was determined using 21 training arms and the model's predictive capability tested in the remaining 8 test arms.

The neural networks model correctly predicted the level of instability in 100% of the training arms and in 88% of the test arms. These results suggest that the geometry of the radius and scaphoid can help constrain the scaphoid following ligamentous injury. These results also provide a means to detect those patients who are likely to progress to higher levels of instability. Those patients who are determined to have a more unstable scaphoid may require more clinical follow-up and surgical treatment.



FP214

Adaptative carpal malalignments and pyrocarbon intracarpal implants

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The stability of the carpal bones is assured not only by the ligaments but also by the spatial coherence of the carpal bones. Any change in shape or volume results in adaptative intracarpal malalignment by carpal collapse. In proximal scaphoid pseudarthrosis the resection of the proximal pole can be replaced by a pyrocarbon implant (APSI) whose purpose is to avoid the SNAC wrist. In all cases a styloectomy had to be associated. The results assessed with the EVAL computerised system of 12 cases after 9 years minimum follow-up are clinically satisfactory and carpal height is maintained. The pre-operative DISI was not corrected by the implant and necessitated a capsuloplasty in 9 cases out of 12 when it was more than 25°. STT arthrosis results in scaphoid verticalisation and carpal malalignment with dorsi-flexion of the first row. The treatment by simple resection of the distal pole of the scaphoid results in an increased DISI. To avoid this malalignment, the authors placed a pyrocarbon implant (STPI) in 15 cases to restore spatial coherence of the carpal bones after distal resection of the scaphoid. The results assessed with the EVAL system with a mean follow-up of 4 years are very good. At the level of the middle column of the carpus, a pyrocarbon implant was recently used to maintain carpal height and kinematics in 3 cases of capitate head necrosis. In Kienboch's disease to avoid carpal collapse and scaphoid horizontalisation (Litchmann's group 3B) the preliminary results of semi lunate replacement by the APSI implant seem promising. To conclude, these pyrocarbon intracarpal implants require a simple surgical procedure not "breaking the bridges" for revisional procedures and seem to avoid carpal collapse with intracarpal malalignment and secondary wrist arthrosis which could need more radical techniques.



FP215

Cervical lateral tilting in brachial plexus injury

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Cervical lateral tilting is sometimes seen on X-ray in brachial plexus injury. But there have been no systematic research about cervical tilting. Incidences of cervical lateral tilting and correlation with severity of injuries are still unknown. The purpose of this study is to investigate the clinical significance of cervical lateral tilting in BPI.

Eighty nine BPI cases that had exploration of plexus in our institution were reviewed. To evaluate the cervical tilting, plain X-ray films taken before the operation were reviewed. On cervical X-ray, 2 lines parallel with the lower cortical plate at the end of the vertebrae that tilted maximally were drawn and the angle of intersection was measured. The distribution of the cervical tilting angle was investigated. The difference between correlation of the tilting angle at (A) age at operation, (B) period from injury to the X-ray and (C) number of root avulsion, were statistically analyzed. The relationship between the tilting angle and existence of root avulsion was also examined.

In the 89 cases, many cases tilted to the healthy side (The frequency of cervical tilting more than 10 degrees was 43%). There was no correlation between the tilting angle and (A) ($r = -0.12$). There was weak correlation between the tilting angle and (B) ($r = -0.32$). There was moderate correlation between the tilting angle and (C) ($r = 0.61$). As for the relationship between the tilting angle and root avulsion, all cases tilting more than 10 degrees had root avulsions. Sensitivity and specificity of tilting more than 10 degrees for root avulsion were 55% and 100%, respectively.

In conclusion, the more roots avulsed, the more severe the cervical spine tilted, and cervical lateral tilting in BPI is helpful to predict the presence of root avulsion.



FP216

Intercostal nerve transfer to restore elbow flexion in C5,6 or C5-7 brachial plexus injury

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Purpose: Intercostal nerve transfer (ICNT) was originally invented to restore elbow flexion for a patient of brachial plexus injury (BPI) with total root avulsion. The specific result of ICNT for the upper root type has not been reported. The purpose of this study is to report the results of ICNT for C5,6 or C5-7 cases.

Materials and Methods: Twenty-seven cases of C5,6 or C5-7 BPI (C5,6 in 10 and C5-7 in 17) were confirmed the diagnosis through operative exploration and electrophysiological assessment, and transferred two or three intercostal nerves directly to the musculocutaneous nerve.

The time of initial recovery of biceps muscle by needle EMG and the final grading of manual muscle testing of elbow flexion (MRC) were researched.

The follow-up periods were at least three years.

Results: The initial recovery of biceps occurred at 5.1 months after operation. The power of elbow flexion became M3 at 11.7 months on an average.

Final results of Biceps were 2 cases of M2 or less, 4 cases of M3 (93%) and 21 cases of M4 or more (78%).

Discussion and Conclusion: ICNT in C5,6 or C5-7 was much better both in the initial recovery and the final result than the previous reports of ICNT including total root types.

Compared with Oberlin's operation, ICNT can afford the equivalent result for elbow flexion in C5,6 or C5-7 BPI.



FP217

End-to-side versus end-to-end ulnar nerve transfer in upper trunk brachial plexus lesions

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Objectives: After brachial plexus lesions, often no expendable motor nerve may be utilized without functional donor sequelae. The Oberlin procedure has been thought to provide a reliable source for transfer. We aim on assessing the impact of two kinds of ulnar fascicles nerve transfers – end-to-end versus end-to side – on restoring innervation for elbow flexion.

Method: Period from 2003 and 2006, eight men referred for repair of the brachial plexus. Mean age was 26.4 +/- 10 years (+/- SD, range 16-45 years). Surgery was performed a mean of 3.8 +/- 1.6 months postinjury (+/- SD, range 2.5-7.5 months). Either redundant ulnar nerve fascicles of the flexor carpi ulnaris were attached to the biceps branch of the musculocutaneous nerve – 4 patients (Group 1), or an end-to-side neurotomy between biceps musculocutaneous branch and ulnar nerve was employed – 4 patients (Group 2).

Results: Evidence of reinnervation of the biceps was clinically noted at a mean of 5.3 +/- 2 months postoperatively (+/- SD, range 1-8 months) and the mean length of follow-up was 19.3 +/- 15 months. Elbow flexion strength was an MRC grade 4 in three patients of Group 1 and Grade 2 in the four patients of Group 2. Follow-up electromyography showed good biceps function with no fibrillations or fasciculations and adequate mature and polyphasic motor unit potentials. No weakness in ulnar nerve or diminished sensation was reported in either group.

Conclusion: The Oberlin procedure provides a reliable source of donor motor axons for transfer in brachial plexus injuries and allows reinnervation of the biceps muscle in timely fashion without functional donor sequelae. In some patients the quantity of functioning motor axons may not be sufficient for the satisfactory recovery. End-to-side nerve response is intimately related to the amount of axonal sprouting.



FP218

Selective neurotization of the deltoid f or treatment of brachial plexus palsy- An anatomic study and case reports

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Introduction: In treatment of axillary nerve palsy of brachial plexus injury patients with nerve transfer, mismatch and dilution of the insufficient donor nerve are important reasons for the poor results. Selective neurotization of the deltoid muscle is a consideration to diminish the problem. Here we describe and report the results of a related anatomic study and a new method of selective neurotization of the deltoid and preliminary clinical results.

Material and Methods: Internal topographic features of the axillary nerve were observed in 40 cadaveric shoulders. Based on the anatomical findings, selective neurotization the deltoid was performed in two brachial plexus injury patients, and patients were followed up for 4 years.

Results: Anatomic study: In front of the subscapularis, the axillary nerve constantly formed into the lateral and medial fascicular groups which could be separated atraumatically in a retrograde fashion until 1.4 cm (range, 0.3-3.7cm) superior to the inferior border of the subscapularis. Proximal this level, the lateral group was mainly traced to the lateral part of the axillary nerve, and the medial group was mainly traced to the medial part. The lateral group became the anterior branch of the axillary nerve after passing through the quadrilateral space, and the medial group became the posterior branch. The lateral group contained all fibers innervating the anterior and middle deltoid and part fibers innervating the posterior deltoid i n 57.5% of cases.

Clinical cases: By a transaxillary approach, the lateral fascicular group of the axillary nerve was selectively reinnervated with two intercostals nerves in two brachial plexus injury patients . The deltoid restored to M3 or more according to Medical Research Council scoring after surgery in the two patients.

Conclusion: Proximal to the quadrilateral space, selective neurotization of the deltoid is practicable, which has been used effectively in two patients.



FP219

Outcome of axillary nerve injuries treated with nerve grafts

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The axillary nerve is vulnerable to injuries such as shoulder dislocation, humeral neck fracture and traction lesions. The aim of this study was to show the surgical outcome of axillary nerve injuries treated with nerve grafting. Out of 47 patients who underwent reconstruction of the axillary nerve from 1990 to 2005, 37 patients with a follow up of more than 12 months were retrospectively reviewed. Mean age at the time of injury was 24.8 years and mean interval from injury to surgery was 6.5 months. Seventeen patients had a shoulder dislocation. Neuromas were mostly seen just after the take off from the posterior cord and at the quadrilateral space. Sural nerve cable graft length varied from 4 cm to 12 cm. Six patients had simultaneous reconstruction of other plexus nerves and/or rotator cuff repair. Median follow up period after surgery was 31.1 months. Thirty-three patients achieved grade M4 or M5 retraction, and 32 patients achieved grade M4 or M5 abduction measured at 90 degrees. Nerve graft to axillary nerve is a reliable method of treatment when the lesion is distal to its take off from the posterior cord.



FP220

End-to-side neurorrhaphy to restore shoulder flexion in C5-7 root injuries: A preliminary report

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Purpose: The secondary goal of brachial plexus reconstructive surgery was to reanimate shoulder function, which mostly concerned with shoulder abduction and external rotation. Shoulder flexion is also one of the most useful functions of the shoulder, which should be considered. The aim of this study was to evaluate the preliminary results of the shoulder flexion by means of auxiliary neurotization using end-to-side neurorrhaphy in C5-7 lesions of brachial plexus.

Methods: Auxiliary nerve neurotization using end-to-side neurorrhaphy was performed in 9 patients with an average age of 23.7 years. The end of the auxiliary nerve was connected to the side of the median nerve in 8 patients, and to the side of the radial nerve in 1 patient. All patients underwent nerve transfer to suprascapular nerve and motor branch of Biceps concomitantly with this procedure. The follow up period ranged from 7-23 months (average, 14 mo.).

Results: The shoulder function recovered in 7 patients (78%). In six (67%) of 9 patients, the shoulder abduction strength was MRC grade III with a mean abduction of 44 degrees. Postoperative needle electromyography showed signs of deltoid muscle reinnervation in 7 patients (78%) with an average time of 10.1 mo. Four patients (44%) demonstrated shoulder flexion grade III with an average flexion angle of 45 degrees. The average time of recovery was 9 mo. (ranged, 6-13). Three patients (33%) had only deltoid contraction grade I.

Conclusions: The auxiliary nerve neurotization by means of end-to-side neurorrhaphy in C5-7 root avulsion brachial plexus injuries demonstrates a promising result. However, the extent of this improvement is still limited due to the short period of follow up. The long term recovery of deltoid muscle function especially shoulder flexion needs further evaluation.



FP221

Long-term outcome of contralateral C7 nerve transfer

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Objective: To follow up long-term outcomes of the repaired and the donor limbs of brachial plexus injuries after contralateral C7 transfer.

Methods: From 1986 to 2006, 28 patients treated with contralateral C7 transfer were followed up for over 2 years to evaluate motor and sensory recovery of the repaired and donor limbs.

Results: There was no impairment of donor limb's function. The C7 were transferred to the median nerve in 20 patients: wrist flexion reached M3 or over in 12 and finger flexion reached M3 or over in nine , there were none whose thenar reached M3. The sensation reached S3 or better in 10 patients ; ⊖ musculocutaneous nerve in two patients : the elbow flexion reached M3 or over in both, the sensation reached S3 in one patient; ⊕ radial nerve in three patients , the wrist extension reached M3 or over in two patients and the finger extension reached M3 or over in one patient, the sensation reached ≥S3 in 2 patients; ④ median nerve and radial nerve simultaneously in two patients, the wrist flexion reached M3 or over in the both and the finger flexion reached M3 or over in one patient , the elbow and wrist extension reached only M2 and M0, the sensation both reached from S1 to S2; ⑤ median nerve and musculocutaneous nerve simultaneously in one patient, the elbow flexion and wrist flexion both reached M3 or over. 22 patients of this series needed contracting latissimus dorsi muscle of the healthy side to move the affected limb, there were only six patients that can move their affected limbs independently.

Conclusion: Contralateral C7 transfer is an ideal procedure for the treatment of brachial plexus injuries; if two recipient nerves were simultaneously repaired , it is better to choose the two nerves that don't antagonize each other.



FP222

Brachial Plexus Reconstruction Outcome Measures

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Introduction : Currently, motor return after brachial plexus reconstruction is measured using manual methods that are quite imprecise.

Methods : A comprehensive review of the literature on brachial plexus reconstruction reveals a paucity of detailed measures of outcome. Motor return is generally measured using manual muscle testing (MMT) with the British Medical Research Council (BMRC) scale of M0-M5. MMT, especially when performed by various examiners from several medical centers, results in a high variability of measures. Higher variability requires larger number of patient to prove efficacy of treatment. One way to reduce variability is to use isometric motor testing with force plate gauges which are highly sensitive to small variations in strength. Various isometric strength testing devices already exist for the shoulder and elbow motions. Unfortunately, these machines do not eliminate the effect of gravity. Therefore, early recovery, when the muscle is not strong enough to overcome gravity, is not detected. Our group has developed specific, reproducible testing of muscle strength using standardized placement of force plates in such a way as to eliminate the effects of gravity. These techniques measure the isometric force generated by a muscle group in a standardized fashion. Specifically, force is measured in shoulder flexion, extension, abduction, internal rotation, and external rotation. Elbow flexion and extension, and forearm pronation are also measured. Using these protocols we hope to establish standards of measurement that will aid in future research on the success of brachial plexus reconstruction. These protocols will be described as they pertain to specific types of brachial plexus reconstruction. We will also present preliminary results from illustrative cases.

Conclusion: Force plate measurements of upper extremity strength following brachial plexus reconstruction yields more precise data than current manual techniques.



FP223

What is the role of shoulder fusion in complete brachial plexus injuries?

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Introduction: Glenohumeral arthrodesis is indicated in flail upper limbs where a stable shoulder is required. The trapezius, levator scapulae, serratus anterior, and rhomboid muscles must be functional to optimize the functional result following shoulder arthrodesis. Contraindication include non-functioning periscapular muscles.

Objective: Evaluate clinical and radiological outcome of shoulder fusion in complete brachial plexus injuries.

Methods: Six patients with complete brachial plexus injury had glenohumeral arthrodesis done in the last 2 years with an average follow up of 9 months were assessed. The shoulders were fused in 30 degrees abduction, 30 degrees internal rotation and 30 degrees flexion via a direct lateral approach and fixed with a 4.5mm reconstruction plate. No bone graft was used in all these cases. An abduction splint was applied postoperatively for a total duration of 12 weeks. The functional outcome in all the patients were assessed.

Results: Radiological fusion was obtained in all of the six patients. One patient had a humeral fracture distal to the plate, which united well with a splint. The functional results at final follow up were satisfactory.

Conclusion: Successful glenohumeral arthrodesis results in a strong, stable and pain free shoulder with satisfactory functional results. Reconstruction plating is an effective method of achieving fusion and reliably improves the function in cases of complete brachial plexus injury.



FP224

Surgical management of Kirner's deformity: Review and case series

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Kirner's deformity is a congenital abnormality resulting in volar-radial curvature of the distal phalanx, typically involving the little finger bilaterally and with an onset between 8-14 years. Surgical opinion is sought when the condition causes significant aesthetic deformity, and functional problems relating to fine motor function may occur. It is important for the surgeon to distinguish this entity from other causes of digital curvature, in order to provide meaningful information to the patient regarding its natural history and to give some indication regarding the likely outcomes of surgical intervention, which should be based on accumulated clinical experience. Although Kirner's deformity is not rare, a search for previously published data reveals only a few reports, almost all prior to 1987. In this article we present a review of the literature to date and analyse the presenting clinical features, surgical technique, and outcomes of 9 clinical cases.

Patient records were identified for patients who had undergone previous surgical correction of Kirner's deformity by one of three hand surgeons. Preoperative clinical and radiological findings were reviewed and the surgical records were examined. All patients had undergone nail plate removal, metaphyseal wedge osteotomies, K-wire fixation and further splinting. Clinical and aesthetic outcomes were recorded for a duration of up to 21 months. All patients were found to have a straight distal phalanx and nail plate, with preservation of normal range of motion. Radiological followup of the distal phalanx consistently showed stable union in a straight position, with minor residual curvature remaining in only one case.

In conclusion, our series of 9 operative cases of Kirner's syndrome shows that surgical intervention, through midlateral incision, volar osteotomies, K wire fixation and splinting will in the majority result in predictable improvement in cosmetic appearance and in some cases function.



FP225

Mobilization of congenital radioulnar synostosis with interposition of pedicled local fat graft

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For treating congenital radioulnar synostosis, new surgical technique, such as interposition of free vascularised fat graft, posterior interosseous fat graft with vascular pedicle and radial forearm adipofascial flap those maintain separated space between the radius and ulna, have been reported. As an alternative procedure, we developed more simple technique consisting of using pedicled local fat graft to keep the separated space.

Patients: Patients are 1 adult (39 y.o.) and 6 children (mean age 6.8

y.o.) with congenital radioulnar synostosis. Preoperatively, the forearm was ankylosed in pronation position in all patients. The radial head was dislocated or subluxated anteriorly in 3 and posteriorly in 3 patients.

Surgical technique: Posterolateral incision was used. The anconeus was detached from the ulna and reflected proximally. An area of synostosis was identified and resection of synostosis was completed. After detachment of the biceps tendon from the tuberosity, dislocated radial head was reduced by shortening wedge osteotomy and fixed with small reconstruction plate. The detached biceps tendon was sutured to the dorsal cortex of the radius. Then rectangular local fat flap (about 4×5 cm) without axial vascular pedicle was raised and interposed between excised area of synostosis. The anconeus was also interposed between the radius and ulna. At the end of the procedure, nearly 90° of rotation was obtained.

Results: All patients were followed up and the duration after surgery averaged 27 (12~36) months. Obtained arc of rotation was 68° on average: supination was 25°(15°~40°), pronation was 43°(35°~50°). Radiographically, there was no re-ankylosis between the separated radius and ulna.

Conclusion: Our results demonstrate that interposition of pedicled local fat graft would be a useful procedure for keeping space between the radius and ulna.



FP226

Complications of distraction lengthening in the hand

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Bone lengthening in the hand is a widely adapted. But complication rate was relatively higher than major limbs. We analyzed the rate and characteristics of denoting complications after distraction lengthening in the hand. 24 metacarpals and 27 phalanges in 41 patients were lengthened for 10 years by callus distraction technique. Indications were congenital (25 patients) and traumatic deformities (16 patients). Gradual distraction at the rate of 0.25(phalanges) to 0.5 mm/day (metacarpals) was carried out to obtain an average lengthening of 16 mm (61.5%) in the phalanx, and 34 mm (63.3%) in metacarpals. The healing indexes were 68.6 days/cm in the phalanges and 52.3 days/cm in the metacarpals. Major complications which needed secondary procedures were non-union (1 case), volar angulation (2 cases) and dislodging of pins (3 cases). Minor complications (9 cases of 6 patients) were delayed callus formation (5 cases) and interphalangeal joint stiffness(4 cases). The overall complication rate was 29.3 %. There were no difference in incidence between congenital and traumatic ones (9 and 7 cases respectively), however, the age and the location had some relationship. Dislodging of pins occurred in 3 children under 13 years old. Joint stiffness and delayed callus formation were seen in the patients at least 18 years old or more. Phalanges produced higher rate of complication rates than metacarpals did (12 and 4 lengthening, respectively). Two children who got dislodged pins abandoned the treatment, however the other 10 patients overcame the problems, then finally got longer digits satisfactorily as those of other uncomplicated cases. Although the callus distraction in the hand requires a longer treatment period and bears relatively higher rate of complications, it seemed effective in achieving adequate bone length. A high compliance of the patient and his parents as well as an prompt management of the unfavorable problems and events by an experienced surgeon would be mandatory for a good result.



FP227

Lengthening in upper extremity congenital deformities

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Upper extremity lengthening has become more popular can be used in congenital, posttraumatic and postinflammatory shortening. Both bones and soft tissues can be elongated

Aim: The aim was to evaluate the usefulness of lengthening in congenital.

Material and method: In 1995 to 2005 in our Department 73 patients (40 male and 33 female) with upper extremity congenital deformations underwent lengthening procedure. The most often deformations were: congenital aplasia of radius, ulna and arm hypoplasia. According to the bone elongated the frequency was: humerus (12%), radius (15%), ulna (26%), metacarpal (10%), phalanges (7%). Lengthening techniques were also applied secondary in toe transferred phalanges. Soft tissue lengthening was used in congenital aplasia of radius in 31% of cases.

Monolateral devices of Pomet, Wagner, Ilizarow and custom kind were used during the procedure. Speed of lengthening was 1mm/day in 4 cycles, phalanges 0,8 mm/day, soft tissues 1-2 mm/day. Onset of lengthening was 7 to 14 day after surgery for bones and 4 to 7 days for soft tissues.

Results: In almost all cases we achieved our planned elongation. The final elongation varied from 0.8 cm to 12 cm, averaging for hand 2, forearm 5, arm 7cm, which stated from 105 to 136% of initiative length. The time from hardware installation to uninstallation varied from 2 to 12 months. During lengthening the following complications occurred: delayed bone formation, pseudoarthrosis at the site of lengthening, misalignment, fractures of hardware, inflammation at the site of hardware and pain.

Conclusions: The procedure was effective and safe for the patient. Soft tissue lengthening was valuable for further surgery.



FP228

Management of Apert's acrosyndactyly

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Surgery for Apert's acrosyndactyly aims to achieve a four digit hand or better with the minimum number of procedures.

The aim of this study was to examine our outcomes using a standard protocol.

We begin surgery after the age of six months and after completion of any essential early craniofacial intervention. If the child is less than 18 months of age we perform bilateral procedures simultaneously but if older, surgery is performed sequentially. In types I and II, in the first procedure, we correct the radial angulation of the thumb and release the 2nd and 4th webs using straight line incisions with full thickness skin grafts and z-plasty to the 1st web if required. In type III, we release the 1st and 4th webs initially and then later correct the thumb angulation and the 2nd web syndactyly. We defer release of the 3rd web until the age of around 7 years when we do pulp-plasties but see no necessity to cover the exposed bone with a flap. Angulatory deformities and further web deepening are carried out when required.

We have reviewed all patients on whom the senior author has operated for an Apert's hand deformity over the past 18 years examining the number of procedures, number of five digit hands achieved and outcome of surgery.

There were 115 hands in 58 patients: 34 type I, 56 type II and 25 type III. X Had previously had surgery elsewhere. The mean number of separate operative procedures on each hand was two for types I and II and three for type III. In 85 hands we were able to achieve a five digit hand (74%). The complication rate was 19%.

The majority of patients achieve five digit hands that benefit them both functionally and aesthetically but this may involve multiple procedures.



FP229

Management of epidermolysis bullosa

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Epidermolysis bullosa is a family of genetic disorders that cause blistering and shearing of the skin from even the mildest trauma. It creates severe hand deformities such as pseudosyndactyly, obliteration of the first web, flexion contracture, with disabling functional limitations.

Materials and method: We present our experience on 38 patients and 48 operated hands. The patients were operated under general anaesthesia performed by an experienced anaesthetical equipe. The surgical plan was different mostly according to the age of the patient. In younger patients complete correction of the retraction is reached through the following schema: hand degloving, release of the contracted tissue and opening and grafting of the first web. In adolescents or aged patients, when retraction is present since long time, surgery is purely functional, to restore the pinch. Each procedure is followed by an acute and intensive rehabilitation protocol. Severe cases of early treatment are followed by intraoperative dynamic splinting. This custom made apparatus produce a constant traction on the finger, avoiding the risk of retraction, but permitting movements.

Results: In 26 patients with an 8 years follow up, 23 had had good or excellent results, and the remaining 3 patients show early recurrence. In our experience the intra-operative splinting has considerably change the perspective.

Conclusion: Association of a correct surgical approach to an adequate intra and post-operative rehabilitation improve hand function and a slow down inevitable recurrence.

References: J. Glicenstein 2000, MG Parente 1991, RW Pearson 1971, L Donati 1992



FP230

Microsurgical dissection of neurovascular structure and transverse segmental resection in the treatment of macrodactyly

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Macrodactyly is a rare congenital anomaly of the hand. The enlargement includes skin, subcutaneous tissue, nerve and bone. Several surgical techniques for correction of this deformity have been reported: epiphyseal ablation, transverse and longitudinal osteotomies, nerve stripping hemidigital resection and defatting.

None of the available methods, however, gives ideal function and cosmetic results.

We describe a new surgical technique for the treatment of macrodactyly.

The technique basically consists of neurovascular dissection and skeletonization of vein, artery and nerve and en bloc segmental resection of excess length of the finger from middle phalanx. Good functional and cosmetic results were obtained



FP231

Natural history of the congenital trigger thumb

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Purpose: Congenital trigger thumb is a relatively uncommon condition showing flexion deformity of interphalangeal joint and Notta's nodule. The treatment is remaining controversial. Our aim is to analyze the change of flexion deformity of interphalangeal joint, to know the rate of spontaneous resolution and eventually to comprehend the natural history of congenital trigger thumb.

Materials and Methods: We prospectively analyzed 53 patients with 71 thumbs from January 1994 to March 2004. They were diagnosed as congenital trigger thumb at the initial out-patient visit and any management such as passive stretching or splinting was not applied. The degree of flexion deformity was measured at their periodic visit and we recorded the date when spontaneous resolution was observed. Thirty children showed bilateral involvement. The right thumb was singly involved in 15 children and the left in 8.

Results: Of the 71 thumbs, 45 (63.4%) resolved spontaneously. Mean time from initial visit to spontaneous resolution was 47.9 months. Although spontaneous resolutions were not observed in remained 26 thumbs, flexion deformities significantly improved in 22 thumbs (84.6%, P-value<0.01). Statistically the degrees of flexion deformity significantly reduced between consecutive 6-months follow up visits over the 4 years period after initial visits. Moreover, after this time, degree of flexion deformity showed a decreasing, though non-significant trend between visits.

Conclusion: The natural history of congenital trigger thumb seems to be self-limiting. As a treatment, conservative treatment should be recommended in most cases. Surgical treatment can be restrictively used in the patient who shows deteriorating disease course.

Key Words: Congenital trigger thumb, Natural history



FP232

Correction of Madelung's deformity with callus distraction technique using a new multiplanar external fixator

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Background: Madelung's deformity (M-D) is caused by arrest of growth on the ulnar side of the distal epiphysis of the radius. The condition may cause pain in the wrist, deformity and impaired ROM. We have previously used the Ilizarov ring system for callus distraction, but instrumentally it is a technical demanding procedure. The new Orthofix® MultiPlanar MiniRail system allows correction of length, volar angulation and radial tilt, all in the same instrument.

Aim: To present our experience with correction of M-D using the multiplanar external fixator.

Methods: During 2005-2006 three painful wrists in two girls were operated on for M-D. For bone fixation we used 3mm self-drilling cortical screws. After mounting the frame an osteotomy was performed 2-3 cm proximal to the distal radial articular surface. Bone lengthening began 7 days after surgery, 0.25mm four times a day. Before full lengthening was achieved the angulations were corrected. Finger, wrist and forearm exercises were undertaken immediately. Frame was removed after bone consolidation.

Results: The achieved radius lengthening was 8-13mm. The volar angulation was reduced from between 38-48° to 26-38, and the radial tilt from between 26-35° to 16-20. The patients achieved satisfactory functional and cosmetic results. No major complication was encountered

Conclusion: The MultiPlanar external fixator is constructed for correction of radial club hand. Turning the instrument 90 degrees allows usage for non-bridging correction of other complex wrist deformities. The method requires frequent contact with the patient for monitoring of the corrections and making adjustments when necessary. However, the method seems promising and is well tolerated by the patient. This technique avoids bone grafting, two stage surgery and immobilization of the wrist during the treatment period.



FP233

Vibrotactile sense and hand symptoms in men with long-term type 2 diabetes, impaired and normal glucose tolerance

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Background: The perception of vibration is mediated through large nerve fibers and their receptors. As a sign of neuropathy, vibration thresholds are increased in the legs and feet of patients with diabetes (DM). The aim was to analyze vibrotactile sense in the hands, and how this might affect hand function and activities of daily living (ADL) in patients with DM and impaired glucose tolerance (IGT).

Methods: We investigated three groups of men (mean 75 yr) with type 2 DM, IGT and normal glucose tolerance (NGT), based on oral glucose tolerance testing, 1989–1991 and 2003–2005. Vibration thresholds in the index and little fingers were examined using tactilometry at seven frequencies 8–500 Hz. Hand function were evaluated using a battery of tests. Patients were interviewed regarding their ability to perform ADL.

Results: Vibration thresholds were significantly increased for men with type 2 DM. Affecting nearly all frequencies (except 64 Hz) in the little fingers, while the index fingers showed changes at high frequencies (particularly 500 Hz). Individuals with long-term DM showed higher frequency of Dupuytren's contracture, impaired sensibility (Semmes Weinstein (SW) monofilament test, 2 point discrimination (2PD) and vibrotactile sense) than short-term DM. Correlation was found between impaired vibrotactile sense and SW monofilament test and 2PD. Individuals with IGT showed more commonly limited joint mobility (LJM) but were otherwise not different in the investigated parameters from NGT.

Conclusion: For men with long-term type 2 DM, vibration thresholds are increased in the finger pulps innervated by the median and particularly the ulnar nerve. The duration of DM, but not IGT, is important for the development of hand symptoms and peripheral neuropathy. Tactilometry, using a multifrequency approach, seems to be a good screening method for neuropathy in the hands of patients with type 2 DM.



FP234

Riche-Cannieu anastomosis in a family

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Introduction: The aim of this study was to explore the basis for the Riche Cannieu Anastomosis (RCA) and specifically whether there is an hereditary characteristic to the anomaly.

Methods: Three members from the same family were evaluated using standard and novel neurophysiological techniques after initial nerve conduction study in the index case inferred that a RCA was present. Nerve conduction studies, and needle electromyography recordings were used to study median and ulnar nerve function before axonal excitability in the ulnar nerve was investigated. The index case also underwent magnetic resonance imaging (MRI) to identify a cause of the findings.

Results: Dual innervation of APB by the median and ulnar nerves consistent with RCA was evident in all 3 cases without evidence of sensory anomalies. Thresholds for compound motor action potentials (CMAP) from abductor pollicis brevis (APB) after ulnar stimulation were smaller, with larger CMAPs, than after median nerve stimulation. Nerve excitability studies recorded from APB after ulnar nerve stimulation for the RCA cases were within previously established normative data for the median nerve (Kiernan, 2000). In the index case, no innervation anomaly was visible on MRI from the forearm to hand.

Conclusions: Neurophysiological features consistent with RCA were identified in all 3 family members. In all cases, APB was predominantly innervated by the ulnar nerve, and the anomaly was structural, without evidence of altered excitability of ulnar nerve properties. These findings confirm an hereditary basis for RCA.

References: Kiernan, M. (2000)



FP235

The diagnostic utility of a new handheld nerve conduction device in carpal tunnel syndrome: A multicenter study

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Introduction: The diagnostic utility and reliability of a new handheld nerve conduction tester for verifying median nerve lesion in carpal tunnel syndrome (CTS) was examined.

Methods: Using the test device in this multicenter study, the results of a new tester and traditional NCS were compared to each other in 194 patients with suspected CTS and in 95 control subjects. In the new tester study, the ring finger and the forefinger were separately stimulated, and the responses were registered at wrist. The nerve responses were analysed both visually and by a signal detection algorithm. The reproducibility of the new device results was also tested.

Results and Summary: In routine visual analysis the new tester correctly classified 146 of the 150 hands (97.3%) with normal findings in traditional NCS and 181 of 199 hands (91%) with median nerve lesion in traditional NCS. After exclusion of the recordings due to missing responses with ring finger stimulation and poor signal quality (8% of the measurements in the latter group) the right detection rate in mild CTS was 86.9%, in moderate 96.3% and in severe 100%. The specificity of the tester study in relation to traditional instrumentation was 98%. For the automatic program algorithm the correct detection rate of the test device was 92.1% for normal hands and 80.6% for the hands with median nerve lesion. In 5 of 95 (5.3 %) controls two peaks (difference 0.7-0.9 ms) occurred during ring finger stimulation due to mild differences in median and ulnar nerve conductions. This indicated that the peak latency difference of 0.8 ms or more is abnormal. The intra-technician correlation coefficient of the reproducibility of the measurements in one session was 0.99 and that of the inter-technician day to day trials 0.89.

Conclusion: The new handheld tester reliably worked, as it found over 90% of the median nerve lesions verified by traditional NCS.



FP236

The usefulness of distal motor latency measurement after palmar stimulation of the median nerve for assessment of severe carpal tunnel syndrome with absence of motor response

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Aims: In advanced carpal tunnel syndrome (CTS), absence of motor response (MR) after stimulation at wrist (wrist-distal motor latency) (W-DML) is caused by severe compression of median nerve. In this situation, evaluation of the damage to the axon of median nerve is important for choice of the operation procedure, either surgical release of carpal tunnel or opponensplasty. In this study, DML measurement after palmar stimulation of the median nerve (P-DML) was investigated. This allowed measurement of the direct track of stimulation, without passage through the carpal tunnel, for assessment of median nerve condition. In addition, the clinical outcome after surgery was investigated.

Methods: Nineteen severe CTS hands (16 women, 1 man) with absence of W-DML were included in this study. P-DML was measured by palmar stimulation distal to the carpal tunnel and recorded at the abductor pollicis brevis pre-and postoperatively (>6months). Surgical release of carpal tunnel with minimum skin incision was performed in all cases. The recovery of subjective symptoms of numbness and tingling and objective symptoms of thenar muscle atrophy were examined postoperatively (>6month).

Results: Preoperatively, P-DML was measured in 18 hands of 19 hands (91%) and all of these responded to surgery with excellent recovery of the symptoms subjectively and objectively with W-DML at an average of 5.8 ms (4.2-6.2 ms). In one hand with pre-operative absence of P-DML, surgery did not relieve the symptoms and there remained an inability to pinch and no response of P-DML.

Conclusions: In severe CTS, the absence of W-DML is considered due to the severe compression of median nerve. In this study, most cases showed P-DML, which suggested the axonal damage was not severe and the surgical recovery was good. However, the opponensplasty might be indicated in those cases with no response of P-DML due to severe and irreversible axon damage.



FP237

Thoracic outlet syndrome: Objective criteria to indicate surgery

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Introduction : Reviewing the literature the indication for Thoracic Outlet Syndrome (TOS) - surgery is based on clinical findings only in the majority of the cases due to lack of objective findings. In a retrospective study we have analyzed our cases in order to evaluate objective criteria for surgical intervention.

Methods: 17 patients (2men, 15 women aging from 12 to 59) were diagnosed clinically 20 times for TOS (Duration of symptoms 44 months, NRS 6). Additionally objective investigations were performed: X-ray of the cervical spine to detect a cervical rib; a comprehensive electroneurographic investigation to detect signs of nerve compression; MR-angiography of the subclavian artery with elevated and adducted upper extremity to detect a stenosis of the artery as an indirect sign of compression of the brachial plexus.

Results: Concerning the objective assessment a cervical rib was present in 50% of our cases. The electroneurographic investigation revealed signs of nerve compression in 47 % of our cases. In nearly 90% of our cases a stenosis of the subclavian artery confirmed the clinical diagnosis. All patients underwent TOS-surgery via a small single supraclavicular incision and recovered from their symptoms.

Discussion: In our series we did base the indication for TOS surgery not only on clinical examination but also on objective findings, either the presence of a cervical rib and/or positive electroneurographic findings and/or a stenosis of the subclavian artery. The MR- angiography was the most significant investigation to objectify the clinical findings. The presented investigation setup seems to be appropriate to objectively diagnose TOS and indicate surgery. The small supraclavicular incision gave adequate access to perform neurolysis of the brachial plexus, scalenotomy and resection of cervical or first rib without major complications in all cases.

Additionally an objective assessment was performed



FP238

Suprascapular neuropathy. Management and outcome of 25 surgical suprascapular entrapments

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Entrapment neuropathy of the suprascapular nerve is a relatively rare cause of shoulder pain and weakness. Four principal forms are recognized: post traumatic, a cyst compressing the nerve, in athletes involved in overhead sports and neuritis (Parsonage Turner syndrome). We present a series of 25 operated cases discussing presenting symptoms, operative findings and follow-up. Each of the 4 etiologies are included in the series. A review of the literature is also presented.



FP239

Anatomical study and clinical observation of thoracic outlet syndrome

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Objective: To investigate the etiology of thoracic outlet syndrome (TOS) from the point of anatomical and clinical view.

Methods: Anatomical study was made on both sides of 30 cadavers. The minimus scalene muscle and the insertions of anterior and middle scalene muscle were dissected and observed Clinically, 45 cases of thoracic outlet syndrome (TOS) were treated and followed up.

Result s: The minimus scalene muscle was found in 88. 3 % of the cadavers. T1 nerve root or the lower trunk of brachial plexus crossed the first rib just over the proximal tendinous part of minimus scalene muscle. Of 45 cases of TOS 34 presented neck-shoulder-pain, 17 had Unchanged symptoms postoperatively, and 7 had aggravated symptoms. Of the recent 8 cases of TOS, 7 presented neck-shoulder-pain. However, the symptom remained in only case after the resection of the tendinous tissue around 5, 6 nerve root from anterior and middle scalene muscle.

Conclusion: The tendinous tissue of minimus muscle is the cause of the compression of T1 nerve root or the lower trunk of the brachial plexus. The crossed tendinous origins from the anterior and posterior tubercle of C4, 5 transverse process is the cause of the compression of C5, 6 nerve root or the upper trunk of brachial plexus.

Key words: Thoracic outlet syndrome, Anatomy, regional, Clinical studies



FP240

Hourglass-like constrictions of the anterior interosseous nerve

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Purpose: The suspected cause of spontaneous anterior interosseous nerve (AIN) palsy has been reported as neuralgic amyotrophy, isolated neuritis or as entrapment neuropathy. Recently, an hourglass-like fascicular constriction of AIN within the main trunk of the median nerve was reported after interfascicular neurolysis without any entrapments. The purpose of this study was to analyze 25 cases of operated AIN paralysis.

Method s: Twenty-five patients were studied. Their average age was 43.7 years old. At the operation, the median nerve was explored from 10 cm above the elbow to the arcade of flexor digitorum superficialis. Then, interfascicular neurolysis in the AIN fasciculi was performed within the main trunk of the median nerve under the microscopy. The operative findings and the post-operative recovery were analyzed.

Result: Twenty-four cases experienced a strong pain through the shoulder girdle to the forearm prior to the onset. None of the patients showed external compression on exploration. Twenty-four cases had 1 to 4 hourglass-like fascicular constrictions in the fascicles of the AIN within the median nerve. The constrictions were discovered from 0 to 7.5 cm above the elbow. All the patients had regained muscle strength of at least MRC grade 3 and 8 had MRC grade 5 of both flexor pollicis longus (FPL) and flexor digitorum profundus of the index. The average period for the contraction of FPL was 5.3 months and there was a significant correlation between the periods from onset and the recovery of FPL.

Conclusion: In 25 patients, there was no external compression and all except for one had hourglass-like constriction. Our result also indicated that operation in the early period of onset leads to faster recovery.



FP241

Carpal tunnel and cubital tunnel in HNPP: Diagnosis and treatment strategy

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Hereditary neuropathy with liability to pressure palsies (HNPP) is an autosomal dominant disease characterized by recurrent isolated acute peripheral nerve palsies with nerve conduction slowing at usual compression sites (carpal tunnel, Guyon's tunnel, cubital tunnel at the upper limb), which are precipitated by pressure or slight trauma. Electrophysiological studies show decreased motor and sensory conduction velocities. In nerve biopsies focal thickening of myelin sheath, also called tomacula, is observed. 1.5 Mb deletion on 17p11.2 chromosome is detected in approximately 85% of HNPP cases.

Materials and methods: We describe a case of 40-years old woman who had a several months history of bilateral carpal tunnel syndrome associated with ulnar compression on the right elbow. She was diagnosed by neurologic and neurophysiologic examination supported by genetic testing (southern blotting and pulsed field gel electrophoresis). The treatment consisted of the decompression at the wrist (both the carpal tunnel and Guyon's tunnel) and at the elbow. The surgical theatre was characterized by abundance of fat cells and a tough ligament. No biopsies were carried out. Clinical improvement with decrease of pain and paraesthesiae followed the treatment.

Discussion and conclusion: The prevalence of HNPP is actually 2-5/100.000 but it might be underestimated. This is the reason why we would propose a selection of all the patients treated in the last 5 years for carpal tunnel, Guyon's tunnel and cubital tunnel with family anamnesis for entrapment neuropathies to send to genetic analysis.



FP242

Stem fixation of the MOPYC radial head prosthesis

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Purpose of the study: The aim of this study was to evaluate the fixation of the stem of the Radial Head MoPyC prosthesis. This implant combines a pyrocarbon head and a titanium stem using an expansion screw device for the primary fixation and microporous titanium for the secondary fixation by osteointegration. A previous review series reported 2 cases of bone resorption under the neck out of 20 cases with 97% of excellent and good results (MEPS score). This present paper based on 40 cases studies the radiological bone resorption under the neck and compares it to clinical results.

Materials and methods: It is a retrospective multicentric study based on 40 cases.

The surgeons were asked to fill a form « on-line » and to send the last digitalized x ray. We obtained 40 cases with an average time of implantation of 27 months.

All the prosthesis had been implanted for more than one year.

Results: We found a rate of 13.5% of radiological bone resorption under the neck. This resorption increases up to the 8 th month and then was stabilized. The average resorption was 5 mm (1 to 8 mm). There was no clinical outcome. There was no statistically significant difference between the resorption group and the non resorption group. There was no breakage of the stem. As in the previous series, there was a 97% rate of good and excellent results at the MEPS Score.

Conclusion: The bone resorption under the neck of the prosthesis is secondary to the rigidity of the stem just below the neck, combined with its strong fixation, creating a by-pass of the forces applied on the neck of the radius. It has no incidence on the clinical results and function of the prosthesis at this time of the follow-up. It has to be confirmed with a long term and larger study.



FP243

Single incision repair with suture anchors for treatment of distal biceps tendon rupture: A 59 cases follow up

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We describe the results of 59 patients who underwent treatment for acute distal biceps tendon rupture using a single incision and suture anchors. The purpose of the study is to evaluate if this method is reliable and if it can reduce the risk of ectopic bone formation or synostosis.

Methods: 59 patients underwent surgical repair for acute rupture of the distal biceps tendon, using suture anchors and a single incision. Our operative technique consisted of an "S"-shaped anterior incision centered over the antecubital fossa. We exposed and mobilized the ruptured biceps tendon. The distal portion of the tendon was debrided and the radial tuberosity gently decorticated. A 4 stranded suture was then inserted into the tuberosity. The tendon was advanced to bone and the sutures were tied using the modification of Kessler's technique, holding the elbow in 90° of flexion.

Results: All acute tears were repaired anatomically. The follow-up period was 39 months. Objective data consisted of ROM (range of motion) of the elbow, flexion and supination strength were measured by a BTE Work Stimulator. The ROM was normal in 49 patients, 10 patients lacked 10° of extension. 51 patients returned to their pre-injury level of activity and within 6 months returned to work. All patients reported pain relief and good recovery of strength. There were no implant failures, nerve palsies or heterotopic bone formation.

Conclusions: Use of a single incision repair with bone suture anchors provides secure fixation of distal biceps tendon with minimal volar dissection which is associated with a minimum risk of synostosis and posterior interosseous nerve injuries. The advantages of this method are less dissection for re-attachment of the tendon, less nerve injuries and no ectopic bone formation or synostosis.



FP244

Surgical treatment of post-traumatic flexion limitation of the elbow

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We analyzed the causative lesions of the post-traumatic flexion limitation of the elbow and suggest the proper operative technique. Among patients who had undergone surgical release for post-traumatic stiff elbow between 1997 and 2005, fifty-seven patients with less than 100 degrees of elbow flexion were included. Mean age was 37.7 years (range; 14-69). The average arc of motion was 84 degrees of flexion (range: 40-100) and 36 degrees of extension (range: 10-70). Successful healing of the initial injuries was confirmed on the radiographs in all patients. The presence of heterotopic ossification (HO) on the plain radiographs were classified into 3 categories; definite, suspicious and not observed. In all patients, posterior release was attempted first, and if necessary, anterior impingement that prevented full flexion were excised. Main lesions causing flexion limitation were investigated during operation, particularly the existence and pattern of HO. Preoperative radiographs demonstrated definite HO in 23 patients and suspicious one in 17 patients. The presence of HO was confirmed during the operation, which always involved the posterior band of medial collateral ligament (MCL) in patients who had showed definite or suspicious heterotopic bone on the preoperative radiographs, and in 8 patients who had no evidence of ossification preoperatively. In overall, HO causing limitation of flexion was found in 84.2%. Greater than 130 degrees of flexion was achieved by posterior release including resection of the posterior band of MCL except 7 patients who required debridement of anterior impingement associated with HO or callus formation. Average arc of flexion at more than 9 months after operation was 121 degrees (range, 90-140). Heterotopic ossification should be considered as a highly related causative lesion of post-traumatic flexion limitation of the elbow. During the operation, posterior release including resection of the posterior band of MCL is mandatory to achieve maximum flexion. including resection of the posterior band of MCL is mandatory to achieve maximum flexion.



FP245

Elbow reconstruction using dynamic external fixation

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Introduction: Deformities of the elbow represent unfortunate conditions. Surgical correction often is not recommended due to high risks. Immobilisation by cast is common to all correctional osteotomies and to a certain amount responsible for the low outcome of the surgical procedures. Replacing the cast by dynamic external fixation offers a new concept to overcome this problem.

Patients and Methods: From 2002 to 2006 16 patients aging from 5 to 40 years (mean 16) were treated surgically for elbow problems. Patients suffered from congenital radial head luxation (2), multiple exostoses disease (4), luxation of congenitally deformed elbows (4), posttraumatic deformities (5) and pseudarthrosis (1). All showed either/and/or increasing pain or deformity or decreasing ROM. The surgical concept consisted of two steps: first open correction of all deformities in order to achieve a stable joint at full ROM. Second: application of a dynamic external fixateur (ORTHOFIX) to achieve mild distraction of the elbow joint and to allow early unloaded and guided movement. Remobilisation was started a few days after surgery. The fixateur was left in place for 8 weeks (pseudarthrosis 16). After that a splint was applied during night until full bony consolidation was achieved.

Results: Intraoperatively in all cases full ROM of the elbow with respect to the disease was restored. With the external fixateur the patients reached full extension and flexion up to 120 ° , nearly full pronation and about 20-40 ° supination. After removal of the device all patients achieved the intraoperatively gained result. Major complications were not observed. The results were kept during 1 to 4 years after surgery.

Discussion: Of course external fixation is not essential for early mobilisation, but in our opinion it is worthwhile to unload the joint and to have guidance during motion. The good initial results encourage us to continue with this concept.



FP246

Hinged elbow fixation for instability following complex elbow injuries

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Purpose: The purpose of this study was to evaluate the use of a hinged external fixator of the elbow in the management of instability after fracture dislocation.

Materials and Methods: We retrospectively reviewed results of 12 patients treated with a hinged external fixator between 2004 and 2005. There were 9 men and 3 women, and mean age was 49(36~61) years. We treated 7 cases elbow fracture dislocation associated with radial head fracture and coronoid fracture using transradial head approach, and 5 cases elbow dislocation associated with medial collateral and lateral ulnar collateral ligament rupture using pull out suture. Time delay from injury to treatment was 12.4(2~27) days. The indication for use of hinged external fixator was instability following fracture fixation or ligament repair. Early mobilization was carried out postoperative 4 days. We removed external fixator at 6(5~7) weeks. For functional evaluation, Mayor Elbow Performance index was analyzed.

Results: Three patients were type 2, and 4 patients type 3 coronoid fractures with comminution. Four patients were MCL and LUCL rupture, and 1 patients LUCL rupture. At follow-up, patients maintained an average total arc of motion 112 o, average flexion contracture 13 o, average further flexion 125 o. The average score on Mayor Elbow Performance score was 89(65~100) with 4 excellent and 5 good cases. One patient developed asymptomatic coronoid nonunion.

Conclusion: When stability following fracture fixation or ligament repair is not rigid, hinged external fixator has provided satisfactory results.

Key Words: elbow, fracture dislocation, hinged external fixator

Davis SR 2001



FP247

Early stabilization with collateral ligament repair in dislocation of the elbow joint may acquire valgus stability and improve functional results

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Purpose: Recent literature reported an association with a worse outcome and valgus laxity in elbow fracture and dislocation. We primarily repaired the UCL and evaluated the residual valgus laxity and the functional results.

Methods: After close reduction elbow stability was checked under full ROM including valgus/varus stability at 30°~45° flexion. We defined valgus instability as following cases; no firm end point with valgus stress test and redislocation/subluxation occurred. The avulsed UCL was reattached using a bone anchor or bone tunnel with fixing of small coronoid fractures (6 cases) in 15 patients. After immobilization for 7~10 days active ROM exercise started without restriction. Patients were assessed for redislocation, pain, valgus stability, ROM, and functional disability using the Mayo elbow performance score (MEPS) at an average of 21.6 months. Ulnar nerve symptom and ectopic ossification were also investigated.

Results: No elbows redislocated post-operatively. No patient complained of pain with manual valgus stress. In 9 cases of valgus stress radiograph, medial gapping was less than 1mm in 8 cases except one case (1.3mm), suggesting well-functioning of the repaired UCL. All acquired functional ROM. Mean extension was 4.1°, flexion 134.7°, pronation 77.5°, supination 78.8°. Mean MEPS was 94.4. Ulnar nerve symptom was found in one patient postoperatively but disappeared within 12 weeks. Ectopic ossification was found in 75% of the patients.

Conclusion: Primary repair of the UCL in acute elbow dislocations may permit full ROM exercise in early postoperative period and lead to improved functional results. It also may reduce valgus laxity and prevent posttraumatic arthrosis.

Reference: D.Eyngendal 2000



FP248

Early operative stabilization and mobilization for unstable elbow dislocations

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Purpose : Dislocation of the elbow is the second most common dislocation in the upper extremity. Although most have recommended closed reduction followed by a short period of immobilization for simple dislocation, primary surgical repair of the ligaments are recommended in the unstable dislocation. A retrospective study of early operative treatment of unstable elbow dislocations is reported.

Methods : We present the early results of 32 such injuries including 13 terrible triads of the elbow and 19 unstable elbows. Surgical indications of the unstable elbow were subluxation or non-congruent elbow joint on the radiographs following closed reduction and those which required extension block splint more than 30-45 degrees to maintain reduction. The avulsed lateral collateral ligament complex and medial collateral ligament were repaired and coronoid, radial head fractures were fixed with screw and plate. In the nine unstable dislocations, full stability was only restored when the medial and lateral collateral ligaments were reattached. Mobilization without a hinged fixator was allowed from day three to seven.

Results : No elbows redislocated post-operatively and two patients complained of instability. Two failed to gain functional range of motion and six patients presented ulnar nerve symptoms postoperatively. Ectopic ossification was found in 63% of the patients. Mean extension was 15° (10° - 30°), flexion 130° (120° - 140°), pronation 70° (50° - 90°), supination 80° (75° - 90°). Mean MEPS was 89.0 (75 - 100).

Conclusion : Early stabilization of unstable elbow dislocations, including the terrible triad, prevents the poor results which are commonly found following non-operative treatment of these injuries and a hinged external fixator is not usually required in the acute setting.



FP249

Osteoarthritis of the elbow with ulnar neuropathy;Outerbridge-Kashiwagi procedure through posteromedial approach

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Purpose: Elbow osteoarthritis with ulnar neuropathy was treated with modified posteromedial approach, for decompression/transposition of the ulnar nerve and an Outerbridge- Kashiwagi procedure simultaneously. The clinical results with the operative technique are reported.

Materials and Methods: Twenty-five patients with primary osteoarthritis of the elbow with ulnar neuropathy underwent this operation. The average age of the patients was 51, and there were 18 male and 2 female. There were 15 manual workers and five were related to workers ' compensation. The ulnar neuropathy was evaluated by the McGowan grading; 3 grade I, 6 grade II and 11 grade III. Using extensile medial approach, both anterior and posterior compartments were exposed and osteophytes were removed from coronoid and olecranon. Fenestration of olecranon fossa into coronoid fossa was made after retracting the triceps muscle.

Results: The pain score improved in all patients, with the exception of in three who had same amount of pain after operation. The ulnar nerve symptoms were improved in all patients; 3 McGowan grade I, 11 grade II and 6 grade III, postoperatively. The average range of motion improved from 22.5 ° -124 ° to 11.5 ° -132.5 ° . No surgical complications were recorded.

Conclusion: A modified posteromedial approach is an effective method for both ulnar nerve decompression and fenestration of olecranon fossa. It provided satisfactory functional outcome with minimal morbidity.



FP250

Revision total elbow arthroplasty: Preliminary results

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Total elbow arthroplasty has become routine surgery with successful outcome for rheumatoid, posttraumatic or idiopathic elbow arthritis. Loosening in long time surviving patients with subsequent fractures and destructive metallosis in unconstrained elbow arthroplasty has made revision arthroplasty necessary.

Between July 2004 and February 2006, 13 patients underwent revision elbow arthroplasty by the presenting author. Indications were loosening (12), periprosthetic fracture (4), destructive metallosis (6) and gross instability (1). All patients had a dysfunctional painful elbow joint. There were 10 female and 3 male patients. Mean age was 68 years (41-80y) at the time of revision surgery. The semi-constrained Coonrad-Morrey elbow prosthesis was used and strut allografts were combined in 7 cases due to fractures of the humerus or severe bone loss due to metallosis. In two cases a staged reconstruction was performed with a six weeks interval during which intravenous antibiotics were given, due to skin perforation as a consequence to metallosis and probable preoperative infection. Preliminary outcome was evaluated with a mean follow up of 19 months (12-30 m) using DASH score and Mayo Elbow Score.

Postoperative evolution and wound healing were uneventful in all cases. In one case there was a humeral perforation of the tip of the prosthesis with a temporary radial nerve palsy but complete recovery in 6 weeks. In 6 patients preoperative partial ulnar nerve palsy remained unaltered. In 2 patients a triceps insufficiency was present and operated on in one patient by use of a V-Y triceps reconstruction, with an excellent result. All patients were satisfied and showed a painless, mobile and stable elbow.

Although challenging surgical techniques are often needed, total elbow revision arthroplasty is a viable operation technique in failed elbow prosthesis.

(Willems, De Smet, JSES 2004; Kamineni, Morrey JBJS 2004)



FP251

Regulation of PIP joint stiffness by intrinsic muscles via MCP joint position

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The tightness of intrinsic hand muscles is a common cause of finger joint stiffness. The purposes of this study were (1) to develop a robot-assisted methodology to obtain torque-angle data of a finger joint, and (2) to investigate the regulation of the intrinsic muscles on finger joint stiffness. Our robot system features the integration of a low payload robot arm, a controller, a force/torque transducer, a robot programs in the controller, and a program in an external personal computer. The system provided highly reproducible torque-angle curves. Torque-angle data of the proximal interphalangeal joint with the metacarpophalangeal joint at 0 and 60 degrees were obtained from eight asymptomatic hands. The torque-angle curve shifted with varying position of the metacarpophalangeal joint. As the metacarpophalangeal joint flexion angle changed from 60 to 0 degrees, the equilibrium of the proximal interphalangeal joint increased more than 20 degrees, and joint stiffness increased more than 50%. The dependence of the stiffness of the proximal interphalangeal joint on metacarpophalangeal joint position supports the regulatory role of the intrinsic muscles on finger joint mechanics. This regulatory mechanics is likely amplified in hands with intrinsic muscle tightness, justifying the commonly used Bunnell Intrinsic Tightness Test.



FP252

The importance of the volar recess in PIP joint stiffness - An anatomical and clinical study with a 7 year follow up

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Purpose: Post Traumatic PIP contracture is a disabling complication. We hypothesized that PIP joint stiffness is initiated by intracapsular adhesions in the volar recess of the joint hinders the gliding of the volar plate. Based on our anatomical study we devised a minimal access surgical procedure to release these adhesions and presented the successful outcome. The aim of this study is to revisit the anatomy and surgical procedure and evaluate the long term outcome of this procedure.

Methodology: 40 PIP joints in 40 consecutive patients underwent release of the intracapsular adhesions of the volar recess followed by early intensive regime of hand therapy. All joints were treated for post traumatic joint stiffness 18.4 weeks from the time of injury. 50% were manual workers. Patients were followed up regularly and flexion measured and analysed statistically. The first 10 patients have been followed up for 7 years and the others ranging from 2 – 6 years.

Results: All patients gained an additional 20 degrees of flexion ($p < 0.001$) after the procedure. This gain in flexion was maintained consistently throughout the post op follow up period.

Conclusion: The initial gain in flexion in a Stiff PIP joint following the surgical procedure is consistently maintained during long term follow up. This validates our hypothesis and makes a strong case to be proactive in treating PIP joint stiffness using the method described.



FP253

The treatment of post-traumatic flexion stiffness of the long fingers with a new external fixation system

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Introduction: We have treated 11 patients (5 females and 6 males), average age 27 (youngest 14yo, oldest 45yo), with post-traumatic stiffness of the long fingers (flexion). Three patients had had multidigital replantation, four presented flexor tendon injury, and the others had scarring retractions secondary to finger injuries, without tendon lesion.

The deformity ranged between 70 and 110 degrees in flexion, and all patients had already followed an intensive rehabilitation program.

Material and methods: An external Smart fixator was applied in all cases, and gradual distraction began on Day 2, with a daily 5-degree increase over twenty days. Full extension was obtained in all patients, however in four cases stiffness reoccurred two months after fixator removal. In one case we had psychological refusal of the device, and the fixator was removed on Day 7.

Six patients recuperated 100% of the ROM.

Conclusions: The mini-invasive Smart system allows closed, gradual, and satisfactory resolution of joint stiffness, while preserving the soft tissue.



FP254

Two-stage reconstruction of finger extension for chronic flexion deformity of the finger

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Introduction: Treatment for chronic flexion deformity of the finger is difficult, because this deformity is sometimes due to the combined troubles of osteochondral structure and tendon excursion. These include several problems such as joint contracture, power source of lateral band, tendon excursion, and so on. Even after improvement of bony structure, adhesion or insufficiency of extensor tendons including lateral bands disturbs the finger function because excursion of intrinsic muscles is very delicate. We tried 2-staged EIP tendon transfer with tendon graft for those patients to obtain good function.

Materials and Methods: Four post-traumatic and one congenital cases (three adults and two boys) were operated with this concept. At first operation, release of joint contracture (MPj, PIPj and DIPj), tenolysis of flexor tendon and placement of silicone tendon spacer on the dorsal extensor attachment of PIP or DIP joint were performed. The tendon spacer was placed along the lateral band, below the transverse metacarpal ligament and again dorsal side of the wrist near the EIP tendon. After the first operation, aggressive physiotherapy was applied to obtain good active flexion and passive extension. Three months after the operation, the second procedure was performed. Silicone spacer was replaced by the palmaris longus tendon graft and transferred to the EIP proximally.

Results: All patients improved active extension of PIP or DIP joint with minimum joint contracture. Nearly normal function and appearance was regained in three posttraumatic cases and much improved in other two cases.

Discussion and Conclusion: Fowler's procedure is one of the principal methods, however we are sometimes encountered by extension contracture of the operated finger because of adhesion of the reconstructed tendon. Our procedure was complicated but reliable because adhesion of reconstructed lateral band was minimum and tendon excursion was good enough.



FP255

Management of the central extensor tendon in the surgical approach for exposure of the proximal interphalangeal joint: A biomechanical study

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Purpose: Since 1966 silicone implant arthroplasty has been used to treat arthritis of the PIP joint as an alternative to fusion. The volar approach to expose this joint spares the extensor mechanism at the cost of increased risk to neurovascular structures. In the dorsal approach, the extensor mechanism must be carefully handled, reattached and then protected during rehabilitation. Several surgical techniques have been used to handle the extensor mechanism. Swanson et al. recommended midline incision of the central tendon followed by release of the lateral insertion on the middle phalanx and then reattachment to the base of the middle phalanx. Our clinical experience led us to a new surgical technique; splitting then repairing the extensor mechanism without bone reattachment as recommended by Swanson. The purpose of this study was to biomechanically compare strength and function of this technique with that of Swanson.

Methods: Four pairs of fresh-frozen cadaveric hands were used. The index, long and ring finger were harvested for testing. Twelve digits (3 digits x 4 hands) were designated as control and were used to measure the fixation strength of Swanson's procedure. The other 12 digits of the paired hands were designated as experimental and were used to measure the fixation strength of the proposed new technique.

Results: The fixation strength mean \pm SD were 4.74 ± 0.46 N/mm for the control group and 4.62 ± 0.30 for the experimental group. The results were not statistically different, $p=0.45$.

Discussion: The simple repair of the central slip without the bone reattachment preserves the function of the extensor mechanism on the PIP joint. In our clinical cases we haven't noticed any increase in the incidence of extensor lag or boutonnière deformity as a result of that. This technique can also be applied for fracture fixation in the area.



FP256

Treatment of severe post-traumatic extension contracture of the metacarpophalangeal joints of the hand by arthrolysis

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Introduction: Arthrolysis has been used to mobilize stiff MP joint, but the result is not usually successful. The aim of this paper is to report our experience with arthrolysis for extension contracture of the MP joints in fingers and discuss what makes the result to be successful.

Materials and Methods: We performed arthrolysis in 25 extension contracted MP joints of 5 males and 2 females aged 31-68 years. The etiology was electrical burn in 3 patients, flame burn in one, Colles' fracture in one, hot press injury in one, multiple metacarpal fracture in one patient. Among the 7 patients, all MP joints was involved in 4 patients, and two MP joints was involved in 3 patients. We performed arthrolysis by dorsal approach to MP joint, longitudinal incision on extensor tendon, dorsal capsule release, articular surface release up to volar pouch, and collateral ligament release or extensor tenolysis if necessary. After 3 days of postoperative immobilization, the patients was encouraged to flex the fingers with night time splintage for three months.

Result: Active range of motion was increased from preoperative average 23 ° to postoperative average 59.7 ° . In 5 successful patients, the increased range of motion was average 44.5 ° . In 2 failed patients, the gain in range of motion was average 12.7 ° . The failed group had many problems that deteriorate the hand function, such as, severely damaged muscle and tendon, poor skin coverage and destroyed joint.

Conclusion: Arthrolysis procedure requires good skin coverage, structural continuity and functional capacity of flexor and extensor tendons, and preserved joints. If the prerequisite is prepared, then good functional result can be achieved.

Reference: V. Leroy Young, 1978.



FP258

Severe Dupuytren's contracture treated by a two stage technique: A pilot study

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Severe Dupuytren's contracture (>70 o deformity) of the PIP joint is often treated primarily by amputation. We aim to validate a 2-stage technique to correct the deformity.

We treated 30 fingers in 28 patients with Dupuytren's contracture of the PIP joint with more than 70 o flexion deformity. The first stage involved use of an external fixator with continuous distraction and physiotherapy to enable correction of the deformity over a 4 week period. The second stage involved an open palm technique of fasciectomy for the contracted bands restricting MCPJ movement and dermofasciectomy with full thickness skin grafting over the proximal phalanx for bands restricting PIPJ movement. The external fixator was used to maintain distraction until the graft wound healed. It was removed in the outpatient clinic 2 weeks after the second stage procedure. Patients were followed up with clinical measurement of residual PIPJ deformity and radiographic evaluation (Kellgren/Lawrence Scale) for OA changes at the PIPJ. Complications were also recorded. Mean follow up was 22.7 months

Results were assessed based on Tubiana's staging of Dupuytren's contracture. This technique was effective with excellent results (0-20 o) in 30.0% (n=9) fingers, good results (21 o – 40 o) in 36.7% (n=11), fair results (41 o – 60 o) in 26.7% (n=8) and poor results (> 60 o) in 6.7% (n=2) fingers. There were 6 cases of pin site infections and one case each of loose pins, OA at the PIPJ, and disease recurrence needing PIPJ fusion.

We conclude that our simple two stage procedure can successfully be applied in severe Dupuytren's PIPJ contractures.



FP259

The use of CMMS (casting motion to mobilise stiffness) to regain digital flexion following Dupuytren's fasciectomy

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A principle priority of hand therapy following Dupuytren's Fasciectomy is to maintain extension of the proximal interphalangeal joint. Historically this has been achieved through the application of mechanical stress to the affected digit with splinting and exercise. However, loss of digital flexion in both the operated and non-operated digits is a common complication of this procedure.

This case series report demonstrates the effectiveness of prioritizing tissue nutrition over joint motion in the early stages of wound healing, followed by a brief period of casting in order to regain the normal pattern of digital flexion.

Four patients who underwent a Dupuytren's Fasciectomy and presented with generalised stiffness and swelling of the operated hand were treated with traditional therapy, which was ineffective. The CMMS technique was therefore applied. The type of casts that were applied, the duration of casting, duration of sessions and cast exercises is described.

The outcomes indicate that all patients regained a normal pattern of digital flexion with an improved scar condition. The use of the CMMS technique is beneficial as it promotes the release of joint tightness and tissue adherence so that tissue elongation can be regained and joint motion restored.



FP260

Prioritizing extension following injury about the PIP joint

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This paper will advocate prioritizing extension over flexion at the PIP joint following injury in the area encompassing the proximal and middle phalanx-- extensor zones III and IV. Too often, clinicians make PIP flexion the focus of treatment following injuries at this level. Whether the injury involves bone, soft tissue or both, the restoration of first passive extension and then active must be number one in the mind of the clinician. As W Burkhalter (1991) reminds us "it is far easier to gain flexion than extension at the PIP." The window of opportunity, with respect to time post injury or surgery, for restoring extension is narrow while for flexion it is wide. The presence of an extensor lag rapidly becomes a fixed flexion contracture (SM Page and PJ Stern 1998). Without coordinated treatment of the entire extensor system, the injured finger, and often the adjacent fingers will suffer an irreversible imbalance that leads to contracture and decreased hand function. (Hardy 2004, Chinchalkar 2003) This paper will present the case for prioritizing extension. It will outline a comprehensive approach including early protected motion (Evans & Thompson 1992), joint blocking exercises, splinting and scar modification techniques that have demonstrated effectiveness for restoring functional extension and finger balance post injury.



FP261

Validity of the active movement scale: An evaluative tool for infants with obstetrical brachial plexus palsy

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Introduction: The Active Movement Scale (AMS) is an evaluative tool that was developed to quantify movement in the upper extremities of infants and children with obstetrical brachial plexus palsy (OBPP). The purpose of this study was to explore aspects of validity of the AMS.

Method: A chain-block study design, using 10 raters was used to examine the AMS scores of 15 upper extremity movements in 10 children under the age of 1 year with OBPP. Each child received 3 assessments by 2 raters to produce a total of 30 evaluations. Post hoc principal component factor analysis of the data was conducted to determine if there was a score-based effect underlying the instrument. A correlation matrix of the scores was developed using a varimax rotation to convert the AMS measures to standard scores. A scree plot was constructed from this matrix using the Eigenvalue test to determine the number of factors that were underlying the 15 items of the scale.

Summary: Inspection of the scree plot revealed that there were two factors underlying the 15 items of the scale. By examining the correlation matrix, it was evident that 5 of the movements loaded onto factor 1 when a critical value of 0.5 was used to divide the factors. The five movements when compared with a nerve root contribution chart, were all noted to originate from root levels C5, C6, ± C7 which in-turn corresponds to the definition of an upper root lesion.

Conclusion: Post hoc factor analysis of the results identified two patterns of injury that were associated with AMS scores. Matching the physical classification of injury in OBPP with a pattern of scores provides a strong argument for content validity of the AMS.



FP262

The development of a multimedia teaching aid for the active movement scale: An evaluative tool for infants and children with obstetrical brachial plexus palsy

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Introduction: The Active Movement Scale (AMS) is a valid and reliable tool developed to quantify movement in the upper extremities of infants and children with obstetrical brachial plexus palsy (OBPP). The purpose of this project was to produce a teaching aid for healthcare professionals who wish to use the AMS evaluation process.

Method: A joint venture between the Biomedical Communications at the University of Toronto and the Division of Plastic Surgery at the Hospital for Sick Children (HSC) led to a collaborative partnership between a Masters student and the Brachial Plexus Clinic team at HSC. This facilitated contribution from medical, clinical and biomedical experts in the development of a multimedia teaching tool which demonstrates the AMS. The use of DVD-formatted, video footage was believed to be the best tool to promote learning of this evaluative process. A computer animated model was proposed to represent scenes that could not be accurately captured on video. A manual of written information was planned to further aid in the dissemination of information.

Results: A DVD has been produced that features the examination and grading of four infants and children with varying degrees of upper extremity weakness using the AMS. Included is an animated model of an infant that precisely features the dynamic aspects of evaluating each of the 15 movements graded in the upper extremity. A written manual has also been created to accompany the DVD.

Conclusion: A mutually beneficial collaboration between a Masters student and clinicians has resulted in the creation of an educational aid of the administration of the Active Movement Scale. A four minute excerpt from the DVD will be shown to highlight aspects of this multimedia teaching approach.



FP263

Evaluated limb shortening in obstetrical brachial plexus palsy

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Introduction: Purpose of this study would be the answer of this question that how much early microscopic brachial plexus surgery will be effective in preventing upper limb shortening which ultimately leads to normal motion of shoulder and good functioning of the upper extremity.

Methods: We evaluated 55 patients for about 10 years. In 25 patients recovery of the biceps is not observed by 3 months of age and we had operated and called operated group. In 30 patients recovery of the biceps is not observed by 3 months of age, they didn't accepted microscopic brachial plexus surgery and these patients were called non operated group. Data regarding, age, sex, length of the upper extremity of the normal and affected limbs. Muscle function were assessed by using Mallet score and data analyzed by two statistical soft wares.

Finding: The most common type of palsy was (Erb's) palsy and the most common surgical procedure was nerve graft. The mean range of shortening of the upper extremity in non operated group was 3 to 15cm (mean: 10cm), but patients with microscopic brachial plexus surgery was 0-3cm with (mean of 1cm) chi-square showed good results for limb shortening and function of shoulder and elbow in operated group as comparing with non operated group.

Conclusion: The tendon transfer surgery leads to limited function of involved limb and as it is done in some stages it could not prevent the occurred disabilities especially in adults. In our suggested method the disability treated rapidly in cases, it prevents limb's shortening also the rate of recovery is high as the operation was done in one stage.

References: Barry G Chow L.2000, Xuj Cheng. 2000 Key Spj. 1998, Gilbert A. 1997, Grossman Ja. 1998, Clark 1996



FP264

Value of neuropathological examination in brachial plexus surgery

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Introduction: In our 10 year experience with brachial plexus surgery, we always use frozen sections for intraoperative neuropathological examination on proximal and distal nerve stumps. We present the technique and actual refinements and the specific information this diagnosis delivers.

Material and Methods: Our clinical activity from 1996 until 2006 includes about 200 brachial plexus surgeries, 80 per cent of our patients are children. In every microsurgical reconstruction including intraplexic repair using autologous sural nerve grafts, we examine nerve stumps using frozen sections. Transport to the laboratory of the specimens takes 20´, conditioning and examination another 20´. Within this time the reconstructive surgeons harvest the sural nerve. Two techniques are used: initially fast frozen sections, stained with hematoxyline and eosine (HE) and postoperative semithin sections after epoxy resin embedding of the specimen, stained with toluidin blue (TB) to control the initial results, and for additional detailed analysis of the myelin sheaths.

Results: We found a good correlation between the macroscopic aspect under the operative microscope and the neuropathological microscopic view. Presence and/or degree of endoneural fibrosis and the possible presence of avulsed ganglion cells, originating from the dorsal root ganglia, are recognized equally by both methods. Patterns of neuromatous reinnervation with presence of many minifascicles and loss of pre-existing nerve fascicle structures sign insufficient stump quality and a high risk of weak reinnervation. Myelin sheaths are better to analyze in postoperative TB staining.

Discussion and conclusion: Our routine protocol using the contribution of intraoperative frozen sections (HE) to ascertain histologic nerve root quality before grafting has been validated by confrontation to operative views and postoperative functional outcome. postoperative microscopical control in more detailed semithin sections a TB staining in semi-thick slices and an ongoing control on postoperative functional outcomes. There is still no reliable and fast method to differentiate proximal motor and sensitive nerve fibers.



FP265

Final results of grafting versus neurolysis in obstetrical brachial plexus palsy

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The objective of this study was to examine the final outcome of interposition nerve grafting versus neurolysis alone in patients with obstetrical brachial plexus palsy.

Patients undergoing primary operative reconstruction of obstetrical brachial plexus palsy in our institution from 1988 to 1998 were eligible for inclusion if they had been followed for four years from surgery. Patients were classified as neurolysis only ($n = 16$) or grafting ($n = 92$) and as Erb's or Total Palsy. The Active Movement Grading Scale (AMS) was used to measure fifteen joint movements. AMS scores were analysed using the Wilcoxon two-sample test. Fisher's exact test was used to compare the proportion of patients achieving a score of Grade 6 or 7. In neurolysis for Erb's Palsy patients at four year follow-up significant improvement was seen for only supination and pronation decreased. In neurolysis for Total Palsy, AMS scores were improved across many joints but only occasionally to the Grade 6 or 7 level. A second analysis examined the proportion of patients achieving a score of Grade 6 or 7 at final follow-up to determine outcomes deemed functionally important. Neurolysis in Erb's Palsy decreased the proportion achieving good function for pronation. Grafting in Erb's Palsy produced significantly more useful function for shoulder movements, elbow flexion, supination and wrist and thumb extension. Neurolysis in Total Palsy showed significant increases in function for shoulder adduction and supination only. Grafting in Total Palsy produced significantly increased proportions of patients with useful function for shoulder movements, elbow flexion, supination, wrist flexion and extension of the wrist, fingers and thumb. Improvements in function produced by neurolysis in Erb's Palsy were not sustained over time. Grafting for both Erb's Palsy and Total Palsy produced significant improvements in AMS scores and significant improvements in the proportion of patients demonstrating functionally useful scores.



FP266

Long term results of patients with obstetric brachial plexus palsy undergoing primary brachial plexus reconstruction at or later than twelve months of age. A retrospective review

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This study was undertaken following the late referral of a patient with obstetric brachial plexus palsy. The aim of this study was to determine the long term out come of patients with C5, C6+/-C7 lesions who underwent primary reconstruction of their brachial plexus at or later than 12 months of age.

Methods: Data was extracted from the recently instituted Royal Children's Hospital Obstetric Brachial plexus database. Entry of data into the data base was undertaken in a retrospective fashion. Parameters extracted from the data base included patient identifying number (ID), type of palsy, surgery (Yes/No), age at surgery (months), the Hospital for Sick Children muscle grading system scores for shoulder abduction and external rotation, elbow flexion and extension, wrist and finger extension at 9, 12, 24, 36, 48 months of age.

Results: Thirteen patients had Erbs type palsy with involvement C5, C6+/- C7. Age at surgery varied from 12 months to 18 month of age (Mean -14.5 months). The majority of the patients demonstrated an improvement or no change in measured muscle scores post operatively at 24,36 or 48 months when compared to preoperative scores for shoulder abduction (92%), external rotation (100%), elbow flexion (92%), elbow extension (92%), wrist extension (83%), finger extension (100%). A greater number of patients demonstrated an improvement in scores for the measured parameters except for elbow flexion where the majority showed no change.

Conclusion: Primary Brachial plexus exploration and reconstruction in this population is still indicated up to the age of 18 months of age. Patients who are referred late should still be considered for primary surgical reconstruction of their brachial plexus with nerve grafts.



FP267

Rationale and technique for suprascapular nerve neurotisation in severe obstetric brachial plexus palsy

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Introduction: The suprascapular nerve (SSCN) is the first motor branch to the upper limb exiting the upper trunk of the brachial plexus and responsible for active lateral rotation (LR) and supporting abduction of the shoulder by innervating the supra- and infraspinatus muscle, thus contributing to the rotational balance of the glenohumeral joint.

In a severe traction injury, SSCN is the first motor nerve to suffer; responsible for reversible or permanent rotational imbalance and progressive bone deformities of the glenohumeral joint.

Material and Methods: In more than 800 children examined between 1996 and 2006, some 150 plexus reconstructions and about 40 elective SSCN neurotisations have been performed. In children older than 2 years, where nerve procedures were inappropriate, shoulder release and tendon/muscle transfers (modified Hoffer transfer) were used to restore the balance and joint congruence.

The typical ventral exploration and the elective dorsal approach to neurotise the SSCN are shown; the donor fascicles come either from the distal branch of the spinal nerve or from the ipsilateral C5 root, without additional graft.

Results: In elective SSCN neurotisation, we got a functional active LR in about 70 percent; results varied from 10 to nearly 90°. Later muscle transfers only occasionally provide such good results, depending on the strength of the transferred latissimus dorsi and teres major muscle and the limb weight.

Discussion and conclusion: we illustrate all aspects of the progressive rotational imbalance and thus the need for careful diagnosis and neurotisation of any severe SSCN lesion.



FP268

What can be performed for the treatment of old, permanent brachial plexus palsy?

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Introduction: Brachial plexus palsy that does not recover within three months is operated on. If the palsy persists more than two years, the nerves of the plexus territory will not recover, and the paralysis is considered permanent. This article is discussing what can be performed with these cases.

Materials and Methods: Since the nerves of the paralyzed side have completely lost their function, the nerves of the contra-lateral side must be used. The transfer of C7 root of the healthy side to the paralyzed region followed by transfer of a suitable muscle as a free flap was suggested in 1994 and was performed for a while. It was found however that the severing of healthy side c7 root reduces muscle force in the territory of brachial plexus, as was noted in the four cases we performed.

The best procedure for the treatment of the condition is the transfer of Medial Pectoral Nerve from the healthy to the paralyzed side by the use of Sural nerve followed by the transfer of gracilis muscle to the arm, neurotized by the transferred Sural nerve one year after the primary operation. Elbow flexion is achieved with the recovery of transferred gracilis muscle.

After complete recovery of elbow flexion, the biceps tendon is transferred to the digits flexors by a fascia bandlet of tensor fascia lata muscle. Fingers flexion is achieved by the contraction of transferred gracilis muscle to the arm region.

Results: This procedure was performed for the first time in Iran. This procedure has been performed on 23 patients, and fingers flexion was attained by the procedure has been satisfactory.

Conclusions: Some functional movement of the paralyzed limb is attained by the transfer of the healthy side pectoral nerve to the paralyzed side, followed by the transfer of gracilis muscle.



FP270

Botulinum toxin A in obstetric brachial plexus palsy

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Since September 2004, 20 children with obstetric brachial plexus palsy have been treated with botulinum toxin A (Botox) injections to assist with the management of contracted muscles and joints as well as co-contraction. The median age at treatment was 2.1 years (range 7 months to 11 years). 80% of the patients were less than 3 ½ years of age. As experience was gained, the total dose of Botox increased from 4 to 10 units per kg.

12 patients were treated primarily for restriction of passive external rotation at the shoulder at an average age of 24 months (range 7 to 42 months). These patients had an ultrasound examination looking for evidence of posterior subluxation at the gleno-humoral joint. This group had the most impressive gains which became apparent within a week of injection. There was a high level of parental satisfaction with an improvement in passive range and increased ease of physiotherapy. Six had excellent and 4 had good results. The two patients who had little improvement had clear indications for surgery. Shoulder subluxation identified by ultrasound should be further imaged with CT or MRI and be considered for an open procedure. Seven (58%) of these 12 patients went on to have a repeat injection , in 2 cases with a higher dose, aiming to achieve further gains.

The 5 patients were treated for co-contraction of the latissimus dorsi and/or teres major were aged 8 months and from 8 to 11 years. They reported minor gains.

All five patients who had triceps injections had improved elbow flexion.

One patient had an over active biceps injected with minor benefit.

It is hoped that persistent physiotherapy assisted by botulinum toxin A injections targeting internal rotators can reduce gleno-humoral joint dysplasia, posterior subluxation and the need for open procedures.



FP271

Influence of core suture geometry on tendon deformation and gap formation in porcine flexor tendons

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Introduction: The standard modified Kessler technique has been the golden standard of flexor tendon surgery. With the changes in post-operative treatment protocols there is a need for stronger repair techniques. However, more information is needed on mode of failure, but also on the effects of core suture geometry on the tendon.

Methods: 41 fresh cadaveric porcine superficial flexor tendons were transected following a specified protocol and repaired using five repair types: Standard Kessler, non-locked corner loops (KN); Standard Kessler, locked corner loops (KL); double Kessler (DK); continuous double Kessler (CK); and the McLarney cruciate repair (ML). The epitendon was omitted because of facilitation of evaluation of gapping and mode of failure. Elongation, stiffness and maximum breaking strength were measured by a digital strain gauge. Mode of failure, gapping and transverse narrowing were recorded on digital video.

Results: At 15N, KL showed most elongation (11.1 mm) and the ML least (6.6 mm). DK elongated significantly less than KN and KL. Stiffness was greatest for ML (2,4N/mm) and worst for KL (1.3 N/mm). At maximum breaking strength, ML gapped more than DK (12.8 mm vs 9.1), but DK failed at lower force (37N vs 46N). Transverse narrowing at maximum breaking strength was 22% and 24% for KN and KL and only 11% for DK, with no measurable transverse narrowing for the ML.

All Kessler type sutures failed by suture failure. The ML failed by pull-out of the suture.

Conclusions: Core suture geometry is a key factor in gap formation, tendon deformation and mode of failure. The transverse part of the Kessler type sutures prevents suture pull-out but allows for gapping and lateral tendon deformation. Shortening the transverse part of the Kessler decreases gapping. However, eliminating the transverse segment, as in the cruciate repair resulted in suture pull-out.



FP272

Differences in resistance to motion of the repaired flexor tendons at different parts of digital flexion

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Purpose: Early mobilization of the repaired flexor tendons is a popular practice, but rupture of the repairs has not been completely avoided. Little is known about differences in resistance to tendon motion at different parts of the digital flexion. We investigated gliding force of the tendon and work of toe flexion within different parts of the digital flexion in a chicken model.

Materials and Methods: Thirty-six long toes of 18 Leghorn chickens were divided into 5 experimental groups and a normal control group. The FDP tendon were cut and repaired with the modified Kessler method. At postoperative 1, 2, 3, 4, and 5 days, gliding force of the tendon and work of toe flexion were evaluated in an Instron machine with the toes pulled from full extension to flexion with a constant tendon excursion. By dividing the flexion ranges into 3 parts, changes in the work and force were separately measured within initial, intermediate, and final portions of toe flexion and were statistically analyzed.

Results: The work of flexion progressively increased from initial to final parts at all 5 days after surgery ($p < 0.05$ or $p < 0.01$). Tendon gliding force was significantly greater in the final range than that in the initial parts ($p < 0.01$). The work and force at the final range were about 5 to 10 times of those at the initial flexion parts. The resistance at the final part was drastic after surgery compared with the toes without surgery.

Discussion: This study suggests that early digital mobilization after tendon repairs should be conducted with great care to the final flexion range to avoid overloading tendons, and ruptures may occur more easily within this critical motion range with digits at marked flexion, because resistance to digital motion goes up sharply with this flexion range.



FP273

Changes in resistance to tendon motion after commencement of digital mobilization at different days

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Purpose: The optimum time to start postoperative mobilization is still controversial. We undertook an *in vivo* study to investigate the changes in resistance to tendon gliding as well as the extent of digital edema after commencement of digital mobilization at different days within the first postoperative week.

Materials and Methods: Fifty long toes of 25 Leghorn chickens were divided into 4 groups according to the days starting postoperative mobilization (1, 3, 5, and 7 days). The FDP tendon were partially cut and repaired. The toes were immobilized, and at different days after surgery, passive toe motion was started. Tendon gliding force and work of toe flexion were evaluated with an Instron machine after mobilization for two days. The edema of the toes was graded according to a scoring criteria created by our group. The force, work, and edema scores were statistically analyzed.

Results: Little differences were found in the force and work of the toes with motion starting at 1, 3, 5, and 7 days. The digital edema peaked in the toes evaluated at day 3 with motion starting at day 1, and subsided at the toes evaluated at postoperative days 5, 7, and 9. Within each time-point, the edema scores correlated with an increase in the force and work, but no correlation was found when edema scores were analyzed against the postoperative days.

Discussion: The results indicate that the resistance to tendon motion at tested time-points does not differ significantly. We found no particular day when the resistance markedly decreases. The findings suggest that early mobilization can start at any days within the early period, and may start as late as at 7 days. For individual digits, severer edema signals an increase in resistance to the motion, this should be considered when deciding how aggressive the motion should be.



FP274

Ruptures of the flexor tendon in athletes

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Purpose: Studies of clinical profiles and postoperative results on ruptures of the flexor tendon in sports are reported.

Methods: We performed surgery on 25 fingers in 24 athletes with ruptures of flexor tendons from 1988 to 2003. The age at the time of surgery was 12-58 years. The duration from injury to surgical treatment ranged from 3 days to 9 months. Tendon advancement was performed in 18 fingers, tendon transplantation in 5, and tendon transfer in 2.

Results: 16 fingers had FDP tendon ruptures at the tendon insertion because of extension occurring when the patient grasped another player in contact sports. 6 had FDP tendon ruptures at the tendon insertion because the patient fell down during a game. 3 fingers had FDP tendon ruptures of the little finger because of the pseudoarthrosis following a fracture of the hook of the hamate bone. Ruptured fingers were 16 ring fingers, 8 little fingers and 1 middle finger. Results were excellent in 19 fingers and good in 6 according to the Buck-Gramcko method, while they were excellent in 11, good in 12, and fair in 2 according to assessment of injured tendon function of the Japanese Society for Surgery of the Hand.

Conclusions: Ruptures of the flexor tendon in sports are mostly FDP tendon ruptures of the ring finger at the tendon insertion. Without bone fragments, the detection of the ruptured area or stump position is especially difficult in patients with an old FDP rupture of the little finger or without awareness of a prior fracture of the hook of the hamate bone. Therefore, the patient must undergo thorough interviewing about the type of sport and past history, etc. before surgery. The detection of pseudoarthrosis following fractures of the hook of the hamate bone using radiography and CT is important.



FP275

Results of immediate re-repair of primary flexor tendon repairs in zones 1 and 2 which have ruptured

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This study reports the outcome of immediate re-repair of ruptured primary flexor tendon repairs in zones 1 and 2 of the fingers. As far as we are aware, it is the largest series on this subject ever presented.

Methods : Medical and hand therapy records between June 1989 and May 2003 were retrospectively examined.

Results: A total of 62 fingers in 61 patients presented within 48 hours of a ruptured flexor tendon repair in zones 1 or 2. Immediate re-repair and rehabilitation were carried out in 44 fingers (71%) in 43 (70%) patients. Thirty-six patients completed the 8 week therapy program after re-repair in 37 fingers. Nine (24%) had excellent, 10 (27%) good, 5 (14%) fair and 13 (35%) had poor results when assessed by the original Strickland method. Five fingers in five patients ruptured the re-repair. Poor results and ruptures of re-repairs were particularly common after re-repair in the little finger.

Conclusions: In the light of these findings, a policy for dealing with ruptured primary flexor tendon repairs in the fingers is proposed as follows: re-repair in the radial 4 digits; if the little finger has an intact strong flexor, do not re-repair as the chance of re-rupture is 20% and of a stiff finger 35%; if the little finger has no intact flexor consider the use of tendon rod/secondary graft.



FP276

One-stage flexor tendon reconstruction using Brunelli active tendon implant: Results at 5 years

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Severe flexor tendon injuries represent a challenge for surgeons: the excessive scar tissue invasion at the site of reconstruction may lead to poor functional results. Tendon implants introduced by Hunter in 1965 as an alternative to the traditional reconstructive techniques have been improved by introduction of other different structural and functional models. We have evaluated the permanent active tendon implant promoted and used by Brunelli from 1979 and utilized in Microsurgery Department of CTO Hospital in Turin since 1994. Twelve severe flexor tendon injuries (3 FLP, 9 FPD) were treated with active tendon implants between 2000 and 2004. The distal end plate, made of titanium, is located into the third phalanx and fixed with a micro-screw placed through the proximal hole, allowing early mobilization of the finger. The proximal end of the implant, made of silicone outer layers and a polyamidic inner layer, was sutured in a "sandwich" fashion to the proximal stump of the flexor motor tendon. All the patients had been subjected to at least 2 previous operations and presented with flexor tendon injury outcomes at no-man's land and poor prognosis (Boyes grade 2-5). Patients have been examined at 2.5 years mean follow-up by objective (Strickland assessment) and subjective evaluation criteria (Quick DASH).

We obtained 2 excellent, 2 good, 4 fair and 4 poor results using Strickland assessment but the overall function of the hand using Quick Dash evaluation was satisfactory in 10 of the 12 patients. One patient developed postoperative infection with wound dehiscence and tendon exposition, another one had rupture of the proximal suture of the implant. In our experience the Brunelli tendon implants are well tolerated and often efficacious, they represent an important alternative and a potentially permanent procedure in the reconstructive flexor tendon surgery when traditional techniques fail .



FP277

The effect of muscle length and excursion on myostatic contracture. A study in rabbit soleus muscles

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Background: If tendon repair is delayed after injury, muscle atrophy and intramuscular fibrosis will cause an irreversible contracted state called as myostatic contracture. This study attempted to determine which factor would be the most protective in delaying myostatic contracture after tendon injury, with respect to muscle length and excursion in a rabbit soleus tenotomy model.

Methods: Forty rabbits underwent tenotomy of the soleus muscles bilaterally and the tendons were managed according to the five experimental groups (N=8). In group A, the soleus tendon was lengthened, thus the muscle-tendon unit was allowed to maintain half of the excursion. By fixing the tendon to the tibia, the maximal muscle length was maintained in group B and the resting muscle length was maintained in group C. In group D, a positive control group, the tendon was allowed to retract proximally and undergo myostatic contracture. In group E, a negative control group, the tendon was partially transected and repaired. Four and eight weeks postoperatively, soleus muscles were harvested from each hindlimb and histomorphometric evaluations were performed to measure the connective tissue and fiber cross-sectional areas. Electrophysiologic studies were carried out to measure the compound muscle action potential at baseline, 2, 4, 6, 8 weeks to assess the number of functioning muscle fibers.

Results: The results showed that maximal muscle length preservation (Group B) was the most protective in preventing muscle contracture within 4 weeks of tenotomy, but this protective effect was gradually offset by prolonged immobilization, and 8 weeks after tenotomy, maintenance of excursion (Group A) was the most protective.

Conclusion: These observations can be useful in the intraoperative evaluation of myostatic contracture in neglected tendon ruptures, and be applied to the management of acute tendon injuries to prevent myostatic contracture when immediate anatomical reconstruction cannot be performed.



FP278

Effects of botulinum toxin type-A injection on tendon surgery: Biomechanical test results in rabbits

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Purpose: The effect of botulinum toxin injection on biomechanical properties of rabbits Achilles tendons is assessed in order to find out if the treatment decreases re-rupture risk following the surgery .

Method: Twenty seven rabbits are divided into three treatment groups. Only Group I received an injection of botulinum toksin type-A (4 U/kg) within calf muscles, After the Achilles tenotomy and repair, Group I and Group III are permitted unrestricted mobilization and weightbearing. The tendons healed under postoperative rigid immobilization in Group II. Tendons are harvested and analyzed by week 6 .

Results: Specimens from Group I were biomechanically equivalent to specimens from contralateral limbs. Specimens from Group II demonstrated significantly decreased failure tensile strength ($p=0.009$). All of the tendons re-ruptured in Group III.

Conclusion: Local injection of botulinum toksin-A produced significant positive benefit as to increase in tensile strength compared with tendons from rabbits that had received either rigid immobilization or immediate unrestricted mobilization.

Kubota H, Manske PR, Aoki M, Pruitt DL, Larson BJ.1996

[Tuzuner S, Balci N, Ozkaynak S. 2004](#)



FP279

The treatment of the chronic "mallet finger"

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The most popular surgery procedures for the treatment of the chronic "mallet finger" are the tendon's plication (Nettov G., Safin R., 2000; Rahmatulaev S. et al, 2006) and the tenodesis (Bohler J. et al, 2003; Sorene E., Goodwin D., 2004; Sadan A. Y. et al, 2004).

The purpose of this research - to compare efficiency of the above mentioned operations in the treatment of the chronic "mallet finger".

Material and methods: The results of treatment 32 patients (34 fingers) with chronic "mallet finger" were analyzed. The patients of the first group (15 fingers) were treated by the tenodesis. The patients of the second group (19 fingers) were treated by the tendon's plication. The outcomes of the treatment were evaluated in 6-26 months after surgery according to J. P. Crawford (1984).

Results: In the first group (tenodesis) the excellent results were revealed in 7 (46,47 %) cases, good - in 6 (40 %), satisfactory - in 2 (13,33 %). In the second group (plication) the excellent outcomes were revealed on 7 (36,84 %) fingers, good - on 10 (52,63 %), satisfactory - on 2 (10,53 %). No significant difference in both groups was found - $p=0,942732$ ($p > 0,05$).

Conclusion: Thus, the tenodesis and the tendon's plication have the same efficiency in the treatment of the chronic "mallet fingers". In the same time the tenodesis is more simple and more aesthetic procedure.



FP280

Primary extensor grafting in the region of the metacarpophalangeal joints (zone 5)

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Eight cases which had sustained injuries to the extensor mechanism over the metacarpophalangeal joint that required primary extensor tendon grafting were retrospectively reviewed. The mean age was 34 years ranging from 20 to 49 years. The mean follow up was four years ranging from 0.5 to seven years. Five of the injuries were power tools and three were ragged lacerations. Three were complicated by fractures. Five of the injuries involved the metacarpophalangeal joint. The length of the tendon grafts used ranged from 0.7 to 2.5cms. Four required flaps to revascularise the zone of injury. There were no cases of tendon repair failure. One case required a tenolysis. All the cases were workers compensation injuries and they all returned to work in a modified job within one to three weeks and a normal job within six to ten weeks. Two have permanent functional impairment caused by loss of motion and both of these injuries were the result of power saw injuries. One of these cases had a 10% loss of function and the other an 8% loss of function expressed as a percentage of the injured digit as defined by the criteria outlined by the Fifth Edition of The American Medical Association.

The conclusion to this study is that providing there is adequate wound excision to normal tissue, restoration of the normal tension and cadence in the fingers and reconstruction of the defect with a tendon graft, stable fixation of skeletal injuries, revascularisation of the zone of injury with a local flap, if required with immediate hand therapy and splinting is an effective way of managing these injuries.

To our knowledge there is no information or literature defining the use and outcome of primary tendon grafts for this type of injury.



FP281

Intermediate results of synthetic anchovy interposition using PLA after total trapezectomy in the treatment of basal osteoarthritis of the thumb

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Introduction: The aim of this study is to evaluate the results of resorbable anchovy interposition made of polylactic acid in the treatment of trapeziometacarpal joint osteoarthritis after total trapezectomy without ligamentoplasty or tendon interposition.

Material: We carried out a retrospective study in 17 patients. The mean age was 60 years. Sex-ratio was 15 women for one man. All patients were reviewed after a mean follow-up of 24,5 months.

Method: The surgical technique consist to placed the anchovy in the trapezium site. In order to avoid the luxation of the implant, we placed it vertically and rolled it around the flexor carpi radialis tendon.

- Clinical criteria: pain, opposition, retropulsion, force
- Radiological criteria: M1-M2 angle and first metacarpal collapse

Results:

- clinical findings: mean pain was 2.4 on a ten point scale during exercice. The mean opposition score was 10. Mean retropulsion was 2.7. The mean force was 22.29 for grip strength and 9.17 for pinch strenght.
- Radiological findings: The mean angle M1-M2 was about 46°. The mean collapse of the trapezium site was about 6.9 mm and a progression of 0.5 mm has been registred compared to the preliminary study.

Discussion: This simple and fast technique gives similar results to others techniques of the literature. Time is a positive factor for the improvement of force and mobility, but on the other hand it increases the collapse of the first column.

Conclusion: The synthetic PLA Arex interposition seems to be a great alternative for treatment of trapeziometacarpal joint osteoarthritis, nevertheless it doesn't avoid eventually the collapse of the first column.



FP282

Base of the thumb arthroplasty with suspension: A double blind prospective comparison of two techniques

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The purpose of the study is to demonstrate the effectiveness of two methods of suspensionplasty for correction of base of thumb arthritis utilized in a prospective randomized double blind manner. Even though several methods of base of the thumb arthroplasty have been described, information of outcomes of comparable techniques is non-existent.

Methods: 30 patients were submitted to 2 different techniques of base of thumb arthroplasty with suspension of the first metacarpal to the second utilizing tendon transfers. Fifteen had reconstruction with The Abductor Pollicis Longus (APL) and 15 with the Extensor Carpi radialis Longus (ECRL) tendon. The technique selection was made in a blind manner and the patients were evaluated 3 years later by an unbiased observer with no access to the operative data evaluating strength, agility and residual pain. The examinations also included radiographs and a DASH questionnaire.

Results: Three years post surgery, patients had relief of pain, going from an average of 8 in a pain scale to 2. They were satisfied with the results – all of them would have the surgery again if given the choice. The Dash score was similar in the two groups. Settling of the first metacarpal in relationship to the Scaphoid varied from 2 to 4 mm. There were no appreciable differences between the two groups of patients as far as strength and agility.

Conclusion: A comparison between the two groups with different techniques shows no statistical difference. Therefore, the technique employing the ECRL for suspension after Trapeziectomy became the author's preferred procedure, because it is simpler to perform, avoiding the drilling and anchoring of the APL to the base of the second metacarpal, which leads to more pain in the immediate postoperative phase.



FP283

Early postoperative mobilization of trapezium silicone implants

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Objectives : To determine if transfixing the implant with a Kirschner wire would allow the patient early postoperative mobility, without complications such as implant subluxation or silicone rupture.

Patients and methods : Prior to the clinical study, a silicone implant was placed under 1 million cycles of compression, with a frequency of 8 Hz, from 20 to 200 Newton, and no rupture or cold deformity were observed. Twenty nine size one Swanson silicone implants were used in 26 patients. After "concavization" of the trapezoid and capsular repair with the FCR tendon, the implant was stabilized to the trapezoid with a transfixing Kirschner wire. Average postoperative immobilization was 10 days. The K-wire was removed at an average of 6 weeks. All patients were reviewed at an average of 2 years after surgery (from 1 to 4 years). Average key pinch strength was 10.2 Kg (8 to 15 Kg). Average range of abduction-adduction was 57° (30° to 64°) and average range of antepulsion-retropulsion was 39° (30° to 60°). One patient presented a 3 mm subluxation of the implant due to a deficient surgical placement. No subluxations, wear or fracture of the implants were observed in the rest of the patients. Fluoroscopic examination demonstrated that thumb mobility was mostly taking place at the stem of the implant.

Conclusion : Silicone trapezium implants can be stabilized to the trapezoid with a transfixing Kirschner wire until capsular repair is obtained, usually at 4 to 5 weeks. Kirschner wire fixation will prevent implant subluxation and will allow the patient early postoperative thumb use, as the mobility takes place at the stem of the implant. This offers the advantage of minimizing postoperative disability, earlier return to previous occupation and faster recovery of strength and mobility.



FP284

Review following Orthosphere TN spheric interpositional arthroplasty for the treatment of thumb basal joint arthritis

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The Orthosphere TN (Wright Medical Technology Inc, Arlington) is a spherical interpositional implant made of yttrium-stabilized zirconia which is inserted into the TMC joint after hemispherical reaming of the proximal metacarsal and the trapezium. The device is designed to replicate natural joint function and maintain thumb height.

A recent study by Athwal *et al.*, 2004, reported that of seven patients who underwent interposition arthroplasty with an Orthosphere TM implant between 2000 and 2001, all seven failed with five patients requiring revision surgery less than one year after receiving the implant. The chief investigator of this study, J.K, has inserted approximately thirty-five Orthosphere devices since 2003 when the device was first used. Given the failure of the device reported by Athwal *et al.*, 2004, a retrospective consecutive review of patients who have received the implant was undertaken.

Anterior-posterior thumb radiographs were reviewed for implant position, deformity, subsidence and resorption of bone. The clinical parameters assessed were pain, thumb opposition, strength, instability and deformity. A self-evaluation patient questionnaire, the Michigan Hand Outcomes Questionnaire, was completed to assess patient satisfaction with the procedure.

Radiological and clinical assessments have been carried out and the data obtained from the study is currently being analyzed. Results of the study, including the functional outcomes, complications, and the revision rate of the procedure will be presented in detail at the meeting. Recommended modifications to the surgical technique used to insert the device will also be discussed.

Athwal, G.S., Chenkin, J., King G.J., and Pichora, D.R. Early failures with a spheric interposition arthroplasty of the thumb basal joint. *J Hand Surg* (2004) **29A**: 1080-1084



FP285

Resurfacing prostheses for trapeziometacarpal osteoarthritis: Preliminary results

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The purpose of this study is to report a retrospective serie concerning 30 cases of Pyrocarbon hemi-arthroplasty for primary arthritis of the thumb basal joint (stage EATON 2and3)

Materials and Methods: This new unipolar Pyrocarbon implant features a convex head and a non cemented stem. The head is varised and off-set to allow a good congruency of the articular surface of the TMC joint. The surgical procedure requires a minimal resection of the first proximal metacarpal. Trapezial reshaping is achieved thanks to a special concave powered reamer. Stabilization procedure by tendons transfers and capsular repair were necessary in all cases.

Of the 30 implants, 24 were implanted in women, the mean follow-up was 3,5 years (5 to 1 year). The mean patient age at the time of surgery was 57 years .

Results were evaluated by an independant observer using EVAL database system; Kapandji X-rays (static and dynamic view) were performed in all cases.

Results: Three patients (at the beginning of the series) required a revision surgery for severe pain and weakness at an average of 6 months. Revision was performed by total prostheses with final good results. For others 27 patients, pain decreased from 9 to 2 on VAS scale, and persisted during effort in only 50 % of the cases.

Thumb mobility was 38° in Abduction and 35° in Antepulsion, while retropulsion remained poor (-7°). Kapandji score reached normal value (mean score9,7)

Mean strength evaluation showed 20kg for grasp, 3,5 kg for tip-pinch and 5 kg for key-pinch. DASH evaluation aroused 4 to 20.

Radiographic results showed a very good bone/ stem interface, even improving with time. Trapezial surface stayed stable without sclerotic nor bone resorbtion. Even if 50% of implants were radiologically subluxed, none of them was totally dislocated and functional result was not impaired by this subluxation. (less than ¼)

Conclusion: This new Pyrocarbon resurfacing implant is adequate for trapezio-metacarpal arthritis (stage 2 or 3) in young patients. The minimal bone resection and the anatomical implant shape allow in case of failure to go back to any-other arthroplasty procedure. With a precise surgical procedure and despite a long (2 to 4 months) and painful rehabilitation period, we achieved good results, comparable to those of the total ball and socket joint prostheses but without their long-term risks of failures.



FP286

Finite element analysis and clinical outcome of titanium basal joint hemiarthroplasty

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Purpose: Our goal is to define the mechanics and determine the clinical outcome of titanium implant arthroplasty in Trapezio-metacarpal arthritis.

Methods: Finite Element Analysis (FEA): A two dimensional FEA mesh of the titanium arthroplasty was constructed with 8-node quadrilateral elements and analyzed with ANSYS. Flexion-Extension displacement of the metacarpal was analyzed. Clinical Study: 47 patients (50 thumbs) with Eaton Stage 3 trapezio-metacarpal arthritis were treated with Swanson titanium basal joint arthroplasty; the patients were prospectively followed from 1996 to 2003. The average follow-up was 2 years. DASH questionnaire answers, Grip and Pinch measurements were obtained at pre-op and final follow-up. Failure was strictly defined as the point when revision to the standard soft tissue interposition arthroplasty became inevitable.

Results: Finite Element Analysis (FEA): Titanium implant showed pistoning behavior within the metacarpal shaft with maximum stress concentration in the mid-metacarpal shaft of 1.92 Megapascals (Mpa). The convex sphere of the implant rotates and lifts out of the trapezium crater with high stress concentration 0.51Mpa at the radial and ulnar corner of the trapezium. Clinical Study: 20% of the patients failed before 9 months. All were successfully converted to standard LRTI. The remainder 80% of the patients showed significant improvement in DASH scores ($p < .0001$) albeit with continued weakness at 2 year follow-up. The reconstructed thumb never attained the strength of the contralateral thumb; even in the success group residual swelling was not uncommon with any increase in activity level.

Conclusions: Our results are contrary to the published literature in that high failure rates are common early in the follow-up. Our FEA results are confirmed by the clinical study. Titanium implant arthroplasty may have a role in a low demand patient with good bone stock; however, we have stopped offering titanium hemiarthroplasty to our patients at our institution.



FP287

Anatomic pyrocarbon metacarpal hemiarthroplasty in thumb CMC osteoarthritis

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New and novel treatments are emerging for the treatment of carpo-metacarpal osteoarthritis at the base of the thumb, particularly in younger and more active patients. The purpose of this study is to assess the function of a consecutive cohort of patients that have undergone an anatomic resurfacing metacarpal hemiarthroplasty at the base of thumb metacarpal for osteoarthritis. Pyrolytic carbon is a composite 2D graphite and 3D crystalline structure. As a material it has strength and wear properties between graphite and diamond. The surface characteristics are therefore highly favourable due to its polished surface. It can be inserted without cement and has a micro-surface structure that allows bone in-growth. These properties make it a very attractive material for small joint arthroplasty prostheses, with notably low wear characteristics.

Six younger active patients with symptomatic Eaton-Littler Stage III osteoarthritis at the base of the thumb underwent a CMC hemiarthroplasty using a metacarpal based, anatomic pyrolytic carbon resurfacing. All patients had an additional 1/3 FCR tendon transfer to maintain stability at the thumb base. The average age at surgery was 57.6 (range 54-66) years. The cohort has had prospective clinical and radiological scoring. At a minimum of 12 months they have all had significant improvements in objective and subjective pain, grip strength and function. There have been no revisions and all implants are stable. One patient has had further surgery for a cutaneous radial neuroma and resection of a residual impinging trapezial osteophyte. All patients remain satisfied with their improvement in hand function and have returned to their active life-styles. In this younger group of patients, resurfacing hemiarthroplasty for CMC osteoarthritis seems a viable surgical option for ongoing treatment in these younger patients. Ongoing annual assessment continues as the cohort increases.



FP288

Treatment of symptomatic CMC instability by combined closing wedge extension osteotomy of metacarpal I and opening wedge osteotomy of the trapezium using the metacarpal wedge

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Symptomatic prearthritic instability of the CMC joint (Eaton stage I) in the younger and active population can be equally disabling as its arthritic variant predominantly present in the somewhat older population.

Besides conservative treatment several surgical treatment options have been proposed such as Eaton's stabilization, Pellegrini's extension osteotomy of metacarpal I, Kapandji's opening osteotomy of the trapezium, ...

On 3D reconstruction CT scans of these patients a bidirectional subluxation observed: the slant slope of the trapezium promotes a lateral slide of the base of metacarpal I which is combined with a dorsal subluxation resulting from an incompetent beak ligament and the transmitted shear forces in the joint during pinch.

Since the subluxation is bidirectional a bidirectional corrective osteotomy has the potential to correct the subluxation in both directions. The feasibility of such procedure was tested and optimized using CT scan based planning software. This allowed optimization of the metacarpal extension osteotomy in such a way that the resected wedge could be fitted in the opening wedge osteotomy of the trapezium. Individual surgical guides, based on the CT scan data, were made using rapid prototyping. They are used during surgery to ensure that the preoperative planning is followed.

A total of 9 patients have been treated so far using a combined metacarpal and trapezial osteotomy. Osteosynthesis was performed using crossed K-wires and combined with thumb spica cast for 6-8 weeks until bony healing occurred.

All patients had preoperative and postoperative CT scans, the preop planning is compared with the result after consolidation of the osteotomies. The clinical evaluation consists of pre and postoperative Dash scores, Kapandji scores, grip strength and key pinch.



FP289

Comparison of bioreplaceable joint prosthesis with trapeziectomy and APL arthroplasty in the treatment of the osteoarthritis at the CMCj level. A randomised parallel groups study in adult subjects

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Our Unit has attended in an European project, coordinated from Tampere University, Finland, regarding new "biodegradable" prosthesis.

The investigational bioreplaceable joints prostheses consists a porous, fibrous spacer (scaffold), made of L and D lactic acid copolymers with L,D-monomer ratio 96 to 4 (PLDLA).

The primary aim of this study is to compare the new biodegradabile "scaffold" in osteoarthritis subjects at the CMCj level to the patients treated with trapeziectomy and arthroplasty with ABLP tendon. The secondary aim is to estimate (follow-up 5 years) the performance and the life of this scaffolds.

The study had been carried out as a randomised, multi-centre parallel groups study with two treatment groups.

The surgical technique for the implantation of the "scaffold" has been performed by our personal technique: mini-incision at the CMCj level, trapeziectomy and positioning of the prosthesis stabilizing with a bone anchoring device to the distal pole of the scaphoid and distally to the base of the first metacarpal by a double suture.

The Aa have performed 42 trapeziectomies, from November 2004 to June 2006, adding the scaffolds in 25 cases, according to personal surgical technique, and the AbPL arthroplasty in the 17 cases of the controlled group.

Actually the preliminary results in a groups of 20 patients, follow-up of 11 months, have shown a significative improvement of the results in the "scaffold group" compared to the control group (Jamar test of 35%, pinch test of 16%, Kapandji test of 12%). In the VAS scale the impairment of the perceived pain has been of 70% in the scaffold group compared to 40% of control.

The preliminary report shows encouraging outcome studies, presenting better results to the controlled group. However, because of the incomplete controlled cases and follow-up it's necessary wait since to the end of the study for reasonable results.



FP290

The surgical management of basal thumb arthritis: A Cochrane systematic review

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We performed a Cochrane systematic review on the surgical management of basal thumb osteoarthritis. Studies need to pass a rigorous appraisal of their scientific method in order to be included in the analysis. Of the 139 papers identified, only seven met the inclusion criteria. We found adequate randomised controlled trials of the following techniques: trapeziectomy alone (T), trapeziectomy with ligament reconstruction alone (T&LR), trapeziectomy with tendon interposition alone (T&TI), trapeziectomy with ligament reconstruction and tendon interposition (T&LRTI), trapeziectomy with porcine collagen interposition (T&PI) and Swanson trapezium replacement (S). In all, 384 patients were included in these studies and they were predominantly female. There were no adequate studies of the following techniques: ligament reconstruction alone, fusion of the CMC joint, osteotomy of the first metacarpal, other interposition arthroplasties or total joint replacements. We analysed the results in terms of pain, physical function, range of motion, strength, scaphometacarpal distance, adverse effects and patient global assessment. There is enough power in the data to show that T has fewer adverse effects (16%) than T&TI, T&LRTI and T&PI. There is enough power in the data to show that T & LRTI has more adverse effects (11%) than T, T&TI and T&LR. There is enough power in the data to show that there is no difference in the outcome of strength between any of the procedures. There is insufficient data to show any difference in the outcomes of pain, physical function, range of motion and patient global assessment. On the strength of the available evidence, we recommend simple trapeziectomy for the treatment of basal thumb arthritis. We recommend further research for those techniques hitherto not adequately studied, for the results of all techniques in men and for longer term follow-up.



FP291

Update on assessment on spasticity at the upper limb

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The accurate evaluation of spastic patients is the most important criteria in the selection of candidates for surgical treatment. It must take in consideration. The main criteria are the following: initial clinical features of the patients;; functional and anatomico-pathological classification; sensibility; neuro-psychological status; neuromotor control and muscle contraction; pain. The patient evaluation must be a multidisciplinary one (surgeon, physiatric, neurologist) before as well after the treatment. Every indications to a functional surgical treatment is based on a good cognitive level, in the other case we performed only an aesthetic treatment.

The intrinsic muscles spasticity is a very important aspect in the spastic lesions. It may be immediately present. However, we performe a proximal to distal surgery treatment, starting from shoulder, elbow and forearm, considering that the extrinsic muscles release may modify or make aparent the intrinsic muscles spasticity.

The treatment must be done through a global vision of patients' problems and the goals of the intrinsic muscles spasticity correction need to be established and changed if evaluation after the proximal procedures require a reorientation.

When spasticity of the upper limb is managed with a global approach and objectives are clearly defined in advance with the patient and caregivers, treatment of shoulder, elbow and hand deformities can achieve important results for hygiene or functional targets.



FP292

Motion lab analysis of the upper extremity in spastic hemiplegia due to cerebral palsy

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Purpose : The purpose of this study is to determine if the post-operative EMG pattern of FCU activity changes phase when compared to the pre-operative EMG pattern of FCU activity in children with spastic hemiplegia due to cerebral palsy treated with an FCU to ECRB tendon transfer.

Materials and Methods : Seven children were evaluated pre- and post-operatively with an EMG/video motion lab analysis during grasp and release of the heavy can during the Jebsen-Taylor test. The average age at surgery was 9,75 years (range 7 -11). The average follow-up was 3.5 years (range 1-6.75). The pre- and post-operative analysis was compared for the phase of FCU firing (grasp versus release), the position of the wrist at the time of grasp, and whether the child was effective in lifting the can.

Results: During the pre-operative analysis, 5 children fired the FCU during grasp; 2 children fired the FCU during release. In the post-operative analysis, 6 children fired the FCU during grasp; 1 child fired the FCU during both grasp and release. Pre-operative wrist position was neutral (1 patient), 45 degrees flexion (2 patients), 60 degrees flexion (2 patients), and 90 degrees flexion (2 patients). Post-operative, wrist position was 45 degrees extension, (4 wrists), neutral (1 wrist), and 90 degrees flexion (2 wrists). Pre-operatively 5 children were ineffective and 2 were effective. Post-operatively 3 were ineffective, and 4 were effective.

Conclusions: Pre-operatively the FCU fired during grasp in 5 children causing wrist flexion while lifting the can, which was effective for 1 child. Post-operatively the FCU continued to fire during grasp in the same 5 children, now causing wrist extension, which was effective for 2 children. This study demonstrates that the FCU does not change phase in its firing pattern in the majority of children tested.



FP293

Therapeutic approach to upper limb spasticity in different age groups

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The combined use of functional surgery, botulinum toxin and orthotics aims at recovering and strengthening any residual limb functionality to create comfortable morphological conditions for both patients and their families. Neuromotorial rehabilitation and surgery have long been used in spasticity treatment, but only in recent years has this multidisciplinary approach been able to produce growingly rewarding results (Mary Ann Keenan 2004).

From August 2002 to August 2005 we studied 71 patients showing different prerequisites for spastic upper limb treatment. Fundamental to optimal limb control are cognitive capability to make limb functionality part of the everyday activities, as well as proprioceptive ability and kinaesthetic perception. In some cases, dynamic electromyography has been of great help since it provides useful information regarding muscle activity in specific functional exercises. The collected data also allows for good scientific grounds especially when it comes to chose following treatment procedures, which can be surgical, conservative (botulinum toxin), or both. Therapeutic approach in adults is mainly multilevel, since treatment is mostly aimed at morphological/cosmetic results, whereas in growing patients treatment is more selective. In this case the objective is to prevent and correct possible deformities that may appear in the growing age. This is because younger patients often present upper limbs that may be defined as "functional" (James Gage 2003).

Fine hand movements explain why neurological injuries cause patients to lose capabilities which are difficult to recover even with a correct therapeutic approach. Thus, the results of upper limb spasticity treatment are more limited and less evident than those of the lower limb and treatment programs must be personalized and directed to achieve the best possible results.



FP294

Botulinum toxin A in the upper limb in cerebral palsy

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Since 1998, 40 limbs in patients with cerebral palsy have been treated with botulinum toxin A injections to assist with the management of contracted muscles and joints as well as co-contraction.

The average age was 14 years (range 4 to 33 years) and the average dose given was 107 units (range 50 to 200 units). Simultaneous surgical procedures such as tendon lengthening and transfers were performed in 14 limbs. Digital flexors were injected in 26 limbs, elbow flexors in 18, wrist flexors in 17, thumb adductors in 13, pronator teres in 9, intrinsics in 3, shoulder abductors in 2 and ECU in one limb. All patients were injected under a general anaesthetic, allowing for an assessment of fixed contractures. Padded plaster casts were applied, putting the injected muscles on full stretch before the reversal of anaesthesia and were maintained for approximately 3 weeks. Thermoplastic splints were then worn 23 hrs per day for a further three weeks. Splints were serially modified to achieve progressively more extension as the flexion contractures were corrected. Night splinting was continued for at least six months and splinting during the day was progressively reduced to allow strengthening of antagonists and increasing functional activity as the paralysis from the botulinum toxin reduced.

The results in the elbow flexors were disappointing. The finger, thumb and wrist flexors have responded extremely well, despite fixed flexion deformities being documented under anaesthesia in the majority of patients. It is estimated that the muscle bellies have been elongated by 3 to 4 cm either by the lengthening of, or addition to the sarcomeres. The results in these patients are vastly superior to that which could be obtained surgically. A consecutive series of treated patients will be presented.



FP295

Manual dexterity and movement patterns of the upper limb in cerebral palsy before and after corrective surgery: A prospective clinical outcome study

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Surgical treatment of the upper limb in cerebral palsy is an accepted method to correct disabling deformities and improve active range of motion (ROM) in carefully selected patients. The purpose of this study was to measure how surgery aimed at the correction of hand and forearm deformities objectively affects manual dexterity and associated movement patterns.

In 15 patients with hemiplegic cerebral palsy, the postoperative improvement in active ROM of the wrist, forearm and elbow was compared to the change in manual dexterity as tested by the Melbourne Assessment of Unilateral Upper Limb Function. Simultaneous three-dimensional video analysis of the upper limb and trunk was used to evaluate a change in movement patterns.

After a mean follow-up of 33 months (18-44) the ROM of the corrected deformities had improved but the centre of ROM had shifted. This means that a gain in the desired direction was accompanied by a loss in the opposite direction. The overall score of the 'Melbourne test' improved in all patients, but the gained ROM in the wrist and forearm was not always fully employed during the performance of the functional tasks. Instead, the 3D video analysis suggested that a movement strategy with less need for compensatory movements was preferred over the effort of using the full gained ROM. We advocate that typical movement patterns should be anticipated in composing the surgical plan for correcting multiple joint deformities. Compensatory movement patterns associated to one deformity might involve other deformities that are also eligible for correction. Based on the results of this study it is suggested that the surgical approach to correct joint deformities by improving ROM indeed facilitates manual dexterity and decreases the need for compensatory movement patterns.



FP296

Treatment of the cerebral palsy hand

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Purpose: To demonstrate the correction of severe deformities by early treatment of the flexor slide operation.

Methods: The operation consists of a long zig-zag type of incision over the medial border of lower end of arm, elbow, and medial aspect of forearm down to wrist. The origin of all flexors of wrist, fingers and flexor pollicis longus are release from the medial epicondyle, both bones of forearm and interosseous membrane. The ulnar nerve is now found in the ulnar groove, freed from surrounding soft tissues and investing fascia. The nerve is mobilized well proximally in the arm, the medial intermuscular septum is excised, and the nerve is mobilized from its branches and brought anteriorly to elbow.

Summary: Postoperative care is of paramount importance and consists of cast immobilization for 10 days, then dynamic splinting follows. The postoperative evaluation was performed by occupational therapy and the author with the following results: Excellent 35%; Good 45%; Fair 20%.

Conclusion: Early surgery can improve this serious condition.



FP297

Upper extremity surgery in cerebral palsy. A preliminary report

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Introduction: In April 2000 an interdisciplinary protocol for the surgical treatment of patients with upper limb deformity was introduced at H:S Hvidovre Hospital. Patients treated during the first 5 years of practice were evaluated.

Material and Methods: Substantial elbow, forearm, wrist and finger deformities in patients with normal or near normal intelligence were the indication for surgery. The aim of treatment was to improve function.

19 patients (12 male) with cerebral palsy were operated on in accordance with the protocol, median age 11 years (4-31).

Each patient had a mean of 4 procedures.

Results: Follow up by means of interview was carried out at median 23 months (3-57) of 18 patients by 2 occupational therapists. One patient was not interviewed but returned a questionnaire. 17 patients claimed improved function and 18 improved appearance of the hand.

No complications were encountered.

Conclusion: Surgical treatment of selected patients with upper limb deformity due to cerebral palsy may improve function and cosmetics of the hand if treated in accordance with the protocol. The complication rate appears to be low.



FP298

Upper limb spasticity surgery and the wrist. A review of results in Leeds UK

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We present the outcome of surgery to improve wrist function (n=24) in this prospective analysis of 24 patients with upper limb spasticity at the Leeds Cerebral Palsy Clinic.

Spasticity was secondary to cerebral palsy in half of all cases (n=12) with the remainder due to a variety of other causes.

Inclusion criteria were, use of the limb, painful contracture, requirement to improve personal care or aesthetic position and were irrespective of traditional exclusion criteria such as age, mental retardation, poor sensation or co-existing severe distal deformity.

Treatment was carried out in a specialist multidisciplinary team setting.

Surgery was performed by the senior author. Both pre-operative and post-operative assessments were conducted using the same assessors and results were measured using published assessment tools. Nearly 60% were children and there were an equal number of males to females.

Results demonstrated an improvement in both wrist function and cosmesis.

15 out of 24 patients demonstrated functional improvement. 1 patient demonstrated a downgrade in wrist function. All patients without improved function reported the operation a success aesthetically. There were no surgical complications.

Surgery for wrist function in upper limb spasticity is a successful procedure to restore function and wrist cosmesis to this group of patients. With a multi-disciplinary team approach involving surgeons, occupational therapists and physiotherapists a significant, reproducible and measurable improvement in wrist function can be achieved.



FP299

Extensor pollicis longus rerouting for thumb-in-palm deformity in cerebral palsy

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Thumb-in-palm deformity is frequently seen in cerebral palsy and impedes hand function. Surgery may be indicated to improve function, hygiene and cosmetics. Releasing the spastic intrinsic thenar muscles and rerouting the extensor pollicis longus (EPL) tendon through the first dorsal retinacular compartment is a frequently used combination of surgical procedures. The EPL rerouting technique was first described by Manske in 1985. Only when it was technically difficult he suggested to alternatively reroute the EPL around the tendons of the first dorsal retinacular compartment. We have used this alternative and simplified rerouting as our first choice technique since 1991.

We present our experience with this EPL rerouting technique retrospectively in over 90 patients. Postoperatively, we observed an improvement in abduction and extension of the thumb ray out of the palm. Improvement in daily activities and in handling larger objects was noted. This experience suggests that the alternative EPL rerouting technique might be as effective as the original. An experimental setup using five fresh frozen cadaver extremities was designed to objectify the different EPL rerouting techniques. Three dimensional movement analysis of anatomical landmarks was used to determine EPL adduction-abduction and extension-flexion moment arm at the thumb carpometacarpal joint under 4 tendon conditions: (1) intact EPL, (2) EPL out of Lister, (3) EPL transfer through first dorsal retinacular compartment, and (4) EPL transfer around first dorsal retinacular compartment. Changes in the moment arm of the thumb ray were compared between each technique. The results of this analysis suggest that the simplified alternate routing of the EPL yields a satisfactory biomechanical basis for augmentation of thumb abduction. EPL rerouting around instead of through the first dorsal retinacular compartment is technically easier and results in a satisfactory treatment for thumb-in-palm deformity.



FP300

Brachioradialis re-routing supinatorplasty for the surgical correction of forearm pronation in cerebral palsy

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Aim: To investigate the results of brachioradialis re-routing procedure for the restoration of active pronation in patients with cerebral palsy.

Patients and Methods: Brachioradialis muscle rerouting procedure was used to restore active supination in eleven children with cerebral palsy. Following release and lengthening of the pronator quadratus and pronator teres muscles, the brachioradialis tendon is divided as a Z plasty and the distal part of the tendon is passed through the interosseous space in a dorsal to palmar direction, and then sutured to its proximal end.

Results: Mean preoperative supination was -38 degrees (less than neutral), and increased to 43 degrees (beyond neutral). The procedure resulted in a gain of 81 ° in active supination. Due to the release on the pronator mechanism, mean pronation decreased from 76 degrees 58 degrees, however this decrease did not impair function.

Conclusions: Pronation deformity is one of the most common and also one of the most disabling deformity in cerebral palsy, as it interferes with daily activities requiring supination. Brachioradialis re-routing supinatorplasty in this series has given satisfactory results and is presented as an alternative for correction of forearm pronation deformity in cerebral palsy.



FP301

Vascular Anatomy of the 4th dorsal interosseous space: Multidetector-row computed tomography finding and anatomic correlation

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Thorough information about the vascular tree of an anatomical area, including cutaneous perforators, is critical to plan a reconstructive strategy by means of a pedicled or free flap. The vascular anatomy of the 4 th dorsal interosseous space, known as the most inconsistent one, was studied.

Seventeen cadaver hands (8 right; 9 left) have been injected with a mixture of barium sulfate and black latex (25%). The specimens were then studied by a 16-detector row computed tomography. Each specimen images were analyzed by an experienced radiologist and a plastic surgeon. Following data were recorded: the presence of 4 th dorsal metacarpal artery, the presence of the proximal and distal communicating branches and their localization from the carpo-metacarpal joint line and the metacarpo-phalangeal joint line, the number of cutaneous perforators within the proximal two 2/3 of the space and its localization from the carpo-metacarpal joint line, the presence of muscular branches originating from the dorsal metacarpal artery, and finally the presence of the distal recurrent branch. Afterwards, a meticulous dissection of the 4 th dorsal interosseous space was carried on by the same plastic surgeon under magnification. A correlation between the radiological findings and the surgical ones was established.

In all cases, every radiological detail of the specimen such as the number and localization of the perforator vessels and its relationship with anatomical landmarks was confirmed by surgical dissection. Furthermore, in some cases, tiny muscular or periosteal branches identified by CT were not found by dissection due to its small caliber.

The multidetector-row computed tomography provides good quality information about the vascular anatomy of the dorsal aspect of the hand, including perforator vessels with less than 0.5 mm caliber, helping to design the most suitable and safe reconstructive procedure for each case.



FP302

Vascular anatomy of the 4 th dorsal interosseous space: Anatomical dissection

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We present an anatomical study of the cutaneous perforators, including the distal recurrent branch, and the consistency of the dorsal metacarpal artery within the fourth dorsal interosseous space, which is supposed to be the most inconsistent one in terms of vascular anatomy.

Twenty hands have been dissected after black latex injection. A skin paddle was outlined along the 4 th dorsal metacarpal space. Suprafascial dissection was carried out preserving any vessel reaching the skin. Each perforator and the distal recurrent branch were traced back to its origin. Location and origin of each perforator was measured from a reference point. Furthermore the prevalence of the distal recurrent branch and the dorsal metacarpal artery were recorded by digital pictures.

In 85% of the cases at least one perforator (mean 1,53; range 1-3) has been identified within the fourth space piercing the dorsal interosseous muscle fascia and reaching the skin. In 50% of the cases, a perforator branching off the proximal communicating branch was identified, located at a mean distance of 11,2 mm (range: 8-15) from the carpo-metacarpal joint line. The 4 th dorsal metacarpal artery was identified in all specimens and under the dorsal interosseous muscle fascia. The distal recurrent branch was consistent in our dissections, entering the base of the flap distal to the communis extensor tendon of the 5 th finger and the dorsal interosseous fascia.

A "dissectable" perforator is consistently (85%) found in the proximal third of the 4 th dorsal interosseous space. Very few perforators exist within the middle third branching off the dorsal metacarpal artery. The distal recurrent branch is a consistent finding in the distal third. The 4 th dorsal artery is consistent as well subfascially. The 4th dorsal interosseous space is consistent from the vascular point of view, and can be utilized reliably as a local flap donor site.



FP303

Metacarpal flaps without sacrificing the dorsal metacarpal artery

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Introduction: We present an alternate flap over the classical metacarpal flap, similar as design and donor site, but which avoids part of its disadvantages (covering the defects only over the proximal half of the long fingers; the impossibility of early postoperative fingers mobilization). The blood supply of this flap comes from a well represented vascular anastomosis in the proximal half of the long fingers, between the dorsal metacarpal arteries and the palmar common digital arteries or the collateral digital arteries. It is possible to harvest both pedicled and transposition flaps.

Material and methods : We proved the vascular basis of these flaps by fresh cadaver dissections. Then we proved the possibility of harvesting and using this kind of flaps in 65 clinical cases.

Results: The evolution was uneventful in 70% of cases; in 25% of cases we had some temporary venous congestion, that diminished and subsided spontaneously, and in 5% of cases we lost the flaps. In all the cases, the functional rehabilitation started after 24 hours.

Conclusions: This flap has some advantages, as: a) it do not sacrifice the dorsal metacarpal artery; b) it can reach the most distal regions of the long fingers; c) the distal location of the vascular pedicle to the metacarpophalangeal joint allows the early postoperative mobilization of the fingers.



FP304

Proximal perforator flap of second metacarpal artery

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Defects on the radial side of the second phalanx and the DIP joint of the index finger are difficult to treat. In the year 2000 during studies in the anatomical laboratory we found a useful perforator at the base of the second metacarpal artery through LENHOSSEK's and ZAJAK's fascia to the skin.

Anatomical dissections in 10 hands were performed before the first operation. Between 2001 and 2005 defects of the index finger in 5 patients could covered with this flap.

The flap covered the radial side of the DIP joint in 3 cases. A donor side defect at the dorsum of the hand and wrist up to 2.5 x 4.5 cm was primarily closed. The tendon sheath of the extensor indicis tendon, which is also supplied by this perforator, was used to reconstruct skin, tendon and gliding tissue of the proximal phalanx in one patient.

Anatomical dissections in cadavers and in hand injuries in this area in more than 50 patients showed a useful perforator in about 70%. In one patient with a very small perforator only a fascial flap without skin was performed.

Functional results in all patients were excellent.

It is not possible to show the perforator by ultrasound before surgery, so a careful dissection is necessary for this very useful flap to cover distal radial defects of the index finger.



FP305

Retrograde flow posterior interosseous flaps for soft tissue coverage of the hand - A meta analysis

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A meta analysis was done to identify the effectiveness of retrograde posterior interosseous flap for covering soft tissue defects of various sizes in hand. Outcome measures studied included complete uneventful flap survival, partial necrosis requiring split thickness skin grafting, complete flap necrosis and posterior interosseous nerve dysfunction postoperatively. The incidence of anatomical variations of PIA resulting in abandonment of procedure was also studied. Specific comparisons addressed were relationship of total flap survival to its length, width, size (length x width) and sample size. A Pub Med search of English language literature retrieved 10 studies with total of 652 patients, which met study criteria for this meta analysis. Most studies evaluated retrograde posterior interosseous flaps of fasciocutaneous variety. Complete flap survival was 89.20%. Incidence of partial necrosis was 7.9% and of complete necrosis was 2.81%. Transient dysfunction of posterior interosseous nerve or its branches was seen in 1.095% of the cases. The incidence of procedure abandonment due to anatomical variation was 2.02%. Probability of flap survival was modeled using logistic regression in the statistical package R. The only statistically significant correlation of flap survival was with its length.



FP306

Posterior interosseous flap in hand defect reconstruction

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Posterior interosseous flap (PIF) is a fascio-cutaneous flap for dorsal coverage of hand. We would like to present our experience with the use of this particular flap in the treatment of serious soft tissue defects of the hand.

Between November 2000 and May 2006, 37 patients were underwent a posterior interosseous flap. A standar technique was applied. A complete coverage without complications was considered as a good result. This flap was used in dorsal coverage of hand, except in 6 patients who had thump degloving. Soft tissue defects caused by industrial machinery and crashing were the most frecquent lesion mechanism. There was no complications in 83,8%. In 5,4% there was parcial necrosis and superficial infection, and total necrosis in four cases (10,8%). The surgery was performed at the time of admission in thirty two cases (86,5%).

The results are comparable and even better than previously published data. The early coverage leads an early rehabilitation, better functional results and less health cost. Advantages of the PIF are anatomical consistency, versatile and fine coverage which avoids adhesions, and producing an acceptable aesthetic outcome. This is achieved without sacrificing any of the hand vascular trunks (e.g. Radial (Chinese) and Cubital grafts) thus allowing other procedures to be done if needed. Regrettably, due to the dissimilar nature of the injuries, we were not able to make functional comparisons. This has naturally been a problem in other papers as well. The posterior interosseous flap is the best choice for hand dorsal coverage and coverage for thump degloving .



FP307

Reconstruction of the first web space by using the free arterialized venous flap - An alternative to conventional free cutaneous flaps

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A thin, pliable and durable first web space is one of the most important requisites for a comprehensive hand function. For one-stage restoration of first web space from severe traumatic contraction, a thin and durable free cutaneous flap is currently the optimal option. In addition to the popular flap choices such as posterior interosseous flap or anterolateral thigh flap, free arterialized venous flap is not ever reported for this clinical application.

From Jan. 2000 to Dec. 2006, four cases with extensive first web space defect following release of traumatic contraction were successfully reconstructed with free arterialized venous flap. The flap is harvested from the ipsilateral ulnar forearm. Following inset of flap to re-build the first web lining, the perfusion of flap is established with one inflow and one or more outflow through the flap's venous network. Radial artery is the feeding vessel in all our cases. Congestion of flap in the early postoperative period is present in all flaps. With meticulous flap care, all the flaps ended with satisfactory survival and gave significant improvement of hand function with this "new" first web lining.

Compared with the conventional free cutaneous flap, there are some advantages and also some disadvantages. The advantages include: one operation field, inconspicuous donor site and maintenance of thin flap contour without trapdoor bulkiness. The disadvantages are: scar in the forearm, longer postoperative in-hospital stay for flap care and meticulous flap dissection to incorporate rich venous network in the flap.

In conclusion, the free arterialized venous flap is a recommendable choice for reconstruction of cutaneous lining of specific area in the hand, such as the web space. It can give even better functional and aesthetic results than those from conventional cutaneous flap.



FP308

Anatomy of the anterior supramalleolar flap and its clinical application in hand surgery

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Objectives: To find a new flap in leg to repair large skin defects in forearm and hand and secondary skin defects of donor area in foot after transfer of wrap-around flap of big toe and dorsalis pedis flap.

Methods: anatomic study and clinical application are introduced. The lowermost branch of anterior tibial artery, called supramalleolar branch, is located 3.5 ± 0.6 cm proximal to intermalleolar line. The point is key point. The branch has two venae comitantes. Based on the supramalleolar branch, a new flap can be raised in lower third of leg. The axis of the flap is the line between key point and posterior border of the medial condyle of tibia. Along the axis the flap is designed bilaterally. The pedicle length is 5-7cm. The harvestable area of the flap is 20x10cm. The operative procedure of the flap is introduced. The flap can be used in 3 types : (1) antegrade-flow island flap based on supramalleolar branch to repair the secondary dorsal pedal skin defect after harvesting dorsalis pedis flap. (2) free combined flap based on anterior tibial-dorsal pedal artery vascular system to cover large skin defects in forearm or hand. (3) distally based retrograde-flow island flap based on anterior tibial -dorsal pedal artery vascular system to repair secondary defects after transfer of wrap-around flap of big toe.

Conclusion: The pedicle of supramalleolar flap is constant and easy to be dissected due to superficial anatomic position. The blood supply is reliable and harvestable area is large. So it is an ideal flap to repair large skin defects in forearm and hand and secondary skin defects of donor area in foot after transfer of wrap-around flap of big toe and dorsalis pedis flap. The only disadvantage of flap is skin grafting in donor site.



FP309

Upper limb function after the extended latissimus dorsi flap

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Introduction: Latissimus dorsi donor sites are generally accepted to offer minimal impact on the upper limb function. After informal patient feed-back suggested functional limitations following extended latissimus dorsi flaps, we embarked upon a study to formally assess the patient's perception of change in upper limb functioning with extended latissimus dorsi flaps.

Methods: 25 consecutive patients with unilateral extended latissimus dorsi flap breast reconstructions and at least one year follow-up were included. An independent, comprehensive, standardised, telephone questionnaire was carried out recording details on numerous, specific personal, household, work, sport and leisure activities, comparing pre- to post-op. Patients were also asked to comment on limitations, score their satisfaction (with donor site) and if, with hindsight, they would undergo or recommend the procedure. Case-notes were reviewed retrospectively.

Independently, a hand therapist recorded pre- and interval post-op DASH scores.

Results: Questionnaire return was 100%. 8 of 25 had pre- and post-op DASH evaluations, the remainder had post-op evaluations. Mean post-op period was 22 months. 40% of patients perceived no limitation. Details of restrictions in 60% are presented. Activities limited generally required overhead extension, usually with lifting weights. Impact on activities was considered acceptable by the patients with all patients at least, very satisfied. Those who wished, returned to work (mean time 4.5 months).

Conclusion: Extended latissimus dorsi flaps do impact on patient perception of upper limb function in 60%, with donor site tightness or limitation in activities which involve overhead extension.



FP310

Soft tissue reconstruction of extremities using the anteromedial thigh perforator free flap

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Thigh perforator flaps are popularly used, because they have a small thickness, a long vascular pedicle and low rate of donor site morbidity. Among thigh perforator flaps, anterolateral thigh perforator flaps are generally used. But it is not easy to dissect the vastus lateralis muscle to find the vascular pedicle. Only a few authors have reported anteromedial thigh perforator flaps and the anatomy of the anteromedial thigh perforator has not been known clearly. The authors have planned 35 anteromedial thigh perforator flaps that have septocutaneous perforators for the last 2 years. Among 35 flaps, we were able to find anteromedial thigh perforators in 19 cases (54.3%). We couldn't find anteromedial thigh perforators which have suitable size to perform anastomosis in the remaining 16 cases. We converted these 16 cases into anterolateral thigh perforator flaps during surgery. The size of the flap ranged from 5x4cm to 13x10cm. The mean flap area was 68cm². We performed the anastomosis of one artery and one or two comitans veins. In 6 cases, we performed additional vein anastomosis using the greater saphenous vein which is included in flaps. The recipient sites were hands in 9 cases, legs in 5 cases, feet in 4 cases and a forearm in 1 case. The perforators originated from the medial descending branch of the lateral circumflex femoral artery in 6 cases, from a branch to the rectus femoris muscle in 10 cases, from both medial descending branch of the lateral circumflex femoral artery and a branch to the rectus femoris muscle in 1 case and from the femoral artery in 1 case. Of this type of Surgery, 17 flaps (89.5%) survived. However, 2 flaps failed because of arterial insufficiency. We believe the anteromedial thigh perforator flap is a good option when the thigh region is decided as a donor site, but surgeons should keep in mind that the perforator of anteromedial thigh flap may be absent.

Thomas schoeller, 2003

Toshiyuki Shimizu, 1997

Y.G Song, 1984



FP311

Lower extremity free perforator flap soft tissue coverage for large defects of the distal upper extremity

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Background: Large soft tissue defects of the upper extremity are a challenging problem for the hand surgeon. A lack of local tissue often requires free tissue transfer to maintain function of exposed tendons, vessels, neural tissue and bones. Free fasciocutaneous perforator flaps harvested from the lower extremity allow for transfer of thin, well vascularized tissue coverage while eliminating problematic donor site morbidity of the upper extremity.

Material and methods: Options for perforator flap coverage of the distal upper extremity are presented. Case reports show our approach to large posttraumatic defects of the forearm and wrist. The ALT and the peroneal artery perforator flap have become our primary choice due to reliable vasculature and resilient tissue.

Results: Free Perforator Flaps offer a demanding, yet functionally convincing option for the coverage of large distal upper extremity defects. Free fasciocutaneous perforator flaps are thin and pliable and thus ideal for soft tissue reconstruction of the forearm and hand. Tissue transfer is achieved without sacrificing the latissimus dorsi muscle or other functionally important muscles. When the lower extremity is chosen as the donor site, patients benefit from no further impairment of the upper extremity. The size of the ALT allows for coverage of up to 50% of the circumference of the wrist in most patients with primary closure of the donor site. Smaller defects are better addressed with the peroneal artery perforator flap. Due to relatively constant anatomy these flaps can be quickly harvested and transferred. Once the surgeon is familiar with perforator flap surgery, this very elegant technique will become a useful alternative.



FP312

Medial sural artery perforator flaps for reconstruction of soft tissue defects in the hand

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Objective : The medial sural artery perforator flap is relatively new and has been used chiefly to reconstruct tissue defects in lower extremities by several groups. We report our experience of use of this new flap in reconstruction of defects of soft tissues in the hand in 8 cases.

Materials and Methods: In the past 2 years, we used this flap in 8 cases for hand reconstruction. There were 5 female and 3 male. The ages ranged from 23 to 53 years. Soft tissue defects were due to trauma to the dorsal hand and carpus. The flap was harvested from the posterior medial aspect of the upper leg superficial to the medial head of the gastrocnemius muscle. The flaps were nourished by 1 to 3 perforator arteries. We harvested the flap based one principal perforator artery and vein. Flap size ranged from 14 x 10 cm to 8 x 6 cm. The flaps were anastomosed to the arteries and veins in the recipient. The donor area was closed directly or with a skin graft.

Results: All flaps survived except in one patient. In another case, the medial half of the gastrocnemius partially necrotized and was treated with debridement. Follow-up for 5 to 14 months showed that the area with flap coverage had satisfactory cosmetic appearance without apparent bulkiness. Scar in the donor was very localized.

Discussion: We found that this flap is relatively thin and its skin color and thickness match the dorsum of the hand. It provides a satisfactory option to treat an extended soft tissue defect on the dorsal hand. The medial aspect of the upper leg is exposed less frequently than many other flap donors. Similarity of color and thickness of the donor with the recipients and availability of this flap in an extended wound are advantages.



FP313

Comparison of the pins and rubber traction system against the modified Banjo frame for complex intra-articular fractures of the proximal interphalangeal joint

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Introduction: Numerous treatment modalities have been described for intra-articular proximal interphalangeal joint (PIPJ) fractures. However, only a few of these provide dynamic distraction throughout the range of joint motion. These include the Pins and Rubber Traction System (PRTS) described by Suzuki (1994) and the Banjo traction system originally described by Schenk (1994). In our hospital we use a modified version of the Banjo system (MBS) by David Martin where the outrigger has a semicircular shape rather than circular. No previous comparative analysis of these has been undertaken.

Method and Results: An ethically approved retrospective analysis of 18 consecutive PTRS and 23 MBS was performed over a 5 year period. The results are shown below for PTRS: MBS respectively. Average PIPJ range of movement (range) 65(40-122): 70(28-120) ($p = 0.49$), Average Total Active Range of Movement (range) 216(141-318): 203(116-265) ($p = 0.31$), Average Number of Hand Therapy Appointments 12.2: 12.8, Average Extension Lag (range) 15(0-36): 7(0-28), Infection 3/18: 2/23, Early Frame Removal 1/18: 2/23

Conclusion: The MBS is not a commonly used technique; which, when performed correctly, can result in similar good recovery of range of motion and complication rate as the PRTS. The relative ease of operative technique may result in more favorable outcomes from the less experienced operator. Increased awareness of the Banjo technique and its results is therefore desirable amongst both hand trainers and trainees. The MBS has been used effectively at Chelsea and Westminster hospital. However, more recently, the PRTS has been used for complex PIPJ fractures. There is no statistical difference in the results between the MBS and the PRTS. Our results are in line with other papers. The benefits and limitations of each technique will be discussed.



FP314

Dynamic external fixation for digital articular fractures

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Introduction: Based on the principle of ligamentotaxis, many handcraft devices have been developed to treat digital articular fractures, the limits of which being their reproducibility. The authors have initially turned a static external fixator into a dynamic device and thereafter developed a specific device to combine the principle of ligamentotaxis with joint mobilisation.

Methods: Fifteen out of 32 patients operated on with this procedure could be reviewed with a minimum 14-months follow-up. Fractures involved the metacarpophalangeal (MP) joint of the thumb (4 cases) or the proximal interphalangeal (PIP) joint of long fingers. The external fixator was placed under loco-r egional anesthesia. Traction was initially maintained without mobilisation for ten days. The patient was then instructed about locking and unlocking the device to allow passive mobilisation for 15 days. Thereafter, active motion was encouraged for another 15-days period. The fixator was removed at the consultation and the patient is asked to continue active mobilisation trying to increase the range of motion (ROM).

Results: The treatment was well tolerated by all of the patients, and no local sepsis was observed around the K-wires. The best results were obtained with fractures of the MP joint of thumbs (n=4) with a residual ROM of 50 . Final ROM of PIP joints (n=11) ranged from 70 to 90 . Full ROM was achieved in 5 cases, a 10 to 20  lack of flexion was observed in three cases and a 10 to 15  lack of extension was observed in three cases. Mild barometric pain was reported in three cases and effort-related pain in two cases. All of the patients regain their initial professional activity.

Conclusion: The dynamic external fixator is easy to handle and the technique is reproducible. This technique allows articular remodeling while preventing from capsular and ligamentous retraction.



FP315

Results after static and dynamic treatment of hyperextensive volar plate avulsions of the proximal interphalangeal joint of the finger

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Objective: Two conservative treatment methods of hyperextensive bony avulsions of the volar plate insertions in the PIP joints were investigated to compare the results and potential difference in duration of the rehabilitation after immobilization.

Methodes and patients: All patients were adults with an acute hyperextensive injury. Twelve patients in the first group were treated by immobilization in a short arm cast including the injured finger and his neighbour and fifteen patients in the second group were treated by plastic dorsal bloc splint allowing free movement of the wrist and MP joint but reducing the PIP joint extension for 40 degrees. Immobilization was kept for 3 weeks in both groups.

Results: In the first group eight patients were satisfied achieving full range of motion within two weeks, three were bothered by flexion and extension lag due to swelling but achieved full range of motion in 4 to 12 weeks and one by prolonged swelling, flexion as well as extension lag and pain during strenuous work. In the second group all patients were satisfied. Fourteen regained full range of motion within a week, and one still has an extension lag of 10 degrees.

Conclusion: Early active motion after hyperextensive bony volar plate insertion avulsions with a small triangular fragment representing less than 40% of the volar articular arc of the PIP joint results in equally strong and stable joint yet faster rehabilitation since it maintains a significantly better active range of motion and pinch power than static immobilization.



FP316

Fractures around the PIP Joint. Treatment with dynamic traction

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The purpose of our study is to evaluate the efficacy of a new traction splint for the management of phalangeal fractures. The Poole Traction splint combines the concept of ligamentotaxis with early motion. We describe a completely non-invasive method of attaching the traction from a hook secured to the nail to a small 'U' frame extending 5cm from the end of the digit.

60 patients presenting with complex proximal, middle phalanx or intra-articular PIPJ fractures were referred to the Occupational Therapy hand therapists for treatment. The amount of traction applied was determined clinically by assessing patients pain response on movement with the splint insitu, and radiographic examination was undertaken to check reduction position. A passive and active exercise regime was instigated immediately. Weekly therapist supervision to progress ROM and ensure adequate traction was maintained was critical to outcome. X-ray examination was arranged between 3 & 4/52 post fracture to assess fracture healing before the traction was removed. Outcome measures used were Total Active Motion (TAM) and a subjective functional assessment.

55 patients were assessed. Mean age was 34 yrs. Mean period from fracture to application of the splint was 9 days (range 1 – 28). Mean duration of application was 24 days.

87% of patients achieved a functional ROM / TAM \geq 200

Complications and outcome relative to fracture classification will be discussed.

It is our clinical experience that this method is a cheap, quick, effective and patient friendly method of management for patients with complex digital fractures.



FP317

Depressed articular fractures of the proximal interphalangeal joint – Treatment using a novel combination of functional surgical approach, internal fixation and local bone graft.

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Depressed articular fractures of the proximal interphalangeal joint (PIPJ) are often difficult to treat successfully. The joint requires stability and a wide range of painless movement to be functional. The injury is also usually associated with effective bone loss by metaphyseal compression.

Many techniques are described, but most agree that an open approach risks permanent and unacceptable stiffness. For this reason, closed methods involving dynamic traction, or K wires, are favoured by many.

We present a novel surgical approach and fixation technique utilising an anatomically considered approach to reduce surgical trauma, yet providing a clear view of the injured articular surface. A method of local digital corticocancellous bone graft harvest and subchondral impaction is described, together with a stable fixation technique utilising mini lag screws.

8 fractures in 7 patients are presented. All were treated by the senior author using this described technique under regional anaesthesia. There was an average delay of 6.5 days between injury and surgery (range 1 – 27). The median total arc of active PIPJ motion at a final follow up (averaging 24 months) was 82.5 degrees. The median recovery of grip strength was 88% of the uninjured hand. Only two patients reported persistent symptoms described as 'minor' (cold intolerance and discomfort). Return to work (including professional cricket and international rugby) was, on average, 3 weeks (range 1 – 6).

We believe that the application of robust principles of internal fixation and a relatively atraumatic anatomical surgical approach, can be combined in these injuries, to allow early rehabilitation and produce a mobile, functional joint.



FP318

A phalangeal plate for fracture-dislocation of the PIP joint

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Fracture-dislocations involving the proximal interphalangeal joint commonly involves young sports persons and affects 9 out of 100,000 population. The effects are usually disastrous on the function of the injured digit. A plate was designed to facilitate the fixation of severely comminuted fractures.

A whole host of treatment modalities have been proffered over the years, all with a modicum of success. Large single fragments are managed most successfully. Our technique applies specifically to cases where the volar ½ of the base of the middle phalanx is comminuted and the phalanx dorsally displaced. The plate cradles these post-toasties like fragments! It can also be used for large single fragments.

We had 6 patients with PIPJ fracture dislocations. 4 Volar lip fractures. 1 dorsal lip fracture and 1 volar and dorsal or pilon type fracture. 4 patients were treated within 1 week, 1 at 3 weeks and 1 at 4 weeks. Average follow up has been 18 months with a minimum 11 and maximum 26 months. 5 patients are happy with the results having minimal or no pain and a ROM of between 0 to 100. We had one patient with a painful stiff finger at 20 degrees. It didn't affect his work but hindered him in social and sporting activities. This patient presented for treatment after four weeks and was non-compliant post operatively.



FP319

Treatment of dorsal fracture dislocation of the proximal interphalangeal joint using low-profile mini-plate

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Objectives: Treatment of the dorsal fracture dislocation of the PIP joint with articular involvement has been controversial. We have carried out a new specific technique using low-profile mini-plate for this injury and will present this technique and the results of our series.

Methods: We treated 13 patients with an acute dorsal fracture dislocation of the PIP joint. All patients were male with an average age of 36 years at operation. The affected finger in 4 cases was the index finger, the middle finger in 2 cases, the ring finger in 3 cases, and little finger in 4 cases. According to Schenck's classification, 6 cases were Grade IV/ Grade B and 7 cases were Grade IV/ Grade C. The average joint surface involvement was 50.3%. The period from injury to operation was an average of 6 days, with postoperative follow-up period averaging 13 months.

Operative Technique: A 1.2mm K-wire was inserted to the proximal phalangeal head as an extension block with the PIP joint in flexion to reduce dorsal subluxation. Then the joint was extended and volar approach was performed. After the reduction of the impacted fragment and the volar fragment, they are provisionally fixated with a 0.7-mm K-wire. Then internal fixation was completed with low-profile mini-plate. Finally, the extension block was removed, and immediate active motion exercise started in a loose compression dressing.

Results: All patients obtained a bony union. Two patients needed tenolysis with plate removal for tendon adhesion, one patient complained of slight pain, and two had degenerative arthritis. Active motion of the PIP joint was averaged 82 ° (-12.2 ° /94.2 °) and %TAM was averaged 84.5%.

Conclusions: The technique is effective to achieve anatomic articular reduction and rigid fixation of the volar fragment, and early mobilization.



FP320

Treatment of unstable dorsal proximal interphalangeal fracture/dislocation using a hemi-hamate resurfacing arthroplasty

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Purpose: To study the clinical and the radiologic results about treatment of unstable proximal interphalangeal (PIP) fracture and dislocation by hemi-hamate resurfacing arthroplasty.

Materials and Methods: From March 2004 to March 2005, subjects were 11 patients underwent hemi-hamate resurfacing arthroplasty for the treatment of an unstable dorsal PIP fracture dislocation, which articular involvement of PIP joint was more than 50%, or unstable joint despite a lesser degree of involvement. Average middle phalangeal volar lip involvement on initial radiographs was 52% (40-65%), average age was 34 (21-37) years old, and average following up period was 14 months (12-18months). Evaluation of clinical results were determined by postoperative patient satisfaction, range of motion, stability and grip strength, and radiographs were evaluated for union, and graft incorporation, and/or collapse.

Results: All cases satisfied postoperatively compared to preoperatively, and average range of motion of PIP joint measured 80 degrees (75-100 degrees). All cases showed stability of PIP joint, and average grip strength measured 80% of undamaged normal side. Radiological evaluations of all cases showed union, and no complications such as collapse, reabsorption, or recurrent dislocation.

Conclusion: Hemi-hamate resurfacing arthroplasty is efficient in reconstruction of the cup-shaped contour of the joint surface, and recover the functional range of motion of PIP joint when more than 50% involvement of volar base of the middle phalanx, or joint remains unstable despite a lesser degree of involvement.

Key Words: PIP joint, Fracture, Dislocation, Resurfacing arthroplasty



FP321

Ulnar Collateral Ligament Repair of the Thumb Metacarpo-Phalangeal Joint: A Ten Year Experience of a Dedicated Service.

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Early diagnosis and surgical repair, with improved outcomes, for injuries to the Ulnar Collateral Ligament (UCL) of the thumb metacarpo-phalangeal joint (MCPJ) has been achieved in our hand service through a dedicated arrangement between the Accident & Emergency (A&E), Radiology and Hand Surgery departments.

Through a dedicated UCL clinic, supported by a consultant radiologist, patients have been screened early by ultrasound and the extent of the injury diagnosed, allowing early surgery and rehabilitation to be carried out.

Over 1000 cases have been screened, yielding 150 cases requiring surgery. The surgical results are presented here.

The importance of a high index of suspicion and the value of US in the pre-operative assessment of all of the structures around the thumb MCPJ is emphasised.

The surgical technique, including repair of the joint capsule, is described. Extensive experience allows common pitfalls, surgical tips and revision options to be presented.



FP322

Handgun injuries of the metacarpal and proximal phalangeal fractures: Early definitive treatment

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Background: Gunshot injuries to the hand have been studied during military conflicts and in urban settings. Most gunshot injuries to the hand involve a combination of tissue types. Timing of the operation, the type of fixation, time of bone grafting and treatment procedures remain controversial in these injuries. The goal of this study is to report the results of early definitive treatment in extra-articular metacarpal and proximal phalangeal fractures due to low velocity gunshot wounds and to analyze their outcomes.

Methods: A retrospective analysis of 51 metacarpal and 41 proximal phalangeal fractures of 76 patients due to low velocity gunshot wounds treated between 2001 January and 2004 December were carried out. We applied acute fixation in the first twenty-four hours. Also acute bone grafting was applied for sixteen fractures with segmental bone loss and soft tissue reconstruction for twenty-one hands with severe soft tissue loss. The patients were evaluated with total active motion scores, radiographic control, complication rate and the need for second surgery.

Results: The infection frequency was 10.5% and the need for a second surgery was seen 7%. The plate fixation group had significantly higher total active motion scores than external fixation group. The K wire group had the highest ratio of undergoing a second operation. Bone grafting group was associated with good total active motion scores and low complication rates.

Conclusions: The majority of the low velocity gunshot injuries are surgically clean wounds which allow not only early fracture fixation, but early bone grafting and soft tissue reconstruction as well. Plate and screw fixation is associated with significantly better functional outcomes than minimal fixation group.



FP323

Ulnar carpometacarpal joint injuries – A prospective clinical study of injury patterns, aetiology and outcome

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Introduction: Recent cadaveric studies report that ulnar carpometacarpal joint injuries are more complex than clinical studies suggest, with a 55% rate of capitate and 3rd metacarpal base fractures (Yoshida et al, 2003). Clinical studies may be hampered by small case numbers and inadequate radiology yet cadaveric age, gender and mechanism of injury may not match the clinical situation. Outcome might be adversely affected if the severity of injury is underdiagnosed.

Methods: A prospective study was undertaken of 51 ulnar carpometacarpal joint injuries. Diagnostic hand x-rays included AP, oblique, lateral and 60 degree supination from neutral views. Additional CT scan imaging was undertaken in a further cohort of cases. Clinical and/or radiological follow up ranged between 1-58 weeks, mean 19 weeks. Interview of 19 cases was conducted >18 months post injury.

Results: Punch injury and falls were the commonest cause of injury. 82% of cases were male, mean age 31 years.

Injuries: 5th metacarpal base# - 27(2 with hamate#),

4th metacarpal base# -10 (5 with hamate#), 4th & 5th metacarpal base# -10(2 with hamate#), hamate# alone -2, triquetrum# -1, associated dislocations-11. CT scan imaging of additional cases did not reveal the frequency of complex injury patterns reported in the cadaveric studies of Yoshida et al.

Treatment: Undisplaced fractures were treated by cast immobilisation for 4 weeks. Displaced fractures and dislocations were reduced – 5 open, 20 closed. Reduction was maintained by K-wires in 24 cases.

Outcome: Of 19 cases followed up >18 months post injury 58% had persistent pain and 63% reduced hand function. Mean return to work was 11 weeks post injury. 3 patients did not return to work.

Conclusion: Longterm sequelae are not uncommon following injury to the ulnar carpometacarpal joints. A 60 degree supination from neutral x-ray view is a useful diagnostic aid. We urge caution in extrapolating the findings of cadaveric studies of this injury to the clinical setting.



FP324

Fracture and dislocation of the fourth and fifth carpometacarpal joints

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Purpose: Dislocation of carpometacarpal (CMC) joint is frequently combined with the fracture of carpal bone or metacarpal base. Surgical treatment has been preferred rather than conservative treatment because the maintenance of reduction is difficult. However the details of combined fracture pattern has not been well described. Furthermore the indications and the results of open reduction according to fracture pattern have not been well defined. We evaluated the fracture pattern of 4th and 5th CMC joint, and analysed the result of open reduction.

Method: Nineteen of twenty-two patients who undergone open reduction were available. All were male and the mean age was 26 years. The mean follow-up period was 29.3 months. The indications of open reduction were the failure of closed reduction, poor articular congruency or severe comminution of hamate (>Cain IB) and dislocation with fractures of metacarpal base and hamate. We evaluated the fracture patterns using Cain classification with X-rays and CT.

Results: In the location, 4th and 5th CMC joint is 12 of 19 cases, 5th CMC is 6, and 2nd-5th CMC is 1. The fracture of hamate is 16 of 19 cases, which is the buttress against with the dorsal dislocation of the base of metacarpal. There are 3 cases with IA, 4 IB, 4 II and 8 III fractures according to Cain classification. A CT scan taken in 8 cases before operation provided the detail information about the fracture patterns even not visualized in X-ray. The results according to Kumar methods showed excellent and good results in 89%. There was no recurrence of dislocation or arthritis.

Conclusion: A CT especially sagittal image is helpful to assess the details of fracture pattern. Open reduction and K-wire fixation is thought to offer accurate reduction and achieve excellent clinical results.



FP325

Scaphoid bone bruise – Probably not the precursor of asymptomatic non-union of the scaphoid

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The presence on MRI of marrow oedema without fracture following trauma has been described in the knee and called a bone bruise. Such lesions are considered benign and managed conservatively. The clinical implications of similar findings in the scaphoid have not been described. The scaphoid differs from the knee because of concern that a lesion has the potential of leading to scaphoid non-union. This study addresses that concern. It describes clinical and radiological findings, proposes an MRI classification system and investigates outcomes.

Between April 2000 and October 2004, 310 MRI's were performed to investigate acute wrist injury. In 41, a scaphoid bone bruise was identified and this comprised the study group. The bone bruise was classified into 4 grades depending on its extent. The lesion was treated with caution and immobilized in plaster for 6 weeks. Review was arranged at 3 months when, if symptomatic, repeat MRI was requested.

At 3 months, 26 were asymptomatic. 7 defaulted from follow-up. 8 remained symptomatic and underwent repeat MRI scanning. On MRI, 4 of these 8 showed complete resolution of the bruise and the other 4 showed 1 or 2 grades of improvement. At 6 months only 2 patients complained of minor, intermittent discomfort.

This study suggests that scaphoid bone bruise is a benign injury with predictable recovery, unlikely to result in long-term morbidity in the form of non-union. The evidence is of damage to micro-anatomy rather than cortical structure. However, biopsies of bone bruises in the knee have demonstrated chondrocyte degeneration, loss of proteoglycan and necrosis in subchondral bone. At the very least, bone bruising would appear to indicate the possibility of an overlying osteochondral injury. Further study, longer follow-up and repeat MRI scans is required to be confident that caution with these injuries is unnecessary.



FP326

Microstructure and implant fixation within the scaphoid: A micro-CT cadaveric study

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Introduction: Several screw designs for fixation of the scaphoid are available commercially. However, the fixation achieved by screws in relation to the scaphoid microstructure has not been studied previously. The aim of this study was to examine the microstructure of the implanted cadaveric scaphoid to compare fixation achieved with 2 different screw designs: fully-threaded screw (Acutrak) and end-threaded screw with unthreaded shaft (Herbert).

Methods: Five pairs of cadaveric scaphoids were studied. One scaphoid of each pair was implanted with either the Herbert (Zimmer Inc) or the Acutrak (Acumed LLC) screw and then scanned at 36 μ m using a micro-CT scanner (μ CT40 SCANCO Medical). The implant and implant track were delineated and 3-D models were reconstructed to allow visual inspection of the screw fixation in bone. Volume measurements of bone, implant and implant-track in the bone were computed and compared for the two screws.

Results: Reaming the scaphoid produced a track with peripherally impacted trabeculae. The fully-threaded screw maintained bone contact along its length and the end-threaded screw left an unfilled void at the scaphoid waist. Mean scaphoid volume was similar for both groups (Herbert: 1585 + 335 mm³ and Acutrak: 1557.2 + 325 mm³). The mean Herbert implant volume (70.7 + 5.9 mm³) was significantly lesser than the Acutrak (140.6 + 10.9 mm³). The implant/bone volume ratio was significantly higher for the Acutrak screw (0.09) compared to the Herbert screw (0.05, p=0.01). Also, the implant/implant-track volume ratio was significantly higher for the Acutrak (0.53) versus the Herbert screw (0.39, p=0.04).

Conclusions: Fully threaded implants provide better bone contact and fill of the reamed track within the scaphoid. End-threaded implants do not provide any fixation at the level of the scaphoid waist and this may compromise fixation in unstable waist fractures.



FP327

Scaphoid fractures: Protocol of treatment

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Scaphoid fractures account for 2 – 7% of total fractures, and 70% of carpus fractures. It is a frequent entity and of particular concern in view of the type of patient usually attended at our Hospital del Trabajador of Santiago – young working population requiring a prompt labor re-entry, either to clerical or heavy-duty activities. A surgical treatment protocol covering every scaphoid fracture has been adopted as from year 2000 using the Acutrack cannulated screw. A retrospective study, from June 2000 through May 2006, including 100 patients who underwent surgical treatment at the Hospital del Trabajador of Santiago is presented. All patients were male, with a mean-age of 25 years. All patients underwent a conventional radiological study with four projections. Moreover, a wrist-CT scan was performed on 85% of them to confirm classification and location of the fracture. According to Herbert classification, 43% of the fractures were A2-type, 29% were B1, and the remaining 7% were B4. We used a palmar approach for 64% of them, and an average surgical duration of 60 minutes. Bone healing was obtained after 8 weeks. Average medical discharge was 12 weeks. Follow-up median was 32 months. We had no complications due to surgical procedure. Average objective functioning results: 55 degrees of flexion, 60 degrees of extension, 20 degrees of radial deviation, and 35 degrees of ulnar deviation. Comparative fist-strength of 90/112 lbs; and a comparative grip-strength of 16/17 lbs. Subjective results according to PRWE scale: 86% of cases were excellent or good, 10% regular, and 4% poor. In summary, we have presented a treatment protocol suitable to the type of patient most commonly attended by us. The treatment allows for an early recovery, counting from the immediate post-surgical time. We have reported percentages on complications and labor re-entry which are similar to those reported by medical literature.



FP328

Kirschner wire placement in scaphoid bones using fluoroscopic navigation: A cadaver study comparing conventional techniques with navigation

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Purpose: During scaphoid bone fixation, fluoroscopy is typically used to verify the correct screw position, with the disadvantage of irradiation to the patient and surgical staff. Thus, using fluoroscopy, it is impossible to visualize the guide wire or implant position in more than one view simultaneously. The goal of this experimental study is therefore to compare two distal percutaneous Kirschner wire placement techniques in Scaphoid bones: conventional fluoroscopy (CF) vs. fluoroscopic navigation (FN).

Methods: Eleven upper limbs of cadavers were divided into two groups. The CF group included four scaphoids which, using a distal approach, were to be percutaneously fixed with k-wires under CF and then screwed with cannulated screws. The FN group included seven scaphoids which were to be percutaneously fixed with the same technique under FN. We have evaluated the results by measuring the number of guide wire placements needed using fluoroscopy, total fluoroscopic time needed to perform each technique, total operative time, and the accuracy of screw insertion with respect with the axis of the scaphoid.

Results: The accuracy of screw insertion in both groups does not differ significantly. In the CF group, the x-ray exposure time is more than four times higher than in the FN group. In the CF group, an average of more than two insertion trials was necessary. The total duration of the surgical procedure is slightly higher in the FN group than in the CF group.

Conclusion: We are of the opinion that FN offers significant benefits in the treatment of percutaneous fixation of the carpal scaphoid. These benefits primarily include more precise first pass positioning of the guide wire and reduced radiation exposure.



FP329

Percutaneous transtrapezial fixation of acute scaphoid fractures

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Introduction: Percutaneous fixation is an accepted treatment method in acute scaphoid fractures. Fracture healing and biomechanical strength have been shown to be best when the screw is placed centrally. This is often difficult to obtain through a standard volar approach without forceful manipulation of the scaphoid or excision of a part of the trapezium. The purpose of this study is to examine a new percutaneous transtrapezial approach for the fixation of scaphoid fractures.

Method: The outcomes of acute scaphoid waist fractures, fixed transtrapezially with a cannulated Headless Bone Screw (Martin, Germany) from 2000 until 2004 were evaluated. Postoperatively the wrist was protected by a splint for 2 weeks. Results were graded with use of the modified Mayo wrist score. Repeat radiographs were taken to assess screw position and scaphotrapezial osteoarthritis.

Results: 41 patients were included in our study. The mean operating time was 17 minutes. The follow-up time ranged from 14 to 68 months. There was a 100% union rate with an average time to union of 6,4 weeks. According to the modified Mayo wrist score there were 4 good and 37 excellent results. Radiographs showed central placement of the screw in all patients. In 3 patients the screw was removed after one year. One patient developed a CRPS type 1 reaction, with some residual stiffness of the small finger. There were no other postoperative complications. Clinically and radiographically, there were no degenerative changes of the scaphotrapezial joint.

Discussion: Percutaneous transtrapezial fixation is an easy and accurate technique for central screw placement in acute scaphoid waist fractures. This allows early return to daily activities with fast healing of the fracture. Midterm results showed no evidence of scaphotrapezial degeneration. We believe that this technique is optimal for the treatment of acute scaphoid waist fractures in a young and active population.



FP330

Percutaneous screw fixation for scaphoid fractures

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We report percutaneous screw fixation for the treatment of acute and chronic fractures of the scaphoid.

Patients: 67 patients with an average age of 26 years (13 to 69) were treated with this technique. Of these, 57 patients were treated within two months of the original injury (acute group); the remaining 10 were treated at more than two months after injury (chronic group). Acute group included 30 type-A2, 8 type-B1 and 19 type-B2 on the classification of Herbert. The indication to the use of this technique for chronic fractures were minimal sclerosis or resorption at the nonunion site. The mean time from injury to surgery in this group was 3 months (2 to 6 months).

Methods: A standard Herbert screw was used in 40 cases and a double thread cannulated screw in 27, all being inserted with a volar percutaneous technique. 50 patients in the acute group and 7 patients in the chronic group were allowed to use the injured hand immediately after surgery. Seven wrists in the acute group were immobilized in a short arm cast for 3-6 weeks because of an ipsilateral fracture of the distal radius. Three wrists in the chronic group were immobilized in a short arm cast for 2-4 weeks.

Results: All patients underwent a follow-up clinical examination at an average of 10 months after treatment using the scoring system described by Cooney. One patient in each group failed to obtain solid union. The average time for union in the acute group was 6.5 weeks (4-15) and in the chronic group 10 weeks (7-16). There were 51 excellent, 5 good and 1 fair results in the acute group and 8 excellent, 1 good and 1 fair in the chronic group. There were no complications.

Conclusions : Percutaneous screw fixation for acute and selected chronic fractures of the scaphoid is satisfactory and gives rapid functional recovery.



FP331

Scaphoid AARIF: Arthroscopic assisted reduction and internal fixation with the Herbert Whipple system

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The purpose of this study was to assess the results of arthroscopic stabilization of the fractured scaphoid with the Herbert-Whipple system. Twenty five patients were prospectively enrolled with a mean age of 22, 78% male. Preoperative fracture assessment included plain radiographs and dedicated scaphoid CT. Inclusion criteria included nondisplaced to minimally displaced scaphoid fractures with displacement of $\leq 1-2$ mm, coronal intrascaphoid angle (ISA) of $< 55^\circ$ (nl $35^\circ \pm 5^\circ$), sagittal ISA $< 45^\circ$ (nl $25^\circ \pm 5^\circ$), and scapholunate angle of $< 75^\circ$. The exclusion criteria were displacement > 2.0 mm, severe elevation in ISA's or intercarpal angles, significant comminution, and trans-scaphoid perilunate fracture dislocations. Preoperatively, fractures averaged 0.9mm of displacement, with coronal intrascaphoid angles (ISA) averaging 36° , and sagittal ISA's averaging 27° . There were four proximal pole fractures, 2 delayed unions, and one stable nonunion with relatively normal ISA's. The average interval from date of injury to surgery in the acute group was 23 days, and approximately 7 months in the delayed union / nonunion group. All fractures were treated via AARIF with a cannulated Herbert-Whipple screw through the Herbert-Whipple jig. Two cases of delayed union with resorptive changes, yet stable ISA's were treated with concomitant trapezial ridge cancellous bone grafting supplemented with autologous PDGF (platelet derived growth factor) gel. Assessment of union was determined by serial CT scanning until fractures healed. All fractures united with an STS (scaphoid trabeculation score) of 76% at week 6, 84% at week 12, and 92% at week 26. Mean follow up was 7 months with wrist extension averaging 55° , flexion 66° , and grip strength 94 % of the contralateral side. The sole complication was one delayed union (7 months) secondary to eccentric, off axis, volar screw placement.



FP332

Mini-open dorsal approach for fixation of scaphoid waist fractures

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We report the outcomes of fifty surgeries to repair an acute scaphoid waist fracture using a mini-open dorsal approach. The technique permits easy access to the central axis of the scaphoid and accurate screw placement. No other large series using a mini-open dorsal approach for open reduction and internal fixation of scaphoid waist fractures is described in the literature. A retrospective review of fifty surgeries performed between 2000 and 2006 to repair acute scaphoid waist fractures using a mini-open dorsal approach was undertaken. All surgeries were performed by a single surgeon utilizing a standard approach and single type of headless compression screw. Patients included in the study had an acute scaphoid waist fracture diagnosed using standard radiographs within three months of the time of injury. The average time from the date of injury to surgery was five weeks. Patients were all followed for a year after surgery. The rate of fracture union, determined by clinical and radiographic criteria, was 98%. The patients demonstrated no significant deficiencies in their clinical wrist range of motion, grip strength, or pain level. This is the largest reported series of surgeries describing the results of a mini-open dorsal approach for treating acute scaphoid waist fractures. This technique is advantageous due to its simplicity, high rate of fracture union, and favorable clinical outcomes.



FP333

Minimum invasive surgery for scaphoid fracture using DTJ screw

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Purpose: Recently, we have developed a new double thread screw (Double Thread screw Japan: DTJ) system as minimum invasive surgery for this fracture. The efficacy and its mechanical property and clinical results for athletes are reported.

Materials & Methods: Since July 2000, internal fixations from a small incision have been done in 156 cases of scaphoid fractures in athletes. In the operation, DTJ can be inserted from a small incision on the skin with a 1.2mm K-wire as guide wire.

Results: Operating time varied from 6 to 32 minutes with the average of 14.5, minutes and post-op. immobilization period was 1.8 week. As the result, bony fusion was seen in 6.7weeks, and the union rate was 100%

Discussion: DTJ is double threaded and cannulated for Φ 1.2mm k-wire. The shape of each thread is so equipped that has the best mechanical property in tensile testing. And also the cannulated body of the screw made the surgical procedure much easier. Once the guide wire is inserted properly, there is no need for drilling and tapping because of its self-drilling and self-tapping mechanism. Compared to other screws, DTJ has several advantages. It definitely needs shorter operation time and the operation can be done from a small incision. Considering these points, DTJ can provide a minimum invasive surgery and could be the best choice for scaphid fractures so far. Especially, prompt and accurate diagnosis with MRI, and fixation with the DTJ appear to be the gold-standard treatment. For early returning to work. We came to the conclusion to recommend our DTJ as the best choice for minimum invasive surgery for acute fracture, also, the best screw for scaphoid nonunion .



FP334

A new composite bioresorbable compression screw for scaphoid fracture fixation

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Introduction: Fixation of scaphoid fractures is usually performed using metal screws. Such screws may obscure the presence of union radiologically, make revision difficult if non-union occurs, and may delay fracture healing by stress shielding. We aimed to assess the clinical outcome of a new bioresorbable composite compression screw ('Little Grafter', Biocomposites Ltd.) used for scaphoid fracture fixation. This is a 4 mm diameter cannulated screw with a proven comparable compressive forces, and manufactured from a composite of Poly-L-Lactic Acid and Hydroxyapatite which might contribute to faster or more reliable healing. It has an elastic modulus properties similar to host bone which may prevent stress shielding. This screw is radiolucent and allows better radiological assessment for fracture union, and, if revision is necessary, it may not require removal.

Methods: 23 patients with different scaphoid fractures fixed using 'Little Grafter' were included in the study. Mean time from injury to fixation was 77.9 weeks (0-837). 18 patients had established non-union (Herbert, D2), 3 had delayed union (type C), and 2 were acute fractures (type B2). Patients were reviewed at a mean interval of 36 weeks post operatively (13-73). Clinical outcomes were evaluated using Krimmer modified Mayo wrist score and union was assessed radiologically.

Results: Mean modified Mayo wrist score was 89.1. (73-100). 18 patients had excellent, four good and one moderate clinical outcomes. Union was achieved in 18 patients (77.3%). Five had non-union (22.3%), those were four type D2 and one type C.

Conclusion: The use of 'Little Grafter' screw for scaphoid fracture fixation demonstrated good clinical outcomes in addition to the advantage of good compression and easy radiological assessment. Composite bioresorbable compression screws may represent an alternative to metal screws in scaphoid fracture fixation.



FP335

Acute volar percutaneous scaphoid fixation: 10 years experience

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We present our 10 year experience of volar fixation of acute scaphoid fractures with 97% union rate and no major complications.

We now have an experience of over 200 such cases and are encouraged by the high rate of union to the extent that we now routinely offer surgery as first line treatment as an alternative to surgery.

The technique involves insertion of a cannulated headless compression screw (Acutrak) under fluoroscopic control (Haddad & Goddard 1998). External splintage is not usually required in the post-operative period and patients can return to work as appropriate when they feel fit, resuming sport when the fracture has united.

We have now treated 227 patients and of the 219 minimally displaced Herbert type B1 or B2 fractures all have united without complications by nine weeks, with no cases of avascular necrosis. Normal hand function has been regained by three months. Of the 8 B4 fractures fixed by a volar approach 6 have failed to unite and we recommend using a dorsal approach for these fractures.

The economic and social cost of plaster immobilization following scaphoid fractures must not be under-estimated. Furthermore fracture union cannot be assured and the treatment of subsequent complications is difficult and demanding. Taking our experience in conjunction with other published series we conclude that percutaneous screw fixation represents a straight-forward minimally invasive procedure with excellent clinical, radiographic and functional outcomes.



FP336

8 year Clinical and Radiological outcome of non-operative versus operative management of acute scaphoid fractures : Prospective randomised Trial

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There is an increasing trend towards early fixation of acute scaphoid fractures. The short term results of fracture fixation have not established a significant benefit over traditional cast management (Dias,2005). We have prospectively evaluated the mid term disabilities and radiological outcome of fracture fixation versus the non-operative cast treatment.

Seventy of 86 (1 dead, 1 migrated, 12 untraceable, 3 refused) patients with acute scaphoid fracture who had been randomised to treatment with internal fixation using Herbert screw or plaster immobilization between 1996 and 1999 were reviewed 6 to 10 years (mean 93 months) after injury (80% review rate). The symptom and disability was assessed using Patient Evaluation Measure (PEM) and Patient Rated Wrist Evaluation (PRWE). The range of wrist movement, grip strength and pinch strength was measured. Radiographs were evaluated to document osteoarthritis, osteonecrosis, implant position and loosening.

Out of 70 patients, 36 were treated with cast immobilisation and 34 with internal fixation. No difference was detected between the groups with respect to age, sex or hand dominance. Patients treated with plaster had similar mean PEM and PRWE scores (Cast 9.8, ORIF 10.2, $p=0.8$), pinch strength, grip strength and the range of wrist movements. Osteoarthritic changes were noted at scaphotrapezial and/or radioscapoid joint in 12 patients. However, only 7 of them were symptomatic. There was no difference in the incidence of osteoarthritis between the two methods of treatment. One patient had asymptomatic implant loosening and one had proximal scaphoid osteonecrosis.

This study did not demonstrate any difference in disabilities or radiological outcome between non-operatively treated or internally fixed acute scaphoid fractures in the medium term of 8 years.



FP337

Intensive keyboard use is associated with lower prevalence of carpal tunnel syndrome among working-age persons: Results from a population-based study

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The association between carpal tunnel syndrome (CTS) and work-related activities is intensely debated. Despite increasing computer use few studies have specifically investigated its association with CTS. We studied the association between self-reported intensity of keyboard use at work and prevalence of CTS.

Method : A general health questionnaire was mailed to 2465 persons, 25 to 65 years, randomly selected from the general population of a representative Swedish region. The questionnaire inquired about presence/severity of pain and numbness/tingling in different body regions. It also inquired about current and longest ever employment and work activities including average time using keyboard (or typing) during a usual working day. Responders reporting recurring numbness/tingling in the median nerve distribution in the hands were asked to attend physical examination and nerve conduction studies (NCS). The prevalence of CTS, defined as numbness/tingling in the median nerve distribution plus abnormal NCS, was calculated and compared between groups according to amount of keyboard use as reported in the response to the questionnaire. Prevalence Ratio was calculated adjusting for personal factors (age, sex, body mass index, smoking).

Results : The response rate was 83%. Of the symptomatic persons 80% attended examination. The prevalence of CTS among persons who had reported 1 h/day or more keyboard use during usual working day was 2.7% and the prevalence among those who had reported no or less than 1 h/day was 5.1%; Prevalence Ratio 0.55 (95% confidence interval 0.32 to 0.96, $p=0.035$). The mean length of time on current job was similar in both groups. Among the symptomatic persons, mean median nerve sensory amplitude for the low-exposure group was significantly lower (more abnormal) than for the high-exposure group ($p=0.030$).

Conclusion : Intensive keyboard use at work appears to be associated with lower prevalence of CTS diagnosed on basis of symptoms and NCS.



FP338

Community based management of carpal tunnel syndrome in the United Kingdom: Year 1 of a primary care hand therapy clinic

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Problem: Patient preference for quality locally based treatment. Patient education is empowering but time consuming. Splint choice and fitting, and advice on adaptive aids are all skilled techniques. Rationing and thresholding of Consultant Hand Surgeon new patient appointments is increasingly needed.

Design: Experienced Hand Occupational Therapist led Primary Care Hand Therapy Clinic (HTC) with General Practitioner referral access and Carpal Tunnel Syndrome (CTS) diagnostic and non-operative management facilities.

Background and setting: CTS is the most common elective referral to Tertiary Hand Centres and has high community prevalence. Mild to moderate symptoms can often be controlled by Therapy led interventions.

Key measures for improvement: Waiting times for clinic appointments. 'Did not attend rates'. Quality of service. Successful community based CTS management rates.

Strategies for change: The HTC aimed to provide quality, locally based treatment for patients with mild/moderate CTS, whilst prioritising Consultant Hand Surgeon new patient appointments and reducing General Practitioner's referral expenses.

Effects of change: Patients were seen at the HTC on average in 20 days, at a cost of £36 per consultation compared with £144 at the Hand Centre. Of the 75 patients assessed, 35(45%) were successfully managed by the HTC, and did not require referral to the Hand Centre. Only 1(3%) of these patients sought further treatment for their CTS within the following 2 years. Of the 42(55%) patients referred to the Hand Centre from the HTC, 26(62%) required Carpal Tunnel Decompression.

Lessons learned: A Primary Care HTC led by experienced Hand Occupational Therapists can shorten waiting times, provide quality, cost effective treatment for mild/moderate CTS, and act as a useful threshold mechanism for Tertiary Hand Centre referrals.



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The SF-6D health utility index is a valid measure for use in cost effectiveness studies in carpal tunnel syndrome

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Health utility measures are used to estimate quality-adjusted life years that in combination with the costs of various treatments provide a measure of their cost effectiveness. Conventional (direct) utility measures determine health preferences with complex techniques (standard gamble and time trade-off). Multi-attribute (indirect) utility measures (SF-6D and EQ-5D) are quality-of-life measures with predetermined preference weights for different health states derived from large general population samples (US, UK, Europe). The SF-6D, derived from 11 items of the SF-36, covers 6 health dimensions and describes 18,000 possible health states; health state values ranging from 1.0 (full health, no problem with any dimension) to 0.296 (most severe problems with all 6 dimensions). The EQ-5D (5 items) covers 5 dimensions and describes 243 possible health states (values from 1.0 to -0.109). These utility measures have not been used in hand disorders.

Purpose : To assess validity of the SF-6D health utility index in patients with carpal tunnel syndrome (CTS) and determine health utilities for CTS before and after surgery.

Methods : In a prospective cohort study patients with CTS completed the SF-36 and the validated CTS questionnaire (symptom severity and functional status scales) before and 3 months after surgery. Responses to the 11 SF-6D items were complete in 100 patients at baseline and 95 patients on both occasions. The EQ-5D index was derived from simulated (SF-36 based) responses to EQ-5D items.

Results : The mean SF-6D index was 0.69 (SD 0.13) before and 0.77 (SD 0.13) after surgery and the mean EQ-5D index was 0.61 and 0.75, respectively; an improvement corresponding to moderate effect size. The SF-6D could discriminate among patients differing in self-rated health and in whether they had a minimal clinically important improvement in CTS symptom severity score ($P < 0.01$).

Conclusion : The SF-6D can be used as a valid utility measure in cost effectiveness studies in CTS.



FP340

Evaluation of a diagnostic questionnaire and scoring system for carpal tunnel syndrome

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Aim: The aim of this study is to evaluate a score, derived from a patient based questionnaire for symptoms combined with the findings of clinical examination, in the diagnosis of CTS.

Methods: 88 patients referred to the Hand Clinic with possible CTS were given the symptom questionnaire, which included the location of paraesthesia in the hand, nocturnal pain, relief of paraesthesia by shaking the hand, relief by use of a wrist splint, and impairment of manual dexterity. A score was derived from the symptom questionnaire and the clinical signs including Tinel's test, Phalen's test, alteration of sensation in the median nerve distribution, and weakness of the thenar muscles. Nerve conduction studies were performed and used as the standard for diagnosis of CTS.

Results: A combined score symptoms for symptoms and signs was calculated. A threshold score level was selected as indicating a diagnosis of CTS. 71 patients were predicted to have CTS and 17 as not. When compared with the results of nerve conduction studies this score had a positive predictive value of 90%, a negative predictive value of 64%, a specificity of 61%, and a sensitivity of 91%.

If a higher threshold score was used the specificity improved but sensitivity was lower. The presence of clinic features of ulnar nerve compression or cervical root irritation, or a history of occupational vibration exposure were associated with a false positive result for the scoring system.

Conclusion: The results have enabled us to develop a model for the management of suspected carpal tunnel syndrome. We believe that the combined score for symptoms and signs is a useful tool for selecting patients who have a reliable diagnosis of carpal tunnel syndrome and who can be referred for surgical decompression without the need to perform nerve conduction studies.



FP341

My first 4,444 modified chow endoscopic carpal tunnel releases – Immediate complications, techniques to avoid them and current method

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My first 4,444 modified Chow E.C.T.R. were done between 1971 and 2006. The immediate complications- division of common digital nerve and superficial palmar arch, as well as incomplete release (no median or ulnar nerve division) are presented and lessons learned. The technique has been modified so that it, at least for me, has become a very safe, reliable, predictable, quick preferred method for carpal tunnel release. The current technique is presented.



FP342

Early return to work following open carpal tunnel decompression

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Carpal tunnel syndrome is common and debilitating amongst workers in the largest Freezing works in the Southern Hemisphere. This study's purpose was to establish whether expeditious rehabilitation and early return to full work following open carpal tunnel decompression (CTD) was acceptable in such high dexterity roles.

Emails to all consultant orthopaedic surgeons in the NZOA establishing their practice regarding postoperative advice for heavy manual work yielded the following: 72% replied and of those performing CTD advice ranged between 2-16 weeks completely off work. In Southland, those with a neurophysiologically-confirmed diagnosis underwent open CTD by one surgeon and were assessed clinically and with validated questionnaires before and after surgery in the 2005/06 season. In addition all patients who underwent CTD in the previous 3 seasons were reviewed. One observer was involved.

In the retrospective group (70), all patients had day-case, open CTD under local anaesthetic, 70% bilaterally. The average return to light duties/rehabilitation was 10 days: to full duties was 28, no further time off was taken, 94% returned to the previous role and there were 2 infections, one superficial and settling with oral antibiotics and one requiring washout. In the prospective group (12), the average return to rehabilitation was 12 days, 33 days to full duties, 92% returned to their previous role and there was one superficial infection. The improvement in QuickDASH score was statistically significant at the 5% level at six weeks follow up. The difference in return to full duty times was not significant ($p>0.05$). Validated symptom visual analogue scores, grip and pinch testing and complication rates are comparable with previous studies (Thurston et al, 1995). This study shows that early rehabilitation and return to work is possible and acceptable in a high demand patient population.



FP343

The synovial flap for recurrence of carpal tunnel syndrome

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Introduction: Recurrence of carpal tunnel syndrome is often related to adhesions of the median nerve to the palmar scar. A simple neurolysis is then inadequate and embending of the nerve in a richly vascularised flap is recommended to allow free gliding of the nerve and prevent from new adhesions while providing vascularisation to the nerve. In 1980 W ulle described the synovial flap, taken from the synovial sheet of the superficial flexor tendons.

Material: Eighteen upper limbs from fresh specimens were dissected and/or radiographed after infusion with coloured gelatine or a radio-opaque mixture to identify the arterial branches supplying the flap.

Twenty out of the 35 patients operated on with this procedure could be reviewed with a minimal one-year follow-up. 11 of the patients previously had carpal tunnel release and remained painless for many months before recurrence of the symptoms.

Results: Dissections and radiographs showed the flap to be constantly supplied by a small artery arising from the ulnar artery. Clinically, ten patients presented with permanent paresthesiae, six with night paresthesiae and four with a painful hand. Tinel's sign was positive in 18 cases and Hunter's sign in 15 cases. Grip strength was constantly reduced. Intense scarring surrounding the median nerve was always noticed during the procedure. The nerve was dissected and isolated from the scar by a synovial flap. Pain totally resolved in 14 patients and remained unchanged in 4 patients. Two patients developed a complex pain syndrome resulting in a poor functional result. Tinel's sign became negative in 16 patients and hunter's sign in 14 patients. Grip strength improvement averaged 15 kg and DASH score was increased up to 50%. No complications related to dissection of the flap were reported.

Conclusion: the synovial flap is simple and reliable while providing results similar to those achieved with more complex procedures.



FP344

Results of ulno-dorsal fascia flap according to Becker/Gilbert after intrafascicular neurolysis for recurrent carpal tunnel syndrome

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Introduction: Multiple revisions because of persistent complaints after carpal tunnel release are leading to an increasing fibrosis at the level of the median nerve and the surrounding tissue. In spite of technical adequate microsurgical intrafascicular release, hyperesthesia at the palmar wrist level may persist.

Material and Method: Between 1995 – 2002 5 patients with recurrent compression complaints of the median nerve at the wrist level were treated with a microsurgical intrafascicular neurolysis according to MILLESI in combination with a pedicled fat-fascia flap according to BECKER/GILBERT. There were 4 female and 1 male patient. Their age ranged from 36 to 55 years. In all patients a minimum of 4 (4-7) previous operations had been performed. All patients had an adequate pain treatment. In a retrospective clinical study the following criteria were evaluated: 1) pain (analog scale 1 – 10), 2) sensibility (static 2PD), 3) active and passive ROM (neutral-0-method), 4) power and pinch grip (JAMAR, PINCHMETER), and 5) subjective judgement of the flap donor site by the patient (excellent, acceptable, fair). The minimum follow-up was 18 months.

Results: In all patients reduction of pain from an average of 7/10 (heavy permanent pain under pain medication) to 4/10 (intermittent pain without permanent pain medication) occurred. There was no change in sensibility after operation. However there was an increase in power grip from an average from 14 kg to 20 in average. The flap donor site was judged acceptable by all patients.

Summary: Combination of microsurgical interfascicular neurolysis with the ulno-dorsal fascia flap will lead to better vascularization at the palmar wrist region, better vascularization at the median nerve and additional "padding" of the neurolysed nerve. This leads to a significant amelioration but not to a complete pain free status of the patient.



FP345

Modified Camitz opponensplasty using transverse carpal ligament pulley in patient with carpal tunnel syndrome

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Purpose: Thenar muscle wasting is common in long standing severe carpal tunnel compression. Unfortunately, muscle wasting rarely recovers after decompression of the nerve. In many cases, a single- stage procedure, combining carpal tunnel release and Camitz opponensplasty, has been used to treat severe carpal tunnel syndrome (CTS) with thenar muscle atrophy. However, Camitz opponensplasty provided good effect to abduction, but little effect to flexion and pronation of thumb. This problem could be solved by making a pulley at transverse carpal ligament.

Method: Ten CTS patients with severe thenar muscle atrophy were selected. All were female and the mean age was 56 years. The mean follow up period was 11 months. The CTS was diagnosed by the physical examination and nerve conduction test. The simultaneous opponensplasty was done in patients with severe thenar atrophy and failure of pulp to pulp pinch. On the last follow up, thumb opposition was assessed by means of three separate indices: maximal palmar abduction, spatial rotation and thumb-to-finger apposition. The outcome was defined as "good" when maximal palmar abduction and spatial rotation was achieved over 80% of the contralateral side and when thumb-to-finger apposition was symmetric.

Results: The average maximal palmar abduction was 80%, spatial rotation was 89%, and symmetry of thumb-to-finger apposition was 88% of contralateral side at the last follow up. Nine patients were recorded as good and only one patient who had an adduction contracture of the thumb before surgery was defined as poor.

Conclusion: Modified Camitz opponensplasty using transverse carpal ligament pulley is simple and effective procedure for restoration of opposition.



FP346

The role of membrane-type 1 matrix metalloproteinase (MT1-MMP) in rheumatoid arthritis

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Introduction: The invasion of adjacent tissues by synovium in rheumatoid arthritis (RA) is associated with joint deformities and tendon rupture in the hand. The process of synovial invasion into cartilage and tendon is poorly understood. Collagen is the main constituent of these tissues and must be degraded for invasion to occur. Collagen is degraded by matrix metalloproteinases, one of which- MT1-MMP- promotes neoplastic cell invasion. MT1-MMP is also expressed on the surface of RA synovial cells. This study aimed to investigate the role of MT1-MMP in RA synovial cell invasion.

Methods: To specifically modulate MT1-MMP activity in RA synovial cells, adenoviral gene delivery vectors were generated. These vectors induced the expression of a dominant negative inhibitor of MT1-MMP and fully active MT1-MMP on the cell surface and enabled inhibition and enhancement of MT1-MMP activity respectively. Synovial invasion into collagen matrices was examined using an ex-vivo tissue invasion assay and cellular invasion was quantified by development of a three-dimensional cell invasion assay.

Results: A fibroblast like (FBL) population of synovial cells invaded from specimens of freshly harvested RA synovium into type I collagen matrices; this invasion was reduced by specific MT1-MMP inhibition. Quantitative analysis demonstrated a statistically significant reduction in synovial FBL cell invasion after MT1-MMP inhibition, and significant enhancement after over-expression of fully active MT1-MMP.

Conclusion: MT1-MMP is critical during synovial cell invasion into collagen matrices.



FP347

Evolution of surgery for scleroderma of the hand

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Purpose: Scleroderma significantly affects the function of the hand. The evolution of hand surgery for scleroderma over a 20 year period is reviewed.

Materials & Methods: 271 hand surgery procedures were performed in 137 patients by a single surgeon. 76 digits in 36 patients underwent partial or ray amputations for gangrene. 165 digits in 31 patients with digital ulcers or Raynaud's phenomenon were treated prophylactically by digital sympathectomy and 6 patients by microsurgical revascularization. Painful or infected deposits of calcinosis were debulked in 42 digits in 26 patients. 36 patients with severe contractures of the fingers underwent 118 PIP joint arthrodeses and 43 MCP joint capsulotomies.

Results: Poor wound healing was extremely uncommon following digital amputations for gangrene. Digital sympathectomy and microsurgical revascularization promoted healing of digital ulcers and decreased the severity of Raynaud's phenomenon, but ulcers recurred in 34% of patients within 2 years. Arthrodesis of PIP joints was very effective in promoting healing of ulcers over the dorsal aspect of the PIP joints and allowed improved grasp function. However improved flexion at the MCP joints following MCP joint capsulotomies was disappointing.

Conclusions: The hand surgeon can effectively collaborate with the rheumatologist in surgical treatment of the functionally disabling manifestations of scleroderma in the hand. Amputations for digital gangrene are very effective in relieving pain. Digital sympathectomy and microsurgical revascularization are probably only palliative in reducing the severity of Raynaud's phenomenon. Arthrodesis of the PIP joints in a functional position of 45 - 55° will allow healing of dorsal PIP joint ulcerations and improved grasp in patients with severe flexion contractures. Restoration of motion at the MCP joints remains an unsolved challenge.



FP348

Efficacy of magnetic resonance angiography of the hand in management of patients with scleroderma

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Scleroderma is a generalised multiorgan connective tissue disorder, with Raynauds phenomenon a common manifestation resulting in digital ulceration and pain. Medical treatment has limited efficacy, with surgery in the form of microarteriolytic and reconstruction also advocated.

Up to the recent past standard Catheter Angiography has been used as the pre-operative investigation of choice. Contrast material-enhanced Magnetic Resonance Angiography has been validated for use in the imaging of vascular disorders of the abdomen and the lower limb. There is little in the literature with regard to its use in the upper limb, and specifically with regard to patients with scleroderma.

A retrospective review of patients who underwent surgery for the treatment of manifestations of scleroderma was carried out from 2000 to 2005. A total of 17 patients were identified. Twelve of these patients had Magnetic Resonance Angiography, with the remainder undergoing standard catheter angiography.

The indication for investigation, along with patient demographics were documented. The radiological pattern and severity of disease was carefully noted in each patient and correlated with the presenting clinical complaint.

The digital arteries were the most commonly affected vessels in all patients.

In over one-third of cases the ulnar artery was significantly occluded, with the radial artery invariably patent in all patients.

The information collected using Magnetic Resonance techniques was compared with that of patients who underwent standard angiography and was found to be comparable.

We feel that this non-invasive technique readily identifies the vascular pathology associated with scleroderma and should be used as the investigation of choice in such patients.



FP349

Scleroderma in the hand and its surgical approach

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Scleroderma can occur as a spectrum of diseases from localized to systemic types. It is mainly the systemic type, named systemic sclerosis which involves the hand, leading to Raynaud phenomenon, ulcerations, arthropathies and calcifications. Systemic sclerosis will lead to significant functional loss of the hand. Surgical intervention has been controversial due to anticipated wound healing problems arising from diminished blood circulation. Nevertheless a surgical approach is indicated when conservative and pharmacological treatment options fail. Surgical options include microsurgical revascularization, debridement, arthroplasty, capsulotomy, and amputation. We discuss surgical options in regard to risks in scleroderma patients. Despite the increased risk the hand surgeon can offer reasonable treatment options and thus greatly increase the quality of life for patients.



FP350

Seventeen-year survivorship analysis of silastic metacarpophalangeal joint replacement

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We reviewed the records and radiographs of 381 patients with rheumatoid arthritis who had undergone silastic metacarpophalangeal joint replacement during the past 17 years. The number of implants was 1336 in the course of 404 operations. Implant failure was defined as either revision or fracture of the implant as seen on radiography. At 17 years, the survivorship was 63%, although on radiographs two-thirds of the implants were seen to be broken. Factors which improved survival included soft-tissue balancing, crossed intrinsic transfer and realignment of the wrist. Surgery to the thumb and proximal interphalangeal joint had a deleterious effect and the use of grommets did not protect the implant from fracture.



FP351

Metacarpal phalangeal replacement with a resurfacing implant

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Anatomic replacement of the MCP in patients with Rheumatoid arthritis was performed in 40 patients with a resurfacing arthroplasty

Methods and Material: The clinical records and radiographs of patients with a resurfacing implant of the MCP joint were reviewed. Pre and post operative motion and stability were assessed. Radiographic analysis of loosening or instability were measured.

Results: The range of motion after surgery averaged 15° lack of extension to 65° of flexion. Recurrence of ulnar drift was less than 20° in all but 5 patients. Volar subluxation of the MCP joint occurred in 6 patients as a result of inadequate ligament repair. Pinch strength improved 3 kg and grip strength 5 kg. Patients were please with the increase in hand function and strength. No evidence of implant loosening is reported

Conclusion: Resurfacing implants provide a good option for the rheumatoid patient and give better motion and stability than silicone implants.



FP352

In-vitro testing of MCP implants with varying ulnar deviation

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Introduction: Silicone MCP joint prostheses remain the Gold Standard arthroplasty in RA. However their clinical lifespan does not match the performance achieved in in vitro testing. Previous in vitro testing has been conducted in flexion/extension only with no ulnar deviation although this frequently arises in the clinical scenario. We have conducted in vitro tests to establish if ulnar deviation may explain the earlier failures encountered in the clinical situation.

Method: A 12-station MP prosthesis test facility was developed to evaluate the effect of ulnar deviation on 12 size six Swanson-type implants. The proximal and distal stems were located in bespoke holders with 0,5mm clearance around the stem to allow prosthesis pistoning. Four stations had no ulnar deviation, four had 10 degrees and four had 20 degrees of ulnar deviation. All 12 implants were simultaneously flexed through 0-90° at 1.6Hz and submerged in Ringers solution at 37°C. Implants were visibly inspected until failure every 250,000 cycles using stereomicroscopy at 15x magnification.

Results: Early wear increased significantly with increased ulnar deviation starting at just one million cycles for the implants at 20 degrees deviation. These also failed earlier with typical tearing at the base of the distal stem.

Conclusion: In vitro testing indicates ulnar deviation promotes faster implant failure, which corroborates the clinical experience. This reinforces the importance of radial collateral ligament reconstruction at operation and the important parameters to be considered for optimum implant design.



FP353

Universal 2 total wrist arthroplasty: Early results

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To assess the outcome of Universal 2 total wrist arthroplasty.

Sixteen patients underwent universal 2 total wrist replacement for severe rheumatoid arthritis at Wrightington Hospital.

Patients were evaluated clinically for active range of movement, grip strength, DASH score, pain score and patient satisfaction. Radiological assessment included standard PA and lateral views.

All patients were females except two. The average age was 58 years (range 37 to 73). The average follow up was 21.5 months (range 9 to 28 months). Results revealed an average of 27 degrees of dorsiflexion, 38 degrees of palmar flexion, 15.9 degrees of ulnar deviation and 6.6 degrees of radial deviation. Average grip strength was 9.7 kg with a DASH score of 44.5. One patient had superficial wound infection, which settled with antibiotics. One patient had X ray evidence of distal component loosening. No patients had dislocation. All patients were satisfied except three. One patient continues to have problems due to ulna stump instability, one patient underwent removal of wrist implant 9 months post op for a presumed infection and one patient had removal of implant due to fracture of carpal component stem.

We conclude that the early results of universal 2 total wrist replacements are promising, however it will be interesting to follow up the outcome in long-term.



FP354

Total wrist arthroplasty in rheumatoid and osteoarthritis: Comparison of outcomes

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Total wrist arthroplasty bears the historical burden of high failure rates. Promising results with implants of newer design have emerged recently. To our knowledge this is the first study to publish paired results in rheumatoid and osteoarthritis patients with the Universal ® implant.

Material and Methods: 17 (7 OA/10 RA) patients have been operated on between 2002 and 2006. Objective measures such as ROM, grip strength, tip and key pinch, and subjective values such as DASH Score, VAS, satisfaction and complications rate, were matched.

Results: There was no difference in age, sex and dominance of hand between the groups. At a 24 month post-op follow-up, ROM in S, F and forearm rotation showed slightly better results in the OA than in the RA group. Grip strength, tip and key pinch showed significant improvement for the osteoarthritis group. The DASH Score showed better results in the OA group. VAS and satisfaction rate were better in the RA group. Complications were much higher in the OA group.

Discussion: Reports on total wrist implants using a new design like the Universal® are rare, the numbers of cases small and the follow-up short. This applies to our study too. Although considering the small number of cases in the two groups of osteoarthritis and rheumatoid patients, we found favourable objective results in the first and a positive tendency as to subjective values in the latter.

Conclusion: Except for the unsurprisingly significant difference in grip strength, tip and key pinch in favour of the OA group, there is no strong argument for an implant in this group. There is lack of satisfaction and a higher complication rate. In our opinion we prefer salvage procedures in osteoarthritis patients. Higher appraisal and lower complication rates, presumably due to lower demands, favour total wrist arthroplasty in rheumatoid patients.



FP355

Brachial artery thrombosis in infants: An algorithm for limb salvage

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Background: Arterial occlusion in infants, although uncommon, is usually an iatrogenic event associated with arterial vascular access. Most common in the upper limb, the consequences of iatrogenic arterial occlusion may be gangrene and limb loss. Even if there is adequate collateral flow and limb loss is avoided, long-term growth disturbances may be seen. There are few published data to guide the management of arterial occlusion in premature or sick infants. In general, there is agreement regarding the importance of early diagnosis and the reestablishment of limb perfusion with the fewest risks, but the optimal choice and timing of treatment modalities remain unknown.

Methods: This article examines the authors' experiences at the Royal Children's

Hospital, Melbourne, and provides their algorithm for the management of this complex iatrogenic disease.

Results: The management algorithm has successfully treated 11 limbs in 11 patients with arterial vascular access-associated thrombosis over the period 1995 to 2003, with no instances of limb loss. Five of these patients required surgical intervention.

Conclusion: The authors recommend a multidisciplinary approach involving plastic surgeons and hematologists for all cases of suspected or confirmed arterial thrombosis. A consensus algorithm that determines the role of heparin, thrombolysis, and acute surgical interventions, and the sequence of such interventions, is useful in providing the framework of therapy. The early recognition of the *limb at risk* is a key factor in obtaining a successful outcome.

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FP356

Microsurgical reconstruction of complex defects of the upper limb

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Introduction: The upper limb is one of the most involved anatomical segment in various traumas, but also could be the center of other pathological conditions, as congenital malformations, tumors. Its complex anatomy and functionality could raise very difficult problems from reconstructive point of view. In many of cases, the single way to obtain good morphological and functional results is to use various microsurgical procedures.

Material and methods: The study will try to standardize the main tactical and technical principles in the microsurgical reconstruction of complex defects in complete or partial amputations and severe crush injuries of the upper limb, based on more than 300 microsurgical operations. We will insist also to the advantages of the emergency all in one reconstruction in traumas cases. A special attention will be paid to the use of the most recently described perforator flaps, both as free and microsurgical non-microvascular flaps.

Results: We had 91% of successful microsurgical procedures, with very good integration of the simple or composite used flaps; in 4% it was registered some minimal marginal necrosis of the flaps; in 15 cases (5%) we did immediate postoperative revisions of the vascular anastomoses, but we lost 6 flaps (2%). The advantage of using immediate emergency flaps and the principle of all in one reconstruction was proved by the very good and short evolution of all the cases in this category.

Conclusions: In both simple or composite defects the advantage of using microsurgical procedures is evident. More, in traumas cases, the all in one reconstruction whenever possible improves the quality of results and shortens the recovery time. The use of the new perforator flaps both as free or local/regional pedicle flaps improves also the quality of results by the greater tissue similarities and the minimal donor site morbidity.



FP357

Post-traumatic bone defects of the upper extremity: Treatment with VFG

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Purpose: Vascularized bone graft is most commonly applied for lower extremity reconstruction. However, indications for its use in the reconstruction of the upper extremity have expanded in recent years, as the technique has become increasingly appreciated. The aim of this paper is to review our experience with the use of vascularized fibular graft (VFG) in the treatment of large bone defects, after trauma or osteomyelitis, located in the upper extremity.

Method: Between 1993-2005, 31 patients with segmental bone defects following upper extremity trauma were managed with VFG. There were 22 males and 9 females, aged 39 years on average (range, 16 to 65 years). The reconstructed site was clavicle (1 case), humerus (13 cases), radius (11 cases) and ulna (6 cases). The length of bone defect ranged from 6 to 16 cm; in five cases the fibular graft was harvested and used as a vascularized fibula osteoseptocutaneous flap.

Results: 29 grafts were successful. The mean period to obtain radiographic bone union was 5.4 months (mean time in the humerus 6 months and in the forearm 4.8 months). Three patients required additional bone grafts and two cases showed fractures of the grafted bone.

Discussion: The results obtained suggest that the use of the VFG to the arm is more complex than application to the forearm with a higher rate of complications. A vascularized fibular graft is indicated in cases where conventional treatment has failed, and for reconstruction of bone defects larger than 6-7 cm in the humerus or forearm bones. It is also indicated in cases involving osteomyelitis and infected nonunion.

Conclusions: Fibular graft allow the use of a segmental of diaphyseal bone which is structurally similar to the radius and ulna and of sufficient length to reconstruct skeletal defects of the arm.



FP358

A comparison of vascularized fibular graft for segmental loss of the humerus and femur: Technical questions and outcomes

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Purpose: This study evaluates the different requirements of reconstruction of segmental defects of the humerus and femur using a vascularized fibular autogenous bone graft. It intended to determine if there are inherent differences in success rates between the two anatomic areas; what might be the optimal method of fibular graft stabilization; and were there different functional outcomes between the humeral and femoral reconstructions.

Methods: A retrospective study of a single surgeon's experience over an 8-year period with 15 femur and 14 humeral reconstructions with a vascularized fibular transfer forms the basis of this study. 86% of the reconstructions were for posttraumatic defects (12 femur, 13 humerus) while 14% for reconstruction post tumor resection (3 femur, 1 humerus). The average defect of the femur was 10.6 cm and humerus 10.1 cm. Plate fixation was used in 10 femurs and 12 humerus with 4 femur grafts and 2 humeral grafts secured only with interfragmentary screws and 1 femur stabilized with an IM rod.

Results: The time to union was 19.1 weeks in the femoral group and 12.4 in the humeral grafts. Nonunion at one end of the graft occurred in 4 femurs (26%) and 4 humeral grafts (28%). 5 of the 8 nonunions were in grafts secured only with screws. Graft hypertrophy occurred in 14/15 femurs and 11/14 humeral fibular grafts. Limitation of knee or elbow motion was noted in over 50% of both groups.

Conclusions: When Securing a vascularized graft for a segmental humeral or femoral reconstruction, stable fixation with plates should be considered. Because of the complex nature of the injury, associated functional deficits are commonplace and early reconstruction may limit associated joint stiffness.



FP359

Free vascularized fibular graft in the treatment of severe osteomyelitis of the forearm

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Severe infections at the forearm level are difficult to treat not only in terms of sterilization but also in terms of functional restitution. At the forearm level, local flaps generally are not sufficient to cover big defects. Bone reconstruction is the biggest problem. Conventional bone grafts may be resorbed or have difficulty in healing in infected and hypovascular tissue bed. We retrospectively studied 22 cases of severe chronic osteomyelitis - fourth degree of Cierny-Mader classification - of the radius and/or the ulna treated with free vascularized fibula bone grafts (between 1992 and 2003). The mean age of our patients was 35 years and ranged between 16 and 65 years. In 20 cases a two-stage treatment was performed. All patients were reviewed and classified according to the Tang system (clinical and radiological findings).

In all 22 cases the infection never recurred. According to Tang's classification, the following results were obtained: excellent clinical evaluation in 12 patients, good in 8, fair in 2 and poor in none; excellent radiographic evaluation in 12 patients, good in 6, fair in 3 and poor in 1. There were no cases of fractures of the grafted bone. Distal screw loosening was seen in two patients. A second operation was necessary in three cases to remove the previous plate and replace it with a new plate associated with bone graft to achieve bone healing. No complication was registered on the harvesting site. All patients returned to everyday routine activities.

The development of microsurgical techniques has increased the therapeutic possibilities for these severe problems. Vascularized fibular grafts allow use of a segment of diaphyseal bone, which is structurally similar to the radius and the ulna and of sufficient length to reconstruct most skeletal defects. In the upper limb the vascularized fibular graft is indicated in patients where conventional bone grafting has failed or large bone defects are present (exceeding 5 cm).



FP360

Joint reconstruction with free vascularized osteochondral transplantation

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The purpose of this study is to introduce a reconstructive method in major joint defect of upper extremity with free vascularized bone and joint transplantation. We underwent 16 cases of joint reconstruction with free vascularized fibular head or metatarsal joints. Affected joints were 12 wrist, 3 shoulders and one elbow joint. Average age of the patients was 12.3 years (Range 3-34). Average follow-up period was 6.3 years (Range 1-16 years). The etiologies of the joint defect were 7 traumatic, 3 infection sequel, 3 congenital, 3 tumorous conditions. Donor bone and cartilage of this transplantation surgery were 15 fibular head with metaphysis and one case of double metatarsal joints transplanted to the elbow joint. We evaluate the joint conditions and fate of the transplanted osteochondral parts during follow-up period with serial radiographic study and functional evaluation of the joints. Transplanted bony portion united to recipient bone within 5 months in all cases (Average 4.8 months, Range 3.2-8.3 months). The articular cartilage of the donor bone survived with expectable outcome in 13 cases, maintained continuous growth potent was observed in children patients in both volume and length of the bone and cartilage. Adoptive changes of the transplanted osteochondral part were observed in 13 cases. In the case of elbow reconstruction with double metatarsal joints transplantation had persistent lateral instability and weakness of joint power was revealed.

In conclusion, free vascularized osteochondral transplantation to the defective joint portion in major joints in upper extremity can utilize as an one of the most challenging methods in profound joint lesions that has no effective solutions with conventional modalities. The proximal osteochondral part of the fibula can serve very effective donor in this procedure. Free vascularized metatarsal joint transplantation to the elbow joint could not gave sufficient stability even though double metatarsal joints were transplanted.



FP361

Severe civilian blast injuries to the hand: Classification of injury for predicting functional outcome and intervention

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Purpose: To predict functional outcome and interventions necessary for management of severe civilian blast injuries to the hand.

Method: A classification was developed by retrospective review of severe blast injuries treated by a single surgeon between 1993-1999. The classification was used prospectively on 12 patients (2000-2005). Predictions were made on functional outcome and the algorithm of management on the day of the injury. Classification was based on the extent of damage to the thumb as severity of injury to the opposing digits & palm parallels that of the thumb.

Type 1: Severe first web injury requiring radical debridement and free or island flap within 72 hours. MCP dislocation & UCL ligament may be associated. Full functional recovery.

Type 2: Severe first web loss, CMC dislocation, thumb digital neurovascular damage and severe injury to index. Treatment algorithm of serial debridement, CMC reduction & k-wire followed by web reconstruction by free or island flap within 3-4 days. Near full functional recovery with secondary procedures for nerve reconstruction and opposition transfer for type 1 & 2.

Type 3: Severe damage to thumb ray, index, middle fingers and palm. Thumb salvage possible only through MCP joint and varying degrees of amputation of adjoining digits. Serial debridement and large free flap cover 5-7 days after injury. Salvage of hand function possible with secondary reconstruction.

Type 4: Extensive injury, amputation of thumb through CMC, disarticulation of other digits through MCP or PIP joints. Delayed cover with pedicle flaps, followed by secondary reconstruction for hand function.

Result: Prediction on amputation, timing of soft tissue cover & function were valid in all cases.

Conclusion: The proposed classification can predict the course of events, amputations, treatment intervention, timing of soft tissue cover and the functional outcome following primary & secondary procedures for severe civilian blast injuries to the hand.



FP362

Mutilating hand injuries due to circular saws. A review of 124 patients treated between 2000 and 2004

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Introduction: Circular saws are widely used. Hand injuries while dealing with such saws are common but often patients can be treated as outpatients. Sometimes the injury leads to amputation and mutilation of the fingers and the palm. The study describes the methods of surgery used, analyses the demographic data and the functional outcome.

Patients and methods: From January 2000 to December 2004 we treated 124 inpatients who sustained severe hand injuries while working with circular saws. The retrospective data collection consists of patient files, operation protocols, picture documentations, X- rays, examination and questioning of the patients. Functional outcome was evaluated using the Buck-Gramcko and the DASH score. Average time of evaluation after the accident was 36, 7 month (range 10 to 72). Data presentation is descriptive.

Results: Male 121, female 3. Youngest 15y, oldest 85y, average 46, median 44. 99 patients injured while doing private business, 25 working related. 66 right hand and 58 left hand side. 312 fingers, thumb 78 (25 amputated/19 subtotal amputated), index 78 (20/22), middle 71 (8/15), ring 52 (9/7), little 33 (9/1). Replantations 25, revascularizations 40, nerve repairs 101, flexor tendons 96, extensor tendons 35, stump 58, osteosynthesis 90 (K-wires 60, plates 25, external fixation 5). Average DASH of 16,5 (range 0 to 67,24, median 11,66)

Conclusion: The typical patient injured by a circular saw is 46 years old and male. The accident happens while doing private business. More than 2 fingers are involved. Replantation, revascularization and reconstructive surgery are necessary to achieve sufficient results. With an average DASH score of 16, 5 the patients are able to manage their life surprisingly well.



FP363

Financial and social costs resulting from hand injuries due to 'skil' saws

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Aims : Hand held circular saws are in widespread usage in NZ. Related injuries are common. The study assessed the magnitude of this problem in financial and social terms.

Methods: Prospective data was collected between Sept. 2001 and Sept. 2002, exclusively for all skil saws. Hospital costs were collected, along with time off work, ACC payments and lost earnings. All patients had a minimum 6 month follow up and telephone interviews to gain data on return to work & hobbies, permanent disability and functional problems.

Results: 54 patients were included from a total of 544 adult hand injuries admitted over the 12 months [9.85%]. The cumulated cost to the state averaged NZ\$7128/patient. Average loss of earnings NZ\$3504. Average time off work was 5.2 weeks and off hobby was 7.6 weeks [excluding 4 patients with permanent loss]. 32 patients were injured at work, whilst 48 [88.9%] were only using 1 hand. The average length of tool use was 7.49 yrs. None had had training and generally low safety awareness. 30 patients felt they had no permanent functional loss from their injury . The other 24 had predominantly decreased dexterity and grip. 12 patients had cold intolerance and sensory problems.

Discussion and Conclusions : There is little on epidemiology or medico-social studies of serious hand injuries. The high use of "skil" saws in NZ is related to wooden house construction, a "DIY" Kiwi ethic and their cheap price. They cause 10% of our adult hand injuries. Almost half those injured had permanent functional loss. Financial loss to the patients was surprisingly low and partly offset by the ACC scheme in NZ. Costs to state were higher. Costs of any later reconstructive surgery were not included. We feel that these saws should be modified. Public education at point of sale may also be of some use.



FP373

Trends in hand injuries in Ontario, Canada workers' compensation claims between 1996 and 2003

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Workers' compensation claims from the Ontario Workplace Safety and Insurance Board (WSIB) database for hand and wrist injuries between 1996 and 2003 inclusive were analyzed for trends by multiple factors including age, sex and injury type.

In Ontario, a province in Canada, workers' compensation claims resulting in lost time from work have been reported under the National Work Injuries Statistics Program since 1996. Allowed claims for hand and wrist injuries were extracted from the administrative database for the years 1996 to 2003 and the data were analyzed by the author, to ascertain injury patterns for this group of workers' compensation claimants.

The number of workplace injury claims has fallen in recent years and hand and wrist injury claims show a similar pattern with a decrease from 23,083 in 1996 to 19,810 in 2003, a drop of 14.8%. This trend to falling hand and wrist injuries was seen for all of the most common types of hand and wrist injuries coded for, including cuts and lacerations (down by 15.7%); fractures (-7.0%); and carpal tunnel syndrome (-18.2%). In WSIB claimants aged 45 and greater, however, the trends were different: the total number of hand and wrist injuries increased by 5.3% during this interval, with two types of injuries--fractures (+14.3%) and carpal tunnel syndrome (+27.0%)--accounting for most of the observed increase. These findings for workers aged 45 and greater were seen in both male and female claimants. The increase in hand and wrist injuries seen in this group of workers may be due to the increased participation of workers aged 45 and up in the Ontario labour force (Statistics Canada, 2006) over the time period under study.

Although overall numbers of work-related hand and wrist claims are decreasing in Ontario, the demographic shift to an older workforce has resulted in increased numbers of injuries in workers aged 45 and older, with more degenerative injuries such as CTS; and fractures possibly related to increased osteoporosis in this age group.



FP374

Australian orthopaedic activities overseas

Professor William Cumming

St George Hospital, Kogarah, Australia

Orthopaedic Outreach is a registered international charity which is proud to work in team with the host neighbouring nations who would benefit from either assistance in surgical care of the population by service commitment or more effectively if possible the introduction of a training program in orthopaedic surgery.

The service activities involve the following nations: East Timor, Cook Islands, Vanuatu, Kiribati, Samoa, Tuvalu.

Orthopaedic training programs commenced in the following islands: Indonesia 1970,

Fiji 1983, PNG 1994, Honiara 2002, Bali 2006, and it is planned that this program will also extend to the development of a learning centre of international quality in Bali.

Orthopaedic Outreach has an umbrella relationship in the form of a friendship with other activities including the Tongan Club Foot program, Vietnam & Myanmar activities of the Sydney Hospital Hand Surgical team.

Its relationships are with the Royal Australasian College of Surgeons and through them to AusAID.

Orthopaedic Outreach has been involved in the activities of the tsunami in Banda Aceh and the earthquake in Jogjakarta.

Beverley Hughes, Outreach Manager is always interested to hear from surgeons who wish to volunteer or participate and our activities are listed on the website as follows:

www.orthoreach.org.au



FP375

Mycobacterium ulcerans limb infections and resulting deformities

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In non-endemic countries (i.e., most countries), *Mycobacterium ulcerans* is hard to diagnose (and harder to treat), especially when it occurs weeks or months after the person has returned from the endemic region. Excision is the mainstay of treatment and the resulting hand deformities and the wrist and elbow contractures are difficult to reconstruct. Delayed diagnosis has resulted in substantial claims for negligence.

I have treated the condition for over 15 years in Australia, have advised the WHO about it for the past 10 years, have operated in Ghana and have trained doctors from West African countries to treat the disease known there as Buruli ulcer. In some endemic countries, with the control of leprosy, *Mycobacterium ulcerans* is becoming the second most important human mycobacterial disease. It causes much disability and suffering.

The responsible organism was first cultured and characterised in Australia in 1948 and Australia remains pre-eminent in its scientific study, including the discovery of a PCR (polymerase chain reaction) test and the genome and the evaluation of antibiotic therapy.

The causative bacterium cannot be other than a pathogen and yet cannot be transmitted from person to person. Reservoir/s of the bacteria exist in fresh water and swamps but the host organism/s remain/s unknown. *Mycobacterium ulcerans* enters the body via a wound or abrasion or possibly an insect bite. The presentation discusses the diagnosis and the surgical treatment of this strange and devastating disease and of its sequelae.

Reference: Buruli Ulcer - Edited by John Buntine & Kimball Crofts. WHO 2001



FP376

Efficacy of oral minocycline and hyperthermic treatment for a mycobacterium marinum infection in the hand

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Introduction: Mycobacterium marinum, which is an atypical mycobacterium, often causes an infection in the hand such as tenosynovitis and arthritis. A surgical excision following antituberculous drug therapy has been standard treatment for this disease. However, postoperative recurrence and adhesion of the tendons are not rare occurrences. We herein report three cases of a M. marinum infection in the hand which were treated with oral minocycline and hyperthermic treatment without surgical treatment.

Patients and methods: From January 2002 to July 2006, we experienced 3 cases with M. marinum infection in the hand. Two of them were fisherman while the other was a female who kept tropical fish as pets. A subcutaneous nodular le sion, a subcutaneous nodular lesion with flexor tendon synovitis, and wrist arthritis were observed , respectively. For all cases, a daily oral dose of 200 mg of minocycline treatment and hyperthermic treatment using hot packs and microwave treatment were performed

Results: Soon after the treatment, the lesions decreased in size, and they healed completely within three months in all cases. After the completion of treatment no recurrence was observed. In addition, no tendon adhesion or finger contracture was observed in any cases.

Conclusion:This treatment was based on the findings of previous reports which described oral minocycline treatment to be effective in cases with M. marinum infection (Nakajima, H 1984). In addition, the growth of M. marinum was found to be significantly inhibited when cultured at over 37°C (Arai, Y 1998). The results of our cases suggest that oral minocycline treatment combined with hyperthermic treatment is therefore considered to be effective for the treatment of a M. marinum infection in the hand and surgical treatment can therefore be avoided using this treatment.



FP377

Atypical mycobacterial infections of the hand and wrist: Diagnostic and therapeutic considerations

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Introduction: Our purpose is to present six cases of nontuberculous mycobacterial infections of the upper extremity, drawing attention to this rare condition. Because, delayed diagnosis and treatment may cause functional impairment, better awareness is essential to improve outcome. Brown classified nontuberculous mycobacterial species as either fast- or slow-growing. The microbiology laboratory must be informed in any case suspected of nontuberculous mycobacterial infection, in order to avoid the discarding of cultures before slow-growing mycobacteria are ruled out.

Methods: We analysed six cases of upper extremity infections profoundly suspicious for nontuberculous mycobacteria, of which three could be identified as slow-growing. Although clinical, surgical and histopathological findings were suggestive of nontuberculous mycobacterial infections in all cases, species identification succeeded in only three. Treatment consisted of surgical excision of infected tissue and antituberculous therapy for 1 year.

Results: The final identification demonstrated slow-growing nontuberculous mycobacteria, including *M.malmoense*, *M. nonchromogenicum* and *M.szulgai*.

Conclusion: Nontuberculous mycobacterial infections are often diagnosed late, which delays appropriate treatment. In patients with a history of inoculating trauma and chronic tenosynovitis unresponsive to first-line antibiotics, a nontuberculous mycobacterial infection should be considered. Therefore, in cases of clinical and intra-operative suspicion, after staining acid-fast bacilli or based on histopathology, it is reasonable to start chemotherapy immediately until final identification and drug susceptibility tests are available, so as to preserve function and minimize recurrence rate.



FP378

The efficacy of peri-operative skin preparation of the hand

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Purpose : To examine the efficacy of pre-operative preparation of the human upper limb in a fixed time and determine whether staining or clear fluids perform best.

Method : Thirty-two volunteers were randomized into two groups; the first had each of their upper limbs prepared in sixty seconds, the second group in ninety seconds. One limb was prepared with clear fluid (CF) containing a pigment visible only under ultraviolet light and the other limb, with the same fluid with 25% of the volume replaced with an iodine solution making it visible (SF) to the naked eye. Using a UV lamp, the areas missed were visualized and subsequently digitally calculated.

Results : Significantly larger area was missed by trainees using CF than SF, at sixty ($p=0.0005$) and ninety seconds ($p=0.0025$) however, given 90 seconds, trainees missed less area using either. At ninety seconds, junior residents showed significantly better coverage with SF ($p=0.0212$) than at sixty seconds. No significant differences existed between senior and junior residents when using the same solutions over the same time. Sixty-seven separate spots were missed using CF while only thirty-one were detected when using SF. Fingers accounted for approximately 66% and 77% of the spots missed CF and SF preparations respectively.

Conclusions : Significant differences exist in skin preparation when using a staining versus a clear solution. Though alcohol based agents have greatest antibacterial potency, staining fluids are easier to see and therefore missed spots are readily detected and painted by the surgeon. The grade of resident does not impact on how well the limb is prepared but given more time junior residents do perform significantly better. Fingers remain the area most likely to be incompletely cleansed during peri-operative skin preparation.



FP379

Upper limb morbidity as a direct result of IVDU

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The study is aimed at evaluating the impact on the individual and the health system of conditions of upper limb morbidity that are a direct result of intravenous drug use.

A prospective review was undertaken over 6 months at a major metropolitan hospital specialising in hand trauma, of patients with upper limb complications as a result of their drug use. Parameters included the time spent in hospital, number and complexity of procedures performed, medical therapies utilised; such as antibiotics and analgesia and post discharge management including out patient visits, hand therapy and functional outcome.

The Australian Institute of Health and Welfare estimate illicit drug use costs the community more than \$50 million per year in tangible health care costs. These public record figures fail to specifically acknowledge morbidity as a direct result of injecting, no previous prospective hospital based study has been conducted to evaluate upper limb morbidity and outcomes.

We have been able to identify the specific resources needed to manage upper limb morbidity as a result of intravenous drug use and highlighted the vast cost to the health system and individual by providing specific information on inpatient hospital stay and procedures and post discharge management and outcomes. Study is ongoing, results will be updated prior to meeting.



FP380

The effect of skin preparation techniques for hand surgery on bacterial counts, comparing sterile swab or non-sterile plastic bag preparation

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Study examining the effect of swab versus bag pre-operative preparation in surgery of the hand.

50 Volunteers had their hands prepared using povidone iodine 10% (Betadine). Exclusion criteria included active infection, open wounds and an allergy to iodine. One hand was prepared using a standard sterile swab technique and the other using a non-sterile plastic bag technique. The salient features of this technique will be demonstrated.

Before specimen collection, the iodine was neutralized using sterile sodium thiosulphate 1%. Three culture swabs were taken from each hand from identical sites: 1 st nail fold, 2 nd web and 3 rd hyponychium. These were cultured on sterile agar plates for five days. Colony Forming Units were counted and bacteria identified from each swab.

Bacterial colonies were cultured from a number of specimens from both swab and bag groups. There were differences between swab-group and bag-group bacterial counts, with lower counts in the bag preparation group from each comparable site.

This study demonstrates the efficacy, in pre-operative surgical preparation, of a non-sterile plastic bag preparation technique. The advantages of this technique over standard swab techniques will be discussed. This technique has not previously been studied in the literature.



FP381

Severe infections within the upper limb: An analysis of the causes and results of the treatment

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Introduction: Infections within the hand can be a cause of serious problems when not treated early and adequately. Apparently looking innocuous at the beginning, infection can spread through synovial sheath of the tendons from finger to the hand, wrist and forearm. The objective of the study was to review the results of the treatment of deep infections of the upper limb and to analyse the causes of severity.

Patients and methods: 37 patients with deep infections within upper limb were identified. Patients included 28 men and 9 women in mean age of 50 years. The delay between initial event and referral to hospital was mean of 12 days (range 2-62). The most common cause was superficial contusion of the hand (9 patients) and small wound of the finger (8 patients). In 14 cases infection was localised in the finger (felon), in 23 patients within the hand, wrist, forearm or arm. In 6 of these 23 patients whole distal part of the extremity was involved. All patients were operated on under regional anaesthesia with the use of tourniquet. Several wide incisions were performed, pus and necrotic tissues were removed and wounds were further managed in the open manner. Antibiotic therapy was used in all cases.

Results: A staphylococcus aureus was the most common precipitating organism, found in 29 patients (78%). 32 patients recovered (87%). In 5 patients (13%) infection was so deep that resulted in necrosis and amputation was necessary. Partial amputation of the finger was performed in 3 patients, an amputation of 3 fingers was necessary in one patient, and other one lost whole forearm. Mean time of stay in the hospital was 7 days (range 2-22). From 32 patients who recovered without amputation, only 12 eventually regained full dexterity of the hand. The most common causes of development of severe infections were both ignorance of GPs who treated with disregard superficial infections, and stupidity of the patients themselves who delayed visit the doctor until infection became extremely severe.



FP382

The source and pattern of motor collateral sprouting and nerve regeneration in end-to-side nerve repair of nerve to medial gastrocnemius in the rat

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In the presence of segmental nerve loss where direct end-to-end repair is not possible the options include nerve grafting, direct muscle neurotization, and nerve or tendon transfer to regain function. End-to-side repair has already been explored experimentally and clinically. The mechanism of axonal regeneration in this form of neurorrhaphy, however, is still not understood. The purpose of this paper is to study this in an animal model.

Twelve Sprague-Dawley rats were used. The nerve to the medial gastrocnemius (MGN) was ligated at 5 mm from its origin from the tibial nerve and divided to leave a long distal stump. An incision 0.5 mm long was made on the epineurium of the tibial nerve a minimum of 1 cm distal to the proximal stump of the divided MGN. The perineurium was left undisturbed. Silicone tubing was used to envelope both the MGN and the tibial nerve. This was used designed to minimize the possibility of aberrant fascicular linkage from outgrowth from the proximal nerve stump into the distal implanted nerve and facilitated later identification during re-exploration. Axonal regeneration was evaluated electrophysiologically and immunohistochemically.

The results demonstrated contraction of the medial gastrocnemius muscle indicating that re-innervation had occurred. Microscopy of the tibial nerve between the stump of the MGN and the site of end-to-side repair revealed many axons in the epineurium. Many of these axons were partially myelinated. Sections through the site of anastomosis showed that the original tibial nerve remained intact and that injury was not the cause of axonal regeneration.

The conclusion from this study is that regeneration arises from the divided axons of the proximal stump and travel distally down the tibial nerve to the site of the coaptation to re-innervate the medial gastrocnemius muscle.



FP383

Terminal end-to-side coaptation to transfer nerve fibers from an innervated terminal motor branch to the terminal branch of a denervated synergistic muscle: An experimental study with baboons

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Introduction : End-to-side nerve repair has re-emerged in the literature in recent years but clinical applications for this technique are not yet fully defined and clinical reports are rare and controversial. Hypothetically, there might be useful functional results performing peripheral end-to-side nerve graft repair using synergistic terminal branches with defined motor function. An end-to-side nerve graft repair bridging from the terminal motor branch of deep branch of the ulnar nerve to the thenar motor branch of the median nerve was performed in non-human primates.

Methods : Seven adult baboons were used in this study. At baseline, we excluded electrophysiologically and by microsurgical dissection the variation in innervation of median and ulnar nerve innervated thenar muscles. Immediately after transection of the median nerve Baboons underwent end-to-side coaptation of a nerve graft from the deep branch of the ulnar nerve creating an epineurial window to the thenar motor branch of the median nerve. Three months after surgery functional recovery was assessed by electrophysiological evaluation, thenar muscle weight and video slow motion analysis. Specimens were harvested three months after surgery. Neural collagenic connective tissue, and the number of Schwann cells were evaluated.

Results : Clinically all animals recovered opposition of the thumb. These findings were confirmed by electrophysiological studies of the thenar muscles, now innervated by the ulnar nerve. There was a moderate enhancement of neural collagenic connective tissue within the nerve graft in six animals. Schwann cell counts showed similar values within all nerve segments.

Conclusions : The results in this non-human primate model demonstrate the efficacy of end-to-side nerve graft repair at the level of peripheral terminal motor branches. End-to-side neurorrhaphy may present a viable alternative in conditions of unsuitable end-to-end coaptation and inappropriate nerve grafting procedures.

Key words: end-to-side, nerve regeneration, morphology



FP384

Recovery of neurophysiological and functional features with time after rat sciatic nerve repair: The dissimilarities

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Introduction: Experimental assessment of peripheral nerve regeneration in rats by electrophysiology is controversial due to low reproducibility of electrophysiological indicators and diminished quantitative evaluation in conventional experimental set ups. Magnetoneurography (MNG) counteracts these drawbacks by magnetically recording electrophysiological signals ex vivo, thereby providing accurate and quantitative data.

Materials and methods: In 50 rats, sciatic nerve transection was followed by direct repair. MNG outcome parameters, footprints (static-TSF; function) and muscle weight (MW) were studied for their recovery pattern from 2 to 24 weeks.

Results: By using MNG, we showed that the regeneration process still continues when functional recovery (static-TSF) becomes stagnant. With regression analysis MNG parameters amplitude, amplitude area and conduction velocity demonstrated moderate significant correlation with MW, whereas conduction velocity was not significantly associated with static-TSF. No significant association exists between MW and static-TSF. A Kaplan Meier survival curve revealed that autotomy / contracture of rat hind paws was not related to decreased MNG outcome values.

Conclusion and discussion: In conclusion, this study strongly demonstrates the dissimilarities between direct (MNG) and indirect (static-TSF & MW) assessment techniques of the regeneration process. The process of regeneration does not stop when functional recovery measured by static TSF becomes stagnant. Footprint analysis is still widely used and accepted as a powerful evaluation technique in experimental rat studies. However, we emphasize the significance of a direct derivative of the axon regeneration process, like MNG. Additionally, we stress the must for right – left ratios, as neurophysiological indicators vary with age. We revealed no existing relation between poor conduction capacity and autotomy / contracture.



FP385

Transplanted embryonic spinal tissue in severed rat sciatic nerves promotes motor nerve regeneration

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An experimental study was performed to investigate the influence of the transplanted embryonic spinal tissue in severed sciatic nerve on the host motor nerve regeneration. Twenty-seven adult male Lewis rats and three pregnant Lewis rats were used in this study. Eighteen adult rats received operation while the other nine rats kept as normal control. In operation group, the sciatic nerves on both sides were severed. The nerve on the right side was repaired with regular anastomosis. The nerve on the left side was transplanted with embryonic spinal tissue harvested from the embryos (E12) before the nerve incision closed. At 1, 4 and 8 weeks after surgery, nine rats including three normal rats and six operated rats were examined and sacrificed respectively. The electromyography (EMG) was recorded at the 4th and 8th weeks before sacrifice. The wet weight of gastrocnemius and anterior tibial muscles were measured. Motor end plates (MEP) in anterior tibial muscle were stained and analyzed. The sciatic nerves were examined in Epon embedded sections with toluidine blue stain. EMG showed that the latency and mean maximum M-wave amplitude of the left sciatic nerve nearly reached normal at the 8th week, but there were still significant differences between those of the right side and the normal control. MEP counts showed that the distribution density on the left side was significantly higher than that on the right side ($P < 0.01$). The examination of the Epon embedded sections of sciatic nerve also showed that the myelinated axon counts and myelin sheath thickness on the left side were significantly higher than those on the right side at either the 4th ($P < 0.05$) or the 8th week ($P < 0.01$). All these findings indicate that the transplanted embryonic spinal tissue can promote the motor nerve regeneration and the target muscle reinnervation.



FP386

Extracellular matrix modification increases peripheral nerve regeneration

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The tubulization repair technique is a useful model for studying peripheral nerve regeneration since it provides quantifiable parameters for assessing the effects of exogenously applied substances on nerve repair. In this study, we observed that the local administration of hyaluronic acid (HA) in a tubular prosthesis at the time of implantation significantly improved the repair process, and that this effect was dependent on the viscosity of the HA preparation. The sciatic nerve of C57BL/6J mice was transected and the proximal and distal nerve stumps were sutured into a polyethylene tube (PT, 0.76 mm i.d.) to bridge a nerve gap of 4 mm. The tubes were implanted either empty, or filled with a low-viscosity (MW = 450 - 1000 kDa) or high-viscosity (MW = 7000 kDa) commercial preparation of HA. After 4 weeks the PT with the regenerating nerve cables were processed for histological analysis and the total number of myelinated axons was counted using a computer-controlled system. Low-viscosity HA significantly increased peripheral axon regeneration (2191 \pm 82 myelinated axons, mean \pm SEM) compared to the group with empty tube implants (1597 \pm 80). This enhanced regeneration was not observed in the group implanted with tubes containing high-viscosity HA (1643 \pm 69). The stimulatory effect of exogenous HA on nerve regeneration could be due to its activity on non-neural cell proliferation, migration and differentiation which would lead to faster ingrowth of regenerating axons.



FP387

Digital video motion analysis for measurement of upper limb nerve function

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Functional assessment task for upper limb nerve function is lacking. The aim of this study is to establish a nerve transection and repair model in the rat upper limb, and validate the application of digital video motion analysis to quantify limb movements for evaluation of motor function deficit and recovery. Transection and direct coaptation of radial nerve on the left forelimb at mid-upper arm level was done in 6 adult female Sprague Dawley rats. High speed video camera was used to record movement of rats walking in a transparent runway. A mirror mounted at 45° to the floor of the runway captured paw prints. Recording was carried out pre-operatively and 1 week, 4 weeks, 8 weeks, 12 weeks, and 16 weeks postoperatively. Angles of extension of the wrist and metacarpophalangeal (MCP) joints were obtained from digitized images of the gait cycle. Distances between the 2nd and 5th digits (toe spread) and between the 3rd and 4th digits (intermediate toe spread) were computed from the paw prints. Immediately after radial nerve injury, wrist drop and extension lag of the fingers were seen. Extension of the wrist and MCP joints gradually returned when radial nerve function recovered. By 4 months after nerve repair, wrist extension was almost normal while MCP extension lag still existed. Toe spread and intermediate toe spread decreased to 58.04% and 51.72% of the normal side respectively after nerve injury and returned to 84.88% and 90.97% 4 months postoperatively. Our results showed that digital video motion analysis is a valid method to evaluate functional deficit and recovery following peripheral nerve injury and repair. It is more clinically relevant than other tests such as electrophysiology and muscle tension measurement in that it enables comprehensive evaluation of motor function of the limb.



FP388

Evaluation of the sensory deficit after sural nerve harvesting in pediatric patients

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Introduction: The purpose of this study was to evaluate the sensory deficit following sural nerve harvest in infancy.

Method: Evaluation and mapping of the sensory thresholds in the sural nerve distribution were performed using the Semmes Weinstein monofilament (WEST) assessment on four predetermined sites on the foot. A questionnaire was utilized to elicit subjective findings regarding pain, tingling, numbness, cold intolerance, history of injury to the leg, skin changes and concern regarding the sensation of the feet. The inclusion criteria were children greater than six years of age who had undergone bilateral sural nerve harvesting for brachial plexus reconstruction in the first year of life. Normal volunteers served as controls.

Results: Fourteen (n=14) operated patients and fourteen (n=14) controls were enrolled in the study. Eighty-six percent of the operated feet had a sensory deficit in at least one of the four predetermined sites ($p=0.0005$). The patients reported no concerns regarding the sensation of their feet.

Conclusion: Sural nerve harvesting in children causes a measurable sensory deficit, however the deficit does not appear to have clinical implications for the patient.



FP389

Comparative study on the utilization of the empty silicone tubing versus with bone marrow mesenchymal cells in the repair of the median and ulnar gaps at the level of the forearm

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Objective: The aim of this study was to compare the functional results obtained in two distinct series: empty silicone nerve tubing and nerve tubing with mesenchymal cells in the treatment of the median and ulnar nerve gaps at the level of the forearm.

Material: All 42 patients underwent late surgical intervention in the treatment of the medial and ulnar nerve lesions at the level of the forearm. In a group of patients operated between 1992 and 1997, a empty silicone tube was utilized between. To the median nerve, 14 patients, mean age of 23 years and nerve gap of 3cm with post-operative follow-up of 31 months. To the ulnar nerve, 8 patients with mean age of 22 years and nerve gap of 2,7cm with post-operative follow-up of 26 months. In a second group of patients between 2000 and 2004, we utilized a silicone tube filled with mesenchymal cells obtained from the iliac crest and prepared at the laboratory. To the median nerve, 12 patients, mean age of 22 years, mean nerve gap of 2, 5 cm. The number of mesenchymal cells inside the tube was of 2.0×10^8 to 4.2×10^9 cells/ml. To the ulnar nerve, 8 patients, mean age of 20 years and mean nerve gap of 2,8cm. The number of mesenchymal cells inside the silicone tube was of 2.2×10^8 to 4.4×10^9 cells/ml.

Results: In the homogenous study in age, type of lesion and size of the nerve gap, we verified that, according to the British Medical Research Council classification System, the results in the group with mesenchymal cells were significantly superior when the median and ulnar gaps were up to 3cm.

Conclusions: The utilization of mesenchymal cells inside the silicone tube ($p < 0,05$) allowed us a better and faster functional recovery compared to the group with empty silicone tube.



FP390

Arterialized venous sural nerve graft for coexisting injury of ulnar artery & nerve by arc burn at wrist

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As increasing the use of electricity, the incidence of electrical injuries is rising at hand as an input site. Electrical burns cause extensive tissue destruction at the site of the contact and beyond it, because it is characterized as complex of crushed and thermal injuries which involve the soft tissue and bone.

Especially high tension electrical burn could be happened the arc burn with tetanic contraction as considerable thermal injury on skin, nerve, vessels, and tendon at wrist and forearm. Then vascularized nerve graft could reconstruct the major nerve injury coexisting major artery injury at the same time. The advantages of vascularized nerve graft are reducing revascularization period & intraneural fibrosis, rapid axonal regeneration & reinnervation, and used on poorly vascularized recipient bed.

From March 2000 to February 2005, we had treated 4 patients who had ulnar artery and nerve injury by high tension electrical burn with arc burn at wrist using the arterialized venous sural nerve graft as A-A type venous graft.

We obtained satisfactory results in motor & sensory recovery and arterial flow in all patients without specific complications.

Key Words: Arc burn, Arterialized venous sural nerve graft



FP391

Correlation between clinical outcome and electromyography results after ulnar and median nerve repair. Our experience.

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Nerve injuries of the upper limb require great care in repair. Still discussed is the necessity of the correct surgical time. Nowadays it is suggested their repair within 72 hours. Electromyography (EMG) is the most used and recommended device to evaluate their behaviour after repair.

Our aim is to correlate the clinical signs with the EMG results.

Materials And Methods: We studied only direct repair within 72 hours of the ulnar and median nerve, treated from January 2004 to March 2006. We collected 22 nerves in patients within the age of 11 and 56 years. We encouraged early mobilization; all the patients underwent physiotherapy. Patients submitted monthly clinical controls in the first three months and then they were checked every 3 months; they underwent EMG after 1, 3, 6 and 12 months and then, if requested, every 6 months. We try to maintain always the same surgical and neurologist team. Follow up was from 12 to 24 months.

Results: While in the early six months we observed a substantial balance between clinic and EMG's response, after six months, we noted greater differences among clinical signs and electromyography findings especially in the period within 6 and 12 months from the trauma, constantly decreasing in further controls; infact, after 12 months, in the majority of patients we had a good clinical outcome even if the axonal activity was not till complete, anyway, furtherly, the nerve activity was constantly increasing in comparison with the previous EMG.

Better measurements are on work.

Conclusion: In order to our results, we believe to consider electromyography the best device to study the progression in healing of the nervous tissue independently from the clinical outcome, which is often better than what shown by emg findings; besides we believe EMG is a useful device to predict the functional rehabilitation.



FP392

Outcome of muscle strength in patients with ulnar and median nerve injury

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Introduction: Muscle strength outcome of peripheral nerve injuries is often presented with grip and pinch strength measurements while these mainly assess the extrinsic muscles. We evaluated a dynamometer the Rotterdam Intrinsic Hand Myometer (RIHM) which was designed for measuring the intrinsic muscles in isolation.

Material & Method: Thirty-four patients more than 2 years after ulnar and/or median nerve injury were evaluated. Muscle strength was measured using manual muscle strength testing and three dynamometers measuring grip, pinch and intrinsic muscle strength in isolation with the RIHM.

Results: Manual muscle strength testing showed that most muscles recover to grade 3 or 4. Average grip strength recovery, as percentage of the uninjured hand, was 83%. Pinch strength recovery was 75%, 58% and 39% in patients with ulnar, median and combined nerves injuries, respectively. The RIHM measurements of the intrinsic muscles revealed a poor recovery of especially the ulnar nerve innervated muscles (26-37%).

No correlation was found between the measurements of the RIHM and grip strength. Pinch strength was significantly correlated with RIHM measurements of the thumb palmar abduction and opposition (r 0.55 and 0.72, p = .026, .002).

Conclusion: These measurements demonstrated a remarkable discrepancy between the poor outcomes of the intrinsic muscle strength as measured with the RIHM and the high levels of grip strength. A dynamometer like the RIHM provides a more accurate clinical assessment of the outcome. Firstly, because the muscle strength measurements with the RIHM are in much more isolation. Secondly, the RIHM measurements provide a quantitative assessment and are therefore more sensitive to changes and differences.



FP393

Two stage nerve graft, clinical application

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Neural grafting is the standard treatment of nerve substance defects. The result deteriorates with increasing length of defect and is especially disappointing in the background of scar tissue.

We had amazing results with two stage nerve graft using a plastic tube as a spacer in a study on rats and therefore applied this technique on a few selected patients with nerve defects in severely scarred tissue that required nerve grafting. The interval between first stage (plastic tube insertion) and second stage (definitive nerve graft) was 4 weeks

Six patients underwent two stage nerve graft: one due to a ischemic scar, three due to concomitant tenolysis and two due to prolongation of operative time. A total of 9 nerves; 4 median nerves, 3 ulnar nerves and 2 digital nerves were grafted. Defects were located in hand and forearm with mean 10 cm (4-20 cm) gap lengths.

All patients obtained protective sensation to up to 6 mm of two point discrimination and a motor return of M1 to M4 was observed in at least 16 months follow up.

Two stage nerve graft is a viable alternative in cases where nerve grafting must be delayed to decrease time in primary operation, concomitant tenolysis needs to early motion postoperatively and in cases where grafting is needed in scar tissue bed. It may help by forming a well nourished canal for the nerve graft in scar tissue.



FP394

Minimum invasive palmar plating for fractures of the distal radius

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The purpose of this study is to introduce a new palmar plate that we have developed for fractures of the distal radius. Thickness of the plate is only 1 mm and the screw head does not rise than a plate. Biomechanical study showed that a new plate had stronger strength than other low profile plates. Distal screws have the locking system to be able to deal with osteoporosis. Anatomical shape of the plate was designed with three dimensional CT data of old women. This plate enabled the preservation of the pronator quadratus muscle during surgery and the shortening of surgery time was possible. In addition, it may promote the bone union because the periosteum under the pronator quadratus muscle was preserved.

We have treated patients with fractures of the distal radius using this new developed plate in 41 patients. 21 out of 41 patients who had surgery more than two months before were evaluated clinically. 19 were women and two were men, mean age at the surgery was 68 (range, 49 to 84). 18 of 21 were dorsally displaced fractures of the distal radius. Mean post-operative follow-up period was 4 months (range, 2 to 7 months). Parameters such as palmar tilt, radial inclination, and radial length of X-ray were evaluated before and after surgery as well as at the final follow-up. The overall outcome according to the Gartland and Werley scales showed 20 excellent and one good result. There were no plate failures or loss of reduction.

In conclusion, a new plate that we developed enabled minimal invasive surgery with preserving the pronator quadratus muscle for fracture of the distal radius.



FP395

1 Year results comparing palmar, angle-stable plate osteosynthesis and dorsal plate osteosynthesis in high grade intra-articular fractures of the distal radius

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Background: Palmar plate osteosynthesis with angle-stable implants has recently become popular, whereas the dorsal approach has been abandoned due to an increased complication rate. So far, no prospective, randomised studies have been carried out to demonstrate the superiority of either method in high-grade intraarticular fractures of the distal radius

Material and Methods: 36 patients over the age of 50 with unilateral C-fractures (AO Classification) without other relevant upper extremity injuries were enrolled in this prospective, randomised study. 18 were treated with angle-stable palmar implants, whereas 18 received a dorsal Pi-plate osteosynthesis. Follow-up was scheduled at 2 weeks, 6 weeks, 3 months, 6 months and 1 year postoperatively. Data was obtained regarding range of motion, strength, pain medication requirements, length of absence from work, radiological appearance and patient satisfaction. The DASH-Score was evaluated 1 year postoperatively.

Results: The palmar plate group showed a significantly better range of motion, quicker return to work, less pain, less CRPS and generally a high patient satisfaction. Radiographs demonstrated near anatomical results in the majority of patients with palmar implants. The rate of secondary dislocation requiring surgical intervention was also significantly lower. The Pi-plate population did worse in all aspects. Especially a high rate of secondary dislocation requiring reoperation and switch to a palmar implant were observed.

Conclusion: Angle stable palmar plates show improved functional outcomes with significantly less complications than the dorsal Pi- plate osteosynthesis for high grade intraarticular fractures of the distal radius. Return to work, patient satisfaction and range of motion are superior. Patients experience less CRPS and require fewer operations as plate removal is not mandatory with these implants. Even high grade intraarticular fractures may be satisfactorily treated with this implant.



FP396

Mechanical comparison of fixed angle locking volar plate and K-wire fixation of distal radius fractures

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Aim: Open reduction and internal fixation with angle stable locking plates through a volar approach is a new method for operative treatment of unstable distal radius fractures. Our intent is to compare this method with percutaneous K-wire fixation in regards to the efficacy in retaining the reduction of the fracture.

Material and methods: 68 unstable distal radius fractures were treated with fixed angle locking volar plates (group 1: 41 Aculoc, 22 K öngsee and 5 Synthes Compact Hand plate) in a period from December 2004 till May 2006. 72 fractures were operated with K-wires (group 2) in the same period. Plated fractures were allowed to early active mobilization, whereas K-wiring was supplemented with immobilization in POP. We evaluated both preoperative, postoperative and six-weeks control X-ray pictures retrospectively and measured volar tilt, radial inclination, ulnar variance and articular displacement in the intraarticular fractures.

Results: The postoperative parameters in group 1 averaged in above order 9,7 degrees, 23,2 degrees, - 0,6 mm and 0,5 mm. The average loss of reduction were 0,1; 0,1; 0,3 and 0,1; none of them was significant. In group 2 the average postoperative parameters were 3,4 degrees, 21,9 degrees, 0 mm and 0,3 mm. The average changes were 2,5; 2;3; 1,5 and 0,1 of which the first three are significant. We compared the parameters of the two groups, and found significant difference both in the postoperative and 6 weeks volar tilt, radial inclination and ulnar variance.

Conclusion: The use of volar angle stable locking plate osteosynthesis yields superior radiological results compared to K-wire fixation when treating unstable distal radius fractures. Comparative analysis of functional results and of soft tissue complication issues regarding these fixation methods will have to be taken into consideration in addition to the above, when choosing between these operative methods.

Reference : Orbay, JL 2004



FP397

Biomechanical evaluation of volar locking plates for distal radius fractures

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Fixed-angle devices have been a major advancement in orthopedic fracture care and are attractive options for fixation of distal radius fractures. Several plates exist, but there is insufficient literature comparing their biomechanical properties. This study compares the biomechanical strength of two popular volar locking plate systems (Synthes LCP and Hand Innovations DVR-A) along with a non-locking volar T-plate (Synthes).

Methods: Twenty-three cadaveric forearms were divided into three groups with similar ages and bone densities. An unstable extra-articular fracture was created using a standardized osteotomy. Each group was fixed with one of the three plates and loaded in axial compression for 2000 cycles at a force of 400 N. Each specimen that completed cyclic testing was loaded to failure. Stiffness, yield point, and ultimate strength were recorded for each construct.

Results: Each fixed-angle construct completed all 2000 cycles. The non-locking plates failed at an average of 560 cycles. The mean stiffness of the DVR-A, LCP, and the volar T-plates were 277.00 N/mm, 343.17 N/mm, and 175.67 N/mm, respectively. There was a statistically significant difference between both fixed-angle plates and the non-locking plate ($p < 0.05$). The difference between each fixed-angle construct did not reach significance. There was no statistically significant difference between the fixed-angle constructs for both yield point (DVR-A = 855.56 N, LCP = 894.15 N) and ultimate strength (DVR-A = 1021.97 N, LCP = 1114.87 N).

Conclusions: Both tested plates equally withstand cyclical loading representing normal physiologic forces encountered during post-operative rehabilitation. There was no significant biomechanical difference between the two. Our results support that volar fixed-angle locking plates are an effective treatment for unstable extra-articular distal radius fractures, allowing early post-operative rehabilitation to safely be initiated.



FP398

Locked distal radius plating for comminuted intra-articular distal radial fractures

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Introduction: The treatment goal for fractures of the distal end of the radius is full functional recovery of the wrist. Anatomical fixation and early functional therapy are vital. The use of locking plate is a recent advancement in the operative treatment of distal radius fractures.

Purpose: To evaluate the functional and radiological results of fixing unstable intraarticular fractures of the distal radius with a volar locking plate.

Methods: Distal radial fractures in 20 patients (11 men and 9 women; mean age- 34.5 years) were fixed by volar locking compression plate. The fractures were classified using the AO classification. Radiographic parameters on preoperative, postoperative, and final follow-up radiographs were compared. Active range of motion was started immediately after surgery.

Results: The fractures were of AO Type C1 (5) C2 (6) C3 (9). The average follow-up period was 13 months. Average loss of reduction from initial postoperative to final follow-up radiographs was 0 degrees of volar tilt, 1 degrees of radial inclination, and 0 mm of radial length. The final follow-up flexion-extension and pronation- supination arcs averaged 110 degrees and 148 degrees, respectively. According to the scores of Gartland and Werley and Green and O'Brien, 92% and 68% respectively had an excellent or good outcome; 46% were radiologically identical to the uninjured side and in 42% the reduction remained unchanged. Radiological scores demonstrated 22 excellent and 8 good outcomes. No nonunion or infection occurred.

Conclusions: Volar locked plating is an effective treatment for unstable intraarticular fractures of the distal radius. Early active range of motion can be facilitated without compromising fracture reduction.



FP399

Intercarpal ligament injuries in distal radius fractures

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Aim: To assess the one-year outcome of intercarpal ligament injuries associated with displaced distal radius fractures in patients below osteoporotic age.

Methods: 51 patients (27 women), with displaced distal radial fractures, median age 41 years (range 20-57), underwent standard fracture management and concurrent wrist arthroscopy to assess for associated intercarpal ligament injuries. Grading of scapho-lunate (SL) ligament injuries was made with a modified Geissler classification. Group I consisted of 10 patients with a grade 3-4 ligament injury and Group II consisted of 41 patients with a grade 0-2 injury. Patients were reviewed at one-year (11-27 months).

Results: Ulna+more than 3mm at the time of fracture gave a 3.9 (95%CI: 1.1 – 13.3) increased risk of grade 3-4 SL ligament injury. Intra-articular fractures (AO Type B-C) had also increased risk of grade 3-4 SL-injury with radiographic dissociation at one year ($p=0.006$; Fisher's Exact test, Table 1).

Table 1

	AO Type A (n=16)	AO Type B/C (n=35)
Normal	14	26
Dynamic	1	7
Static	1	2

Group I (SL gr. 3-4) had significantly more pain on examination ($p=0.009$) and worse subjective outcome at follow-up ($p=0.039$) . There was no difference in range of motion or grip strength between the groups. Luno-triquetral injuries were uncommon.

Conclusion: Distal radial fractures were associated with grade 3-4 scapho-lunate ligament injuries if the initial radiograph had an ulna+ more than 3mm and the fracture was intra-articular. These injuries lead to radiographic dissociation at follow-up and early treatment may need to be considered.



FP400

Distal radius fractures and concomitant ulnar styloid fractures

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Introduction: Despite progress in the treatment of the distal radius fracture, understanding about the concomitant ulnar styloid fracture remains unchanged. This retrospective study examines the clinical results of a cohort of distal radius fractures treated with volar fixed angle fixation and early rehabilitation but no specific treatment for the ulnar styloid fracture.

Methods: We reviewed 200 distal radius fractures treated with volar fixed angle fixation and followed for a minimum of six months. No specific treatment, besides accurate reduction, stable radial fixation and early forearm rotation, was provided for concomitant ulnar styloid fractures. Cases with fractures of the ulna proper were removed from the study. If present, ulnar styloid fractures were classified radiographically according to size, displacement, degree of comminution and foveal involvement. Information was obtained from the clinical, rehabilitation and radiographic records. Functional results were measured in terms of final finger and wrist motion, forearm rotation and grip strength.

Results: Out of 200 distal radius fractures in 194 patients, 18 or 9% presented with concomitant fractures of the ulna proper. Therefore, 182 distal radius fractures remained in the ulnar styloid study group. Of these, 59% presented with radiographic evidence a concomitant ulnar styloid fracture and 41% did not. Of those presenting with an ulnar styloid fracture, 21% had involvement of the ulnar fovea, 39% had a large fragment, 15% a small fragment and 25% had other classifications. Only 19% of the ulnar styloid fractures united. Of those distal radius fractures presenting without evidence of a concomitant ulnar styloid fracture, 15% subsequently developed a local calcification or other radiographic evidence of a soft tissue injury. There was no statistically significant correlation between final functional results and the presenting or final radiographic appearance of the ulnar styloid. There were no cases of DRUJ instability in this series.

Conclusions: With this method of treatment the incidence of ulnar styloid nonunion is high but functionally insignificant. The precise restoration of radial length provided by volar fixed angle fixation combined with early forearm rotation may decrease the need for internal fixation of large styloid fragments. The decision to fix ulnar styloid fractures should not be based on their size but on the presence of gross instability.



FP401

Coralline hydroxyapatite: A bone graft alternative in distal radius osteotomy

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Purpose: Severely comminuted or displaced distal radius fractures often require bone graft to restore anatomic alignment. Owing to the risks and morbidity of bone graft, we evaluated osteoconductive coralline hydroxyapatite for the surgical correction of problematic distal radius fractures.

Methods: Records were reviewed of 10 patients (11 wrists), average age of 52 years (range: 22-67), who underwent reconstructive osteotomy between 1997 and 2004. At referral, indications for surgery included failed (5) or malaligned repair (6) along with pain and functional deficits. An opening wedge osteotomy was used, packed with Pro Osteon 500 (Interpore International, Irvin, CA), and stabilized with a plate. The wrist was then immobilized for 8-12 weeks postsurgery. A hand therapist assessed clinical outcomes and tabulated a Modified Mayo Wrist Score. The mean follow-up was 20.6 months (range: 1-77 months).

Results: Nine patients (90%) had either no or occasional pain whereas one failed treatment with unremitting pain. No patients had dysesthesias. The average wrist score was 54 (range: 25-80). Wrist flexion, extension, pronation, and supination averaged 35.0 ± 12.1 , 40.0 ± 18.5 , 82.0 ± 12.5 , and 63.0 ± 29.4 , respectively. JAMAR strength averaged between 33.6 ± 11.3 lbs and 47.9 ± 18.9 lbs. and average pinch strength, between 8.7 ± 4.2 lbs. and 12.8 ± 4.9 lbs. All osteotomies healed. Radial height, radial inclination, volar tilt and ulnar variance at the latest follow-up were 8.6 ± 3.7 mm, 18.3 ± 5.8 , 3.7 ± 6.3 , and 1.4 ± 1.5 mm, respectively. Some loss of anatomic correction occurred.

Conclusions: Outcomes were slightly less favorable than similar studies using bone graft (Ladd and Huene, 1996; Wada, 2004) but this may reflect early follow-up (<12 months). Despite subsidence, final anatomic alignment was satisfactory. We conclude that these data are promising but a randomized clinical trial is needed to provide a definitive conclusion.



FP402

Prospective randomized comparison of early vs late wrist mobilization after volar plate fixation of distal radius fractures

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Introduction: The claimed advantage that plate and screw fixation of the distal radius will result in better wrist motion by allowing earlier initiation of exercises has not, to our knowledge, been tested scientifically. We performed a clinical trial of early vs. late mobilization of the wrist after volar plate fixation of a fracture of the distal radius to test the hypothesis that early wrist mobilization improves ultimate wrist function.

Methods: 42 patients have enrolled to this point, 20 were allowed to begin moving their wrist at the time of suture removal and 22 had the wrist immobilized until six weeks after surgery. We anticipate reaching our enrollment of 60 total patients according to power analysis by August 2006 and anticipate 90% completion of the protocol by the time of the annual meeting. This abstract reports preliminary results for 31 patients evaluated at 3 months (15 early, 16 late cohorts), and 22 that have completed the study (11 early, 11 late cohorts).

Results: There are no significant differences in the DASH score at 3 months: 21(early) vs. 24(late) and 6 months: 15(e) vs. 13(l); 3 months Likert pain score: 6(e) vs. 4(l) and 6 months: 1.2(e) vs. 1.3(l); wrist flexion-extension arc: 99 °(e) vs. 94 °(l) at 3 months and 118 °(e) vs. 123 °(l) at 6 months; grip strength: 34 lbs (e) vs. 43 lbs(l) at 3 months and 58 lbs(e) vs. 45 lbs(l); and Mayo wrist score (63 vs. 64 and 74 vs.73) at any time point. There were not statistically significant differences between groups when independent single and paired T tests analysis were performed.

All fractures healed and no complications have been identified.

Conclusion: The contention that internal plate and screw fixation is advantageous because it allows earlier mobilization of the wrist leading to improve wrist function is not supported by scientific data.



FP403

Distal radius osteotomy in the older age patient using angular stable implants and Norian bone cement

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Introduction: Corrective osteotomy of malunited distal radius fractures has technical challenges with the fixation of osteopenic bone and iliac crest donor site morbidity. Two technologic advances have facilitated this procedure. The first is the development of angular stable locked implants with the second being newer bone cements.

Materials and methods: Our series include 11 patients, 7 female and 4 male with an average age of 55 years treated with this approach. 7 patients had corrections through a dorsal approach and 4 through a volar approach. Two corrections included an intraarticular osteotomy. All patients had angular stable plates; the osseous defect was filled with bone cement (Norian®). During this evaluation, range of motion and grip strength were measured. Patients filled at follow-up evaluation the Modified Mayo Wrist score, the Modified Garland and Werley score and the DASH questionnaire.

Results: There were no perioperative complications. All corrective osteotomies healed. At an average follow-up of 12 months, the average wrist and forearm motion was 70% of the opposite side and grip strength 82% of opposite side. There was no loss of reduction at late follow-up. Average postoperative DASH score was 25 points; average Modified Mayo Wrist Score, 67; and the Modified Garland and Werley score averaged 9 points.

Conclusion: We believe this operative technique to be safe, predictable even with underlying osteoporosis, and eliminated donor site morbidity.



FP404

Day case osteotomy for malunited distal radial fractures using bone substitute

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Corrective osteotomy of the distal radius is an accepted treatment for symptomatic fracture malunion. Standard practice involves the use of a trapezoidal cortico-cancellous bone graft harvested from the iliac crest, shaped to fit the defect created after correction of the deformity. Donor site morbidity is not unusual, and significant post-operative analgesia may be necessary.

This study presents the results of 10 patients treated as day case patients under regional anaesthesia, where it was not possible to harvest iliac crest bone graft. Bone substitute (Calcium sulphate – OsteoSet) was used to fill the defect. The correction in radial length (ranging from 11 – 21 mm) was maintained by rigid internal fixation.

All cases united uneventfully within 6 months.

There were no cases of loss of correction. No patients remained in hospital longer than 6 hours. 6 patients (who had dorsal plating) have so far had their metal implants removed after developing tenosynovitis. A palmar approach and angularly stable implant is now used to reduce the incidence of this problem. Late loss of correction after implant removal has not occurred.

The use of bone substitute has resulted in a significant change in our practice in a condition we once considered required major surgery.



FP405

Three dimensional corrective osteotomy for malunited forearm fractures using custom-made osteotomy template

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Purpose: In order to make a precise anatomical correction for malunited fractures, we have been developing a surgical method using a custom-made surgical device designed based on the preoperative 3D computer simulation. In this presentation, we describe our innovative technology for deformity correction and report its preliminary results for malunited forearm fractures.

Materials and methods: Eight patients with malunited forearm fractures were the materials of this study. Three dimensional computer models of the radius, ulna and the distal humerus were constructed from the CT data of the both whole forearms. The accurate amount of deformity was quantified by comparing the affected bone model with the mirror image of the contralateral normal bone model. Then, three dimensional deformity correction was simulated and a custom-made osteotomy template was designed. The template was designed so that it snugly fits to the surface of the deformed bone and has a slit for osteotomy and the drill holes for insertion of Kirschner wires as guides for correction. The template was manufactured as a real plastic model through rapidprototyping technology. In the actual operation, we put the template on the bone surface, cut the bone through the cutting slit and correct the deformity as preoperatively simulated followed by plate fixation.

Results: Correction osteotomy was achieved as simulated in all cases. The deformities on radiographs were disappeared and forearm rotation was improved from 96 degrees preoperatively to 154 degrees postoperatively on average.

Conclusion: Corrective osteotomy for malunited forearm fractures using a custom-made osteotomy template is quite a useful method to achieve an accurate correction and to obtain a good functional result.



FP406

Are patients with normal MRI and X-rays after wrist injury asymptomatic?

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Background: MRI is being increasingly used in the diagnosis of occult wrist injuries. We have tried to determine whether patients with a normal MRI are asymptomatic at 6-12 months follow up

Materials And Methods: All patients presenting to the Emergency department with a history of wrist injury but normal radiographs were offered MRI scans. Between January 2005 and June 2006 134 wrists were scanned with a one Tiesla Siemen's scanner using a dedicated wrist coil. Of these 68 were reported as normal scans. All of them had been discharged from the clinic. We telephonically interviewed 62 of these individuals. Of the remaining subjects 4 were not contactable and 2 had on-going litigation and were excluded from the study. Harvard pain scale (1-10) and the functional component of modified Mayo wrist score (best score 8 and worst score 32) was used to assess the level of symptoms.

Results: Of the 62 patients 25 (40%) were symptomatic. Of the symptomatic group there were 10 males and 15 females (compared to 24 males and 38 females overall). Average age was 39 yrs (range 16-55, SD=11.84). The asymptomatic group were much younger with an average age of 26.8 years. Pain was the predominant symptom (92%), followed by weakness (52%) and clicking (16%). Average pain score was 2.78 (range 1-5, SD=1.06). Average functional score was 10.68 (range 9-12, SD=0.83).

Conclusion: A significant proportion of our subjects were symptomatic. Possible reasons for this may be pathology that was not picked up on MRI, pain syndromes, or pain of unknown cause.



FP407

Value of post-arthrography computed tomography in wrist ligament injuries

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Purpose: To evaluate the use of post-arthroscopy computed tomography in wrist ligament injuries.

Materials and Methods: Thirty consecutive patients who had a history and clinical findings suggestive of ligamentous injuries of the wrist were studied. Fourteen men and 16 women (average age 35 years) were included. The evaluation concentrates on the detection and precise localization of ligament lesions in the triangular fibrocartilage (TFC), the scapholunate ligament (SLL) and the lunotriquetral ligament (LTL)

Results: For TFC, SLL and LTL lesion, arthro-CT showed a sensitivity 96 % (24/25) , 90 % (9/10) and 85.7 % (6/7) , and specificity 80 % (4/5) , 90 % (18/20) and 91.3 % (21/23) , and accuracy 93.3 % (28/30) , 90 % (27/30) and 93.3 % (28/30) , respectively (95% confidence interval, Kappa=0.889, 0.927, and 0.710; $p < 0.0001$) .

Conclusion: Arthro-CT may be useful imaging method for evaluating intra-articular ligament injuries of the wrist.

Key Words: wrist arthroscopy, post-arthrography computed tomography, wrist ligament injuries

Thuermann N 2001



FP408

Wrist arthroscopy: Therapeutic resource or technological toy?

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Introduction : Many patients consult with pain on the dorsal aspect of the wrist as only symptom, located over the scapholunate joint, with increase of capsular tension. Sometimes pain begins after minor trauma or without any apparent reason. Usually they have undergone diverse treatments (oral medication, immobilization, infiltrations, physiotherapy, etc.). "Finger-extension test" is positive indicating synovitis. A small cyst can be present as a "hidden ganglion" on the scapho-lunate ligament. Mobility is complete. X-rays usually are normal and the MRI can show a cystic image or mild ligament lesion. Wrist arthroscopy is indicated in these patients who are refractory to conservative treatment and has two primary targets: diagnostic and therapeutic. To eliminate the inflamed synovial membrane by means of "shaver", washing the joint and injecting a corticoid in the joint.

Materials and Methods : One hundred and four arthroscopies were performed between 2001 and 2005; 80 wrist cases were selected for evaluation. Technique: With the upper limb in traction, with pneumatic tourniquet, portals 3-4 and 4-5 were used. It was complemented, with portals 6R and 6U when needed. Midcarpal joint was inspected through portals MCR and MCU. Shaving synovectomy, articular washing and injection of corticoid were performed. Postoperative treatment consisted of removable splinting for 4 weeks. Pain was subjectively evaluated after at least 6 months.

Results : No patient worsened as a result of the procedure and no complications were detected. In 75 patients pain disappeared, 3 patients presented residual pain, less than previously, and 2 patients did not experiment any improvement.

Conclusions : wrist arthroscopy is useful and has a defined place in the treatment of wrist pain, resistant to conservative treatment. The advantages of the arthroscopic procedure includes less scarring, faster mobilization, and a better assessment of intra-articular pathology.



FP409

Revolution in wrist arthroscopy: Early experience with InnerVue

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Wrist arthroscopy has become regarded as the “gold standard” for the assessment and treatment of patients with wrist symptoms. Whilst having advantages in terms of the accuracy of diagnosing wrist problems and assessing the joint surfaces so as to allow better treatment planning it is an invasive procedure requiring general or regional anaesthesia.

The InnerVue TM(Biomet Inc) arthroscopy system was developed to allow arthroscopy to be performed in a clinic environment under local anaesthesia. This is achieved by use of a flexible 1.2mm arthroscope. To date worldwide experience has been mostly with knee and shoulder arthroscopy.

Over the last 12 months we have performed 60 wrist arthroscopies using the InnerVue TM with the aim of moving towards an outpatient single stop diagnostic wrist service.

The InnerVue has become our arthroscope of choice for both diagnostic and therapeutic wrist arthroscopy. The portals are smaller and therefore more cosmetic and because of the flexibility of the arthroscope, it is now routine to visualize the whole of the radio-carpal and mid-carpal joint via a single portal, i.e. a total of two portals rather than the three or four previously required.

The field of view is sufficient to allow operative procedures to be performed and it has not been necessary to resort to a 2.7mm arthroscope.

In addition patients undergoing diagnostic arthroscopy have the option of having their procedure performed under local anaesthetic infiltration alone, without tourniquet. All patients opting for local anaesthetic have completed the procedure without discomfort and have benefited from being able to review the pathology in real time with the surgeon. No complications have been observed.

A single stop diagnostic wrist service under local anaesthetic is now being established.



FP410

Carpal instability and the role of scapho-trapezoid pillar as stabilizer of the carpus and spacer between radius and metacarpus

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The pathophysiology of carpal instabilities is poorly understood. Many authors consider important the scapho-lunate ligament for carpal stability whereas it is a lax structure which must allow dissociate movements of scaphoid and lunate bones.

Experimental severance of S.L. ligament does not allow the rotary subluxation of the scaphoid nor S.L. dissociation. S.L. dissociation is only possible if rotary subluxation occurs with dorsal dislocation of scaphoid proximal pole which is possible only if scapho -trapezoid ligament is broken. The only spacer between radius and metacarpus is the scapho - trapezoid pillar. The strong volar scapho - trapezoid ligament is little known because is fused with the F.C.R. tendon sheath and concealed by it. Various ligament reconstructions gave inconstant results because they are difficult, the new ligament blocks the dissociation of flexion and if dissociated movements of scaphoid and lunate occur they bring about failure of reconstruction. S.T.T. arthrodesis at middle term follow-up gave secondary arthritis. The rotary subluxation of scaphoid introduces collapse of the carpus up to S.L.A.C. with severe arthritis. My reconstructive technique requires double approach: Dorsal and Volar longitudinal. As the scapho - trapezoid pillar is important and the rupture of its volar ligament is the prerequisite for carpal instability, this ligament is corrected using a slip of the F.C.R. tendon passed throughout the distal pole of the scaphoid and pulled dorsally and fixing it to the remnants of the capsule at radius. Follow up (8 to 180 months) 44 cases – no relapse. All patients but one back to previous job, average absence 3.5 months. Pain absence 40 out of 44. Slight intermittent pain under stress in 5 out of 44 patients. Patients' satisfaction: 44/44. Scaphoid reduction always maintained. Complete R.O.M. of the scaphoid preserved: flexion in radial deviation, extension in ulnar deviation. Carpal height re-established.



FP411

Distraction technique for treatment of injuries and diseases of carpal bones

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We have the experience of treatment of more than 1000 patients with injuries and diseases of carpal bones using distraction technique. Based on our considerable clinical trials we have proved the advisability and practical possibility of distraction method application for treatment of dislocations and fracture-dislocations of carpal bones, nonunions and false joints of the scaphoid bone, aseptic necrosis of carpal bones (Preiser's disease, Kienböck's disease).

In delayed cases of dislocations and fracture-dislocations of carpal bones open single-step reduction leads to poor result, therefore it is an expedient action when two-step treatment obtains. We performed preliminary distraction of radiocarpal articulation using device at first stage. Further after 2-4 weeks we fulfilled open reduction of dislocation, reposition of carpal fractures and osteosynthesis with K-wires.

Distraction technique was performed for treatment of nonunions and false joints of the scaphoid bone. We varied distraction speed and time of fixation depending on X-ray signs of injury. During the process of treatment for the purpose of definition the dynamics of the scaphoid bone union we carried out X-ray study of radiocarpal articulation in three projections. When signs of union appeared, we removed the device and put a plaster slab.

In cases of aseptic necrosis of carpal bones (Preiser's disease, Kienböck's disease) distraction technique was performed in slow mode, which allowed decreasing or eliminating the pain syndrome, preventing further carpal deformations and reaching the union of lunate bone fragments as a result of pathologic fracture. In none cases we fulfilled an operation of arthrodesis of carpal bones.

Analyzing of long-term results of our treatment shows, that good results were received at more than 90% of patients. This indicates a high efficacy of distraction technique application in cases of injuries and diseases of carpal bones.



FP412

Comparison between lesser and greater arc injuries of the wrist

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There are multiple factors affecting the results of treatment of perilunate injuries. The purpose of this study was to compare lesser and greater arc injuries of the wrist concerning distinct surgical findings for each category, based on 71 wrists treated operatively (same surgeon, combined approach, fixation within proximal carpal row) and medium-term results, based on 47 of those wrists.

Seventy patients (71 wrists) were treated over 15-year period for perilunate injuries. There were 24 wrists with lesser and 47 wrists with greater arc injuries, 40 with fractured scaphoid and 7 with scaphoid intact. There were 45 fresh (Group I), 19 delayed (Group II) and 7 wrists with chronic injuries (Group III). Distinct surgical findings were: disruption of volar UC ligaments (5 cases, all with greater arc injuries), disruption of the dorsal RC ligament (40.4% of greater arc injuries), and an abnormal rupture of the scapholunate ligament in 31.3%, while in 50% the ligament was avulsed from the lunate.

Forty-six patients (47 wrists) were reviewed retrospectively at a mean of 52, 9 months (12-176 months). They belong to Group I (28 wrists), Group II (13 wrists) and Group III (6 wrists). Clinical evaluation was based on DASH and Mayo wrist score while radiographic evaluation was based on instability findings and the presence of arthritis. Average flexion-extension motion arc was 80% in lesser and 86% in greater arc injuries, while grip strength was 69.5% in lesser and 86.4% in greater arc injuries, compared with the contralateral wrist. Instability was found in 22.7% of lesser and in 40% of greater arc injuries, while arthritis was in 31.8% of lesser and in 45% of greater arc injuries.

We concluded that: Lesser arc injuries are prone to more advanced stages of lunate displacement and are more frequently overlooked. There are indeed distinct surgical findings in each category, while arthritis and instability are more frequent complications in greater arc injuries.



FP413

Early and delayed treatment of dorsal trans-scaphoid perilunate fracture dislocations

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Introduction: Transscaphoid perilunate fracture-dislocations are complex injuries. Delay in the treatment, anatomic type and close or open nature of the injury affect on clinical results.

Material and methods: Seven cases of dorsal stage 2 transscaphoid perilunate fracture-dislocations were treated by open reduction and internal fixation of the scaphoid with a herbert or cannulated screw. Temporary kirchner wire stabilization of the triquetro-lunate and triquetro-capitate was performed. Four cases were in acute and 3 cases were in the delayed phase. A clinical evaluation scoring system assessing pain, ability function in an occupation range of motion, grip strength was used. Scapholunate angle, radiolunate angle, revised carpal height ratio and presence of mid-carpal arthritis were used for radiological analysis.

Results: The follow-up averaged 28 months. The average clinical score of the four patients in the early phase and 3 patients in the delayed phase were good and fair. Two patients revealed mid-carpal arthritis in the last follow-up. Scapholunate and radiolunate angles increased and revised carpal height ratio decreased

Conclusion: Transscaphoid perilunate fracture-dislocations are best treated with early open reduction and internal fixation. According to our study, we recommend the open reduction and internal fixation for delayed cases.



FP414

Traumatic mechanisms and therapeutic results of the perilunate injuries

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Mayfield suggested the detailed reports about perilunate instability which was one of the unusual injuries. In this study, we evaluate the fifteen patients who have had a perilunate injury with dislocation or fracture, and study the pathomechanics and surgical treatment on the patients.

The subjects are consisted of fifteen patients (fourteen males and one female). The affected side was left in eleven cases and right in four cases. The mean age at time of surgery was 29.8 years old.

Of fifteen patients, eleven was the dorsal perilunate dislocation with the scaphoid fracture or not (including the simultaneous occurrence in both side), two was the dorsal perilunate dislocation with the scaphoid fracture and radial styloid fracture, one was the dorsal perilunate dislocation with pseudoarthrosis of the scaphoid and triquetrum fracture, and lunate fracture with the displaced bone fragment from intercarpal joint. Surgical procedure was performed by the palmar side incision, then the elongated or disrupted ligaments or capsule was repaired. Internal fixation to the scaphoid was performed using the variable full threaded screw. The mean follow-up period was four years and two months.

When the pathomechanics was estimated based on the Mayfield's criteria, fourteen patients were classified as type 3. However, a case of lunate fracture was extremely unusual and should be classified as the subtype of type 2. All patients have achieved the united bone. In the therapeutic results, mean palmar flexion was 68.7 °, mean dorsiflexion was 52.5 °, and grip strength on the affected side was 89.2 % of that on the unaffected side. There was no osteoarthritic changes and instability on the radiographic findings of the wrist joint.

It is important that we should not only make a reduction for the fracture or dislocation of the carpal bone, but also repair the disrupted soft tissues.



FP415

Perilunate fracture-dislocations of the wrist: comparison of temporary screw vs Kirschner wire fixation

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Introduction: We analyzed whether temporary screw fixation of perilunate fracture dislocations would decrease complications and improve final wrist motion when compared to Kirschner wire fixation.

Methods: Eighteen patients with operatively treated perilunate injuries (9 treated with buried screws and 9 with Kirschner wires) were evaluated an average of 44 months (range 7 to 115 months) after injury. Complications included 1 deep infection of the wrist (screw fixation), 2 pin track infections, 2 scaphoid nonunions (screw fixation) and 2 loss of reduction (K-wire fixation) treated with repeat surgery.

Results: Four patients (two in each cohort) had wrist arthrodesis and were considered poor results. Among the 14 remaining patients the final flexion arc was 97 degrees (range, 55 to 135) for patients treated with screw fixation compared to 73 degrees (range, 50 to 100) for patients treated with kirschner wires. Seven patients (2 screws, 5 k-wires) had signs of midcarpal arthritis grade 2 or 3 according to the criteria of Knirk and Jupiter, but none had more than mild radiocarpal arthritis. The mean grip strength was 74% (screw fixation) and 67% (K-wire) of the uninjured arm. According to the Mayo Modified Wrist Score the functional result was excellent (screw), good (one each group) fair (three in each group) and poor (4 screws, 5 K-wire).

Conclusion: Perilunate dislocations and fracture dislocations are severe injuries. Even at early follow-up intercarpal arthritis is commonplace. The results of treatment with screws are comparable to—and perhaps slightly better than—the results of treatment with Kirschner wires.



FP416

Treatment of trans-scaphoid perilunate dislocations

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Background and Purpose: Dorsal trans-scaphoid perilunate dislocations are comparatively uncommon, therefore a series of cases has been rarely reported and we have no consensus as yet. The purpose of this study is to show our treatment protocol of trans-scaphoid perilunate dislocations.

Patients: 28 patients with 29 dorsal trans-scaphoid perilunate dislocations were treated within 2 months after their injury in past 17 years. The mean follow-up period was 18 months. There were 2 female and 26 male patients. The mean age at the operation was 26 years. The average time between injury and surgery was 10 days (range, 0-60). Operative technique and method: Closed or open reduction and rigid internal fixation of scaphoid fracture with a Herbert screw was performed through volar approach or combined volar and dorsal approach. The torn palmar ligament was always repaired. K-wires fixation was used for stabilization of the capito-lunate and luno-triquetral joints. All wrists were immobilized in short arm casts for an average of 5 weeks (range 4 to 8 weeks)

Results: 28 of the 29 scaphoid fractures united well, with proper alignment of the carpal bones. Based on Cooney's clinical scoring system, there were five excellent results, twelve good, eleven fair and one poor. The average post operative flexion-extension arc of the injured wrist was 108° (79 % of the uninjured wrist). The average grip strength of the injured wrist was 77 % that of the uninjured wrist.

Conclusion: Our study supports open reduction, internal scaphoid fixation using Herbert screw, carpal ligament repair and earlier discontinuance of the cast in the management of this injury.



FP417

Minimally invasive approach to transscaphoid perilunate dislocation

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Minimally invasive approach with close reduction and percutaneous fixation is a well established method of treatment of scaphoid fracture; we put forward this method to use in the treatment of the transscaphoid perilunate dislocation.

From year 1999 to 2005, there were nine cases of transscaphoid perilunate dislocation treated with this method. There were eight males and one female, age ranged from 18 to 42. Three cases required open reduction; one for failed close reduction due to delayed treatment, one for failed close reduction due to rotated lunate, one for removal of bony fragments inside the mid-carpal joint. Seven cases were fixed with percutaneous AO cannulated screw and K-wires, one case was fixed with Herbert screw and one case was fixed with K-wires only. The average follow-up period was 50 months (ranged from 16 to 87 months). The average range of motion of wrist was 102 degrees (ranged from 66 to 140 degrees), the mean power grip was 38kgf (ranged from 13 to 62 kgf). The average Mayo score was 81 (ranged from 55 to 100), with three excellent, four good, one fair and one poor result. The average SL angle was 50 degrees (ranged from 30 to 65 degrees). Degenerative changes were found in the x-ray films of four cases, involving the radioscaphoid joint and the scaphocapitate joint.

Minimally invasive approach may be an alternative treatment of transscaphoid perilunate dislocation.



FP418

Arm transplantation for congenital absence of the hand

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Purpose: To present the six year results of an arm transplantation done on a 28 day old neonate.

Methods: An above elbow arm transplantation for congenital absence of the hand was done on May 19 2000 on a 28 day old neonate. The transfer was between two monozygotic twins. The donor was born with a large inoperable posterior meningoencephalocele and the recipient with a transverse absence of the hand at the distal forearm level with a proximal radioulna synostosis.

The site of coaptation of the median and ulnar nerve was at the axilla, only here did the recipient median nerve have sufficient number of fascicles to match the donor median nerve. The recipient ulnar nerve had far fewer fascicles compared to the donor ulnar nerve. No immunosuppressives was used.

Results: Thumb extension was noted two months after the surgery and at eight months the child can grasp and pinch small objects. One year and six months after the surgery the active elbow and wrist motion was full. Nerve recovery was most rapid for the radial nerve followed by the median nerve. Only the the ulnar innervated intrinsics did not show any signs of recovery.

Conclusion: This transplant is different from all other hand transplants performed to date. It is the only hand transplant performed for a congenital hand absence and it is an above elbow transplantation with no immunosuppressives used

Above elbow hand transplantation for congenital hand absence gives an excellent functional outcome. When less toxic immunosuppressives becomes available this case demonstrates a bright future for all those children with congenital limb deficiencies.



FP419

Sentinel skin allograft - A reliable marker for monitoring of limb transplant rejection

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Previous studies have demonstrated that composite tissue transplants such as limbs reject more slowly than skin transplants. This has led to the hypothesis that a simultaneous skin graft may act as an effective marker of limb rejection. The aim of this study was to test the predictive value of a sentinel skin graft as a marker of rejection, using a hind limb transplantation model in rats. Lewis rat recipients received a hind limb transplant s alone from Brown Norway donor (control, n=15) or combined with a full thickness 15 cm² sentinel skin graft (n=45). All animals received drug therapy (FK506, MMF and Prednisone) for 6 weeks, then treatment was ceased entirely. Rejection of the skin graft and limb skin was assessed by both visual and histologic grading system. Detectable rejection (grade 1) was observed 1.35 ± 1.5 days earlier in the sentinel skin graft than in the limb skin ($p < 0.0005$) and clearest rejection (grade 2) appeared 0.91 ± 1.58 days earlier in the sentinel skin graft ($p < 0.005$). The average histologic grade for early rejection of the skin graft was 1.46 and 1.08 for the limb skin ($p < 0.05$). These findings confirm a visual and histological delay in rejection of the limb skin compared to a distant sentinel skin graft. Skin grafts transplanted simultaneously with hind limbs can be a useful marker of early rejection.



FP420

Importance of strict patient compliance in hand transplantation

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Noncompliance among solid organs transplanted patients is recognized as one of the major causes of organ loss. The rate of noncompliant transplanted patients ranges from 20 to 50% with a peak after the 3rd year post-transplantation. Many strategies have been worked out to limit patients' chance of forgetting or mistaking dosages. It seems that one of the most effective ways is to reinforce personal motivations and meet, if possible, their specific needs. Though hand grafted patients are highly motivated and strictly selected, we have experienced transient episodes of non-compliance.

We asked our patients to complete a questionnaire with the aim of understanding their behaviour and feeling about their therapy, the impact of the therapy on their social, working and economic life, their knowledge and the awareness of the risks associated with non adherence to the scheduled immunosuppressive regime.

We present the data obtained from the questionnaire and the subsequent strategies we have worked out with the patients to try and reduce incorrect behaviours, or situations that may interfere with the therapy intake.



FP421

The use of allograft in reconstructive surgery of the hand

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Purpose: The aim of this work is to analyze the results obtained using allografts in reconstructive surgery of the hand.

Methods: Between 2000-2006, 12 patients between 16 and 52 years were treated using an allograft to replace the metacarpal and /or phalanx of the hand. In three cases the cause was recurring neoplastic lesions (aneurysm cyst, osteoma osteoid and TGC), in the remaining cases the etiology was traumatic. The place of reconstruction was the metacarpal in three cases, in one patient the lesion affected only the MP joint. In 8 patients the reconstruction was done at the phalanx transferring the PIP joint as well (except in one case). Different kinds of synthesis were performed: miniplates, micro-screw, K-wires and staples. A cancellous bone graft was used in two cases, platelet-rich plasma gel in four cases and a stromal stem cells in two cases.

Results: Nine patients were followed in a period between 70 and 24 months after surgery. The time needed to obtain a bone union was on average 6 months. The T.A.M. in the reconstructed fingers was between 0° and 270° with an average of 136°.

Discussion: The use of allograft in reconstructive surgery of the hand has been occasional. We believe that this study has been able to provide some useful findings. The waiting time to obtain perfect bone union can cause severe stiffness to joints: the osteosynthesis must be as much as possible stable to allow an early mobilization of the joint, especially in post-traumatic cases. Some questions about the future of the joint, articular cartilage and extensor tendons of allograft still remain unanswered.

Conclusion: We believe that the results obtained in this preliminary report are encouraging and point towards obtaining a reconstruction as much "biological" as possible.



FP422

Long-term acceptance of fully MHC-mismatched limb allografts after a short course of anti-Ab-T cell receptor monoclonal antibody and FK506

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Aims: To examine whether a short course of ab-T cell receptor-antibody (TCRmAb) combined with FK506 drug therapy promotes survival of limb allografts in the strong histocompatibility barrier of Brown Norway donor to Lewis recipient.

Methods: Eight animals received 250 mg/kg/day of TCRmAb and 2mg/kg/day of FK506 from day 1 to day 7 postoperatively (Group 1). Eight animals had FK506 only for seven days postoperatively (Control 1) and five animals did not have any treatment (Control 2).

Results: Early rejection with pink or slightly red skin occurred at an average of 8.6 ± 1.5 days postoperatively in Control 2 and at an average of 59.0 ± 8.3 days in Control 1, both of which proceeded to irreversible rejection. In Group 1, all animals showed evidence of early rejection at an average of 56.8 ± 12.6 days postoperatively, however, in 4 of 8 limbs, early rejection resolved without any treatment and limbs survived >1 year. One of 4 long-term survivors had partial tissue damage due to the early rejection. At 6 months postoperatively, donor skin grafts were accepted and third-party skin grafts were rejected by all four survivors, demonstrating donor-specific tolerance. Detectable chimerism (0.14-0.37%) was observed in the 4 surviving animals in Group 1.

Conclusions: Combined therapy of TCRmAb and FK506 resulted in long-term survival in fully MHC-mismatched limb transplants. The recipients were tolerant in association with a small but detectable level of chimerism.



FP423

Validation of scales used to assess pain and disability in arthritis

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Purpose: To determine the concurrent validity of patient self-report scales to assess outcomes of carpometacarpal (CMC) arthroplasty.

Relevance: Reporting of outcomes should utilize valid self-report scores.

Method: 115 patients requiring a CMC joint arthroplasty were reviewed at long-term follow-up. At this evaluation, motion, grip strength, and self-report scales were administered; arthritis involvement was determined from radiographs. The Patient-Rated Wrist Evaluation (subscales for pain and disability), Disabilities of the Arm, Shoulder, Hand (DASH-unidimensional), and AUSCAN (subscales for pain, stiffness and function) were completed on a single occasion by all patients.

Analyses: Factor analyses, inter-scale correlations, and tests of known constructs were conducted on the PRWE, DASH, and AUSCAN.

Results: Factor analyses did not support the described structure of any of the three scales. PRWE three subscales - 2 factors. AUSCAN - pain and stiffness items loaded on one factor; function items separated into 2 factors. DASH should be unidimensional, but displayed 4 factors. The largest factor on the DASH contained items relating to symptoms and participation restrictions. Items relating to hand function also separated into a separate factor. Correlations indicated a strong relationship between pain or function subscales across instruments ($r > 0.80$) and low correlation with hand appearance ($r < 0.20$). Tests of known constructs on 1. WSIB status (greater pain and disability associated with worker's compensation), and 2. arthritis involvement (diffuse versus local involvement), supported the discriminative validity of all scales ($p < 0.05$), except for the PRWE's function subscale or the AUSCAN's stiffness subscale ($p = 0.08$).

Conclusions: The PRWE, DASH and AUSCAN may not follow expected subscales, but they are valid as measures of patient status when summary scores are used.



FP424

Digital mucous cysts and their surgical management

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Introduction : Digital mucous cysts are common finger tumours from late middle age onwards. They are persistent and often recurrent after simple excision. It has been said that they are always associated with a bony irregularity or spicule at distal interphalangeal level and that surgically removing this irregularity leads to cure 1 .

Methods : A prospective study was conducted to reassess this statement. A sequential series of 12 cysts were excised over a 4 year period. Preoperative x rays were taken ascertain evidence of bony irregularity. Cysts were excised and traced back to joint line. Osteophytes were nibbled off. A minimum 6 month follow up was undertaken.

Results : A total of 12 cysts were removed from 10 patients. 8 had preoperative radiological evidence of osteophytes in the expected dorsal region of the DIP joint line. All 12 had surgical evidence of osteophyte presence. There were no surgical complications with any procedure. There were no recurrences of cyst formation within the 6 month follow up period.

Discussion and Conclusions : The findings support statements of Brown et al. Cyst presence was always associated with osteophytes and removal of the osteophytes did correspond with a 100% cure rate. Personal surgical experience of not removing osteophytes (8 patients, 9 cysts, 3 recurrences) is associated with much higher cyst recurrence rates, although a larger and controlled trial would be required to demonstrate this. It is recommended that osteophytes should always be sought and removed when treating this lesion.

1. Brown RE, Zook EG, Russell RC et al Plast Reconstr Surg 1991;87:14:718-725



FP425

Lateral approach for proximal interphalangeal joint arthroplasty: Clinical evaluation of 51 cases

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The authors purpose to evaluate the clinical results of Neuflex® implant arthroplasty of the proximal interphalangeal joint (PIPJ) using a lateral approach. A retrospective study of 51 implants of the PIPJ performed by a single surgeon was completed with an average follow-up of 36 months. All patients presented either primary arthritis or post-traumatic arthritis. The lateral approach needs a reinforcement of the collateral ligament and the volar plate with Mitek® micro bone anchors. Pain was not present in 86%. The mean active range of motion of the middle and the ring fingers was 71 degrees with a mean lack of extension of 11.7 degrees. The average active range of motion of the index was 59 degrees with a mean lack of extension of 10.6 degrees. This reduction in range of motion is due to the necessity to do a good reinforcement of the lateral ligament to avoid a supraductus of the index. The arthroplasty of the little finger had a active range of motion of 27 degrees. In spite of the improvement of the mobility of the PIPJ, the authors do not obtain any improvement in motion on the distal interphalangeal joint. In conclusion, Neuflex® replacement of the PIPJ with lateral approach is technically more demanding but is effective in providing relief of pain and improvement in motion.



FP426

A new PIP joint osseointegrated prosthesis – IPP2. Presentation and results with mean 5-year follow-up

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This is non a cemented semicontained prosthesis which consists of two screw- shaped stems covered with microporous titanium for stable anchorage in the bone marrow canal, connected with a standard hinge. Each screw has a central hexagonal canal into which the hinge stem is inserted. A dorsal approach without detaching the central slip insertion is recommended. The number of instruments is minimal. 29 prostheses have been inserted: 15 cases of primary and 6 cases of post traumatic osteoarthritis, 2 cases of rheumatoid arthritis, 2 cases of de-arthrodesis, 2 cases of Swanson PIP joint failure, 2 cases of IPP2 hinge failure. 25 patients have been evaluated with a one-year minimum follow-up: mean follow-up is 51 months (range 1 to 11 years). The osseointegration is obtained in all the cases. The prosthesis does not sink into P1, there are no radiographic loosening images around the screws. This is checked by measuring the screw-P1 base distance during the follow-up, and clinically by noting the absence of an extension lack during the survey. 16 of the patients (64%) were satisfied: mean ROM was (-10°/ 85°): in 7 cases mean follow-up was 6 years and for the other 9 mean follow-up was 3 years. For the other 9 prostheses the result was less satisfactory after the fist operation: 3 prosthesis failures, which were reoperated on; the subsequent results were good. 4 cases of "fat finger" with a limited painless ROM: -15°/-65°. In one case, reaming was performed for prosthesis implantation. 1 case of de-arthrodesis: painless ROM of -35°/-45°. One P1 fracture (rheumatoid arthritis).

This new prosthesis gives good and stable late clinical results. Use of pre-operative templation is mandatory for thin fingers.



FP427

Pyrocarbon PIP Ascension® prosthesis. 3 years results

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Osteoarthritis of the PIP joints might lead to a painful joint with loss of motion and grip strength. Joint fusion relieves pain but can be disastrous for the hand function. PIP silicone implants give a poor ROM with high failure rate and limited stability due to frequent implant fracture and the surface replacement arthroplasty therefore constitutes an attractive alternative.

The Ascension ® Pyrocarbon PIP prosthesis is a non constrained implant. At our department 34 patients (40 joints) have been operated since the implant was introduced in 2001. Pyrocarbon is an optimal material for small joint implants with high strength and low friction minimizing wear and with an elastic modulus close to bone decreasing the shear between bone and implant.

We report the results of 20 PIP implants in 15 patients (56 years) with a follow-up more than 3 years. 13 cases were operated because of primary osteoarthritis and 2 for post traumatic arthritis. At the last follow up 14/15 patients were pain free and had an increased functional score (COPM) and decreased DASH score more than 10 points. All articulations were stable. PIP joint flexion increased from 43 0 to 59 0 and total ROM of the finger from 160 0 to 185 0. The increase persisted over time. The extension defect was not improved.

Pyrocarbon PIP Ascension ® prosthesis offers a good alternative for the treatment of osteoarthritis but the short terms results have to be confirmed by longer series. The stem fixation remains a concern. Pyrocarbon is not osteointegrated and only bone apposition can be expected by the press fit fixation. Implant migrations have been observed especially in implants which were not primarily adequately positioned. In our series the migrations remained limited and never had clinical consequences and no patient was reoperated for this reason during the follow-up.



FP428

Proximal interphalangeal joint arthroplasty – A 10 year experience

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The RMS/Avanta/SBI surface replacement (SR) PIP joint arthroplasty consists of distal ultra high molecular weight polyethylene and proximal cobalt chromium alloy components . The design has been modified since 2000 to incorporate a titanium stemmed distal component allowing for press fit cementless fixation.

Cemented implants were used in 27 fingers since February 1997. Modified uncemented implants have been used in 21 fingers since October 2000. A further 17 cemented modified implants have been performed since September 2003 resulting in a total experience of 65 arthroplasties including 6 spontaneously and one surgically arthrodesed PIP joints.

43 joints have been followed for 2 or more years. (Range 2 to 9.5 years, median 5.3 years). There has been a decrease in pain during ADLs from a median of 6.5 to 0 (Av.0.5) "out of 10". The median arc of active motion increased modestly from 40 to 53° (peaking at 76° at a median of 3.6 months postoperatively).

Only two of the cemented implants have loosened and subsided, both in the index finger. A further 23 cemented joints followed for 2 to 9.5 years have no radiological evidence of loosening. Only 6 of the cementless implants followed for 2 to 5.6 (Median 4.1) years have not loosened. Twelve have loosened and subsided, often with angulation resulting the stems penetrating the cortical bone. Four have needed revision. Initially subsidence is asymptomatic. As it progresses, particularly as impingement occurs between the cortical rims of the proximal and middle phalanges, pain and stiffness develop. Methylmethacrylate bone cement should be used to fix the stems of the newer cement-optional PIP surface replacement arthroplasty. Good long term results (at least 10 years), particularly in terms of pain relief can then be anticipated. Surprisingly good results have been achieved following reversal of arthrodesed joints.



FP429

A new technique for the thumb carpometacarpal joint arthroplasty: Flexor carpi radialis sparing human allograft

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Trapezial excision with ligament reconstruction combined with tendon interposition has proven to be a highly effective technique for the treatment of OA of the CMC joint. We describe a new technique using Graft Jacket instead of FCR.

Methods And Materials: 35 patients underwent surgical treatment for CMC arthritis with a new technique using Graft Jacket (Wright Med.) instead of FCR. Graft Jacket is an acellular human collagen (dermis) allograft. It is rapidly revascularized, repopulated with host cells and has high tensile strength.

Technique: The Graft Jacket was placed around or sutured to the FCR and passed into the intramedullary cavity of the metacarpal as in the standard LRTI procedure. The remaining Graft Jacket is sutured together as an anchovy to fill the former trapezium gap, so that both suspension and interposition occurred. The mean age of the patients was 56 years and the median follow-up period was 1 year. Pain, grip and pinch strength, stability and range of motion were measured pre- and post-operatively. The ability to perform Activities of Daily Living requiring use of the thumb and to return to work were analyzed as well. Radiographic examination was performed in all patients at the 10th post-op day, and also at 2 and 6 months after surgery.

Results: Significant improvements were seen with grip strength (average 25lb) and tip (average 3.5lb) and key (average 4.5lb) pinch strength as well as palmar and radial abduction (average 25o). Pain was significantly reduced with an average of 6.0 on the VAS. There were no foreign body reactions or other infections in our series.

Conclusions: This study showed that excellent results can be achieved in strength, pain reduction, range of motion and ADLs with this new technique. Our results indicate less morbidity than with use of FCR (swelling, ecchymosis or weakness) with excellent final outcomes.



FP430

Proximal row carpectomy with capsular interposition – A minimum 2 year follow up study

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Objective: To evaluate the result of proximal row carpectomy with capsular interposition.

Materials and Methods: From October 2003 to June 2004, proximal row carpectomy with capsular interposition was performed in 7 patients. There were 5 males and 2 females. Average age was 45.3 years. Dominant hand was involved in 3 patients. The surgery was performed when cartilage degeneration of grade 3 or more was present on capitate head or lunate fossa of distal radius. All patients underwent conservative management for at least 3 months before surgery. Pain visual analog scale, PRWE, range of motion of the wrist and grip power were measured before and after the surgery, and were compared statistically by Wilcoxon matched pairs signed rank sum test with $p < 0.05$ being considered to be significant.

Results: At an average follow up of 28.8 months, six of the seven patients rated the result as a success. Their average pain VAS of the most painful time was reduced from 8.4 to 3.1 ($p < 0.05$). PRWE score was reduced from 65.0 to 25.0 ($p < 0.05$). Average flexion was reduced from 48.8 ° to 31.3 ° ($p < 0.05$). But average extension was not changed significantly. Average Grip power was improved from 21.0 kg to 25.2 kg ($p < 0.05$). They were satisfied or very satisfied with the result and were willing to recommend the same procedure to those having the same disease. Another one, who rated his result as a failure, revealed reduced grip power and increased pain VAS. But he refused wrist arthrodesis and did not change his job.

Conclusion: Within the scope of this study, proximal row carpectomy with capsular interposition can be performed to avoid arthrodesis for the treatment of severe arthritic changes of the wrist.



FP431

Clinical and CT evaluation of four-corner arthrodesis with spider circular plate in the treatment of SLAC/SNAC wrist

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Background : Four corner arthrodesis with scaphoid excision has been used to reduce pain and to partially preserve motion in patients with radioscaphoid arthritis and carpal collapse (SLAC/SNAC wrist). Four corner arthrodesis can be performed with K wires, screws, staples and circular (Spider®, Hub Cup®) or square plates (Diamond®).

Aims : The aim of this study is to evaluate the results of four corner arthrodesis with scaphoid excision performed with spider® circular plate (MBA) at 12 to 26 months, in terms of motion, strength and pain and to compare them to radiological findings.

Material and methods : Eight patients (mean age 66.3 years), six men and two women, underwent surgery for carpal collapse. In six cases secondary to a long-standing scapholunate dissociation (SLAC wrist) and in two cases to a long standing scaphoid non union (SNAC wrist). All patients were treated with scaphoid excision and luno – capito – hamate – triquetrum arthrodesis with a Spider® plate. They have been re-examined 12 to 26 months after surgery and mobility (ROM), grip strength (Jamar), daily activities and pain (DASH questionnaire) were evaluated. Radiographs, CT scans and MRI were performed pre- and postoperatively.

Results : None of the patients had pain under resting conditions; four of them had slight residual pain and two had moderate pain under stress. Grip strength increased compared to preoperative values. Wrist extension was an average of 31°, wrist flexion 23.5°. CT scans showed no signs of union in six patients (75%) and MRI demonstrated no progression of arthritis in the radio-lunate joint in all cases.

Discussion : Scaphoidectomy with four corner arthrodesis is a reliable procedure for treating pain and for preserving partial wrist motion. In particular, the circular plate simplifies the surgical technique and reduces the postoperative immobilization. The high rate of radiological non-union, although always asymptomatic, needs to be evaluated with a longer follow-up.



FP432

Four corner fusion using circular (spider) plate

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Recent literature has suggested poor results utilizing circular plate fixation for 4 corner fusion. Vance et al, JHS 30A, Nov 2005 1, reviewed 27 4 corner fusions utilizing plate fixation and reported a 26% nonunion rate and a 22% hardware impingement rate.

In contrast, we have not had similar problems with this implant and report on our experience with this implant in 4 corner fusion.

Methods: We identified all patients in whom a Spider or Mini Spider plate was implanted by the surgeons in our unit and conducted a retrospective review .

Results: We identified 28 patients in whom a Spider plate was implanted for 4 corner fusion. 1 patient was lost to long-term follow-up although was progressing to union at time of last review. 1 patient developed a non union and 1 patient achieved clear radiographic union but progressed to wrist fusion for persisting pain. In total there was 1 nonunion from 27 cases with sufficient radiographic followup (3.8%).

Discussion: We achieved a high rate of union with this implant. The difficulties reported in the paper above may be due to technical errors. These errors include malpositioning of the lunette, superficial placement of the plate and so called "in-situ fusions" with inadequate articular debridement.

References:

1 Complications and Outcome of Four-Corner Arthrodesis: Circular Plate Fixation versus Traditional Techniques

Michael C Vance; Jon D Hernandez; Michael L DiDonna; Peter J Stern

The Journal of Hand Surgery; Nov 2005; 30A, 6; pg. 1122



FP433

Conversion rate of intercarpal arthrodesis to wrist pan-arthrodesis

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Introduction: The purpose of this study was to evaluate the rate of conversion of intercarpal arthrodesis to wrist pan-arthrodesis over an average follow-up period of 4 years.

Methods: A retrospective chart review was conducted of 82 consecutive patients who underwent intercarpal arthrodesis from 1990-2002. Complete data were available for 67 patients and analyzed using SPSS software. The average follow-up time for all patients in this study was 46 months (range 7-185 months).

Data: Twelve of 67 (18%) intercarpal arthrodesis went on to require total wrist arthrodesis. Of these, nine of 31 (29%) were midcarpal, two of 21 (10%) scaphotrapezial trapezoid (STT), zero of five radiocarpal and one of ten (10%) lunotriquetral arthrodesis. The average time from partial wrist arthrodesis to total wrist conversion was 13 months (range 7-27 months).

Conclusion: Eighteen percent of all intercarpal arthrodesis failed and required total wrist arthrodesis at an average follow-up period of 46 months. Midcarpal arthrodesis, in particular, were more likely to require conversion to a total wrist arthrodesis. Success at the first postoperative year appears to be an indicator for long term success.

References: Watson HK, J Hand Surg 1999; Brown RE, Ann Plast Surg 1995; Krimmer H, Handchir Mikrochir Plast Chir 2000.



FP434

Findings of multicenter study into a novel ceramic wrist joint prosthesis (MBW)®

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The Implantation of the MBW® ceramic wrist joint prosthesis is an operative procedure with a high patient outcome. Between January 2003 and April 2006, 43 wrists (SLAC-wrist, SNAC-wrist and radiocarpal arthrosis after fracture of the distal radius) were treated by implantation of a novel ceramic wrist joint prosthesis. The follow up was after a mean time of 31,3 months after operation.

The DASH score was on average 19,7 (5-36,3). The visual pain analogue scale following exercise was on average 3.3 (0-8). The verbal pain analogue scale following exercise was on average 2.1 (0-4). Comparing grip strength to the unoperated hand we measured 27 to 37 kg.

There was one complication (postoperatively Luxation). We were not able to find a loosening of the Prosthesis.

All patients would like to be operated on in the same operative procedure again on account of contentment.



FP435

Arthroscopic reduction and percutaneous fixation of scaphoid fracture and non-union

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Purpose: To analyze the radiologic and clinical results of arthroscopic reduction and percutaneous fixation of scaphoid fracture and nonunion

Materials and Methods: Fourteen cases were analyzed clinically and radiographically who were treated with arthroscopic reduction and percutaneous fixation . We treated 3 cases delayed unions, 5 cases nonunion and 6 cases fractures. Time delay from injury to treatment was 264 days in delayed unions and nonunions, 11days in fractures. There were 13 men and 1 woman, and mean age was 30(14~45) years. Postoperative management was carried out by application of short arm brace for 4 ~ 6 (average 5.4) weeks. We checked serial radiograph every 2 weeks to confirm bony union. For functional evaluation, Mayor wrist scores and DASH were analyzed. Scapholunate laxity of arthroscopic finding was graded by Geissler classification.

Results: One patient was A2, 5 patients B2, 3 patients C, and 5 patients D1 according to Herbert classification. In preoperative x-ray, mean intrascaphoid angle were 32(AP) and 29(lat), in postoperative x-ray they were measured 36(AP) and 28(lat). Bony union was achieved at mean 5 weeks. Grade 4 scapholunate ligament laxity was identified requiring pinning. Eight cases were inserted dorsally, and six cases volarly using Acutrak screw or K-wires. Mean Mayor wrist score was 86(60~100) with 7 excellent and 4 good cases. Mean DASH was 11.1(0~63.3).

Conclusion: Arthroscopic reduction and percutaneous fixation of scaphoid fracture and nonunion has provided satisfactory results.

Key Words : scaphoid, arthroscopy, percutaneous fixation

Slade JF 2006



FP436

Scaphoid non-union: The factors effecting outcome after non-vascular bone grafting and internal fixation

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This study identified variables affecting the outcome of surgical management of 126 un-united scaphoid fractures managed by internal fixation and non-vascular bone grafting. The site of fracture was defined by a new method – the ratio of the length of the proximal fragment to the sum of the lengths of both fragments, calculated using specific views in the plain radiographs. Bone healing occurred in 71% of cases. Only the site of non-union ($p = 1 \times 10^{-6}$) and the delay to surgery ($p = 0.001$) remained significant on multivariate analysis. The effect of the delay to surgery on the probability of union increased as the fracture site moved proximally. A prediction model was produced by stepwise logistic regression analysis allowing the surgeon to predict the success of surgery using this technique if the site of the non-union and the delay to surgery is known.



FP437

Asymptomatic scaphoid non-union

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Purpose: There are some patients whose scaphoid nonunion remains asymptomatic or few symptoms to interfere with their works and daily activities. We retrospectively studied radiographic findings and functional status of the wrist which had remained asymptomatic for a long period.

Methods: There were ten asymptomatic patients who had supposedly had a scaphoid nonunion for at least 10 years. Nine of these scaphoid nonunions were accidentally found when the radiographs of the wrist were taken for some other reason. One of them was found owing to the extensor pollicis longus tendon rupture as a result of scaphoid nonunion. All of the patients were males, with an average age at examination of 51 years (range, 30-78). The average time from injury to examination was 27 years (range, 10-40 years). The right and left hands were involved in 6 and 4, respectively. Five cases involved the dominant hand.

Results: Six patients were free of wrist pain. Three patients occasionally had weather pain and one had mild pain after a second injury occurred. The total extension and flexion arc of wrist motion averaged 88.0% (range, 71-100%) of the contralateral wrist. The average grip strength measured was 90.4% (range, 71-100%). Although we found that all of the patients had arthritic changes at the radioscaphoid joint, these are minor changes and all were classified into SLAC stage 1 arthritic changes. The average radiolunate angle was -11 degrees (range, -8 to -18 degrees).

Conclusion: The patient with asymptomatic scaphoid nonunions for a long period remained better wrist functions and showed slower progression to the scapho-lunate advanced collapse wrist than those with symptomatic nonunions. In these circumstances surgical intervention for treatment of the pseudoarthrosis may not be warranted.



FP438

Percutaneous grafting and fixation for selected scaphoid non-union

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In established scaphoid non-unions where alignment has been maintained, minimal sclerosis exists at the fracture site and carpal viability has been demonstrated (Slade & Geissler; 2003 Grade III, IV) it is possible to use an extended percutaneous technique combining rigid internal fixation with autogenous cancellous bone grafting.

The technique involves the placement of a guide wire along the central axis of a reduced scaphoid fracture or non-union (Goddard 2003). A second parallel may be required to provide rotational stability and prevent displacement prior to drilling. The scaphoid is reamed with a standard Acutrak drill in order to freshen up the fracture site and to prepare the drill track. Cancellous bone graft is then harvested from the iliac crest using a modified bone biopsy needle. The cancellous graft is then impacted into the site of the non-union and then the scaphoid is rigidly fixed using a standard headless cannulated Acutrak compression screw. Wrist motion is restricted with a splint or short arm cast for 4-6 weeks, and the patient reviewed until bone union has been established.

We now have over five years experience of this technique with successful union occurring in 41 of the 44 cases.

We believe that for selected cases this minimally invasive technique represents an alternative to open (Russe type) grafting as it generally results in satisfactory union of the fracture with minimal morbidity.



FP439

Mini-Acutrak screw fixation in a consecutive series of 46 scaphoid non-unions

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The clinical effectiveness of very small screws has been questioned in the past.

We studied the use of Mini-Acutrak screw in the fixation of scaphoid non-union.

This is a prospective review of 46 patients with established non-union, treated with bone grafting and fixation using the Mini-Acutrak screw. All patients were operated by a single surgeon. Acute fractures and fractures that required vascularized bone graft were excluded from the study. The procedure was carried out through a volar or dorsal approach for waist and proximal pole fractures respectively. Bone graft was taken from the distal radius or the iliac crest depending on the size of gap left following debridement of the non-union. All patients had a minimum follow up of one year. The patients were clinically assessed using the scaphoid score, patient rated wrist evaluation and the Herbert –Filan criteria were used for radiological evaluation. Forty three out of 46 patients (93%) had clinical and radiological union. Average time to union was 4.8 months. 75% of patients had no pain or mild discomfort with strenuous use, 88% went back to their usual work. 78% of patients achieved equal motion to that of the opposite side and 75% achieved good or excellent results. Four patients had mild scar tenderness.

None had infection. One had prominent metal work.

The rate of union and time to union was comparable with those of other reported series, where large implants were utilized. The Mini-Acutrak screw provided adequate stabilization promoting bone healing. The use of this implant was easy and safe.



FP440

Treatment of the undisplaced scaphoid non-union by a pure cancellous chip bone graft and K-wire fixation

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Introduction: Scaphoid nonunion occurs in 5-15% of scaphoid fractures and induces limitation of motion and pain on the wrist. Inlay bone graft and anterior interpositional wedge bone graft were commonly used but these are technically demanding procedures and have a difficulty to maintain articular surface. We present the results of our cases treated by only cancellous chip bone graft and K-wire fixation.

Materials and methods: Between 2004 and 2005, 10 patients were treated with cancellous chip bone graft and K-wire fixation and we reviewed 9 patients who were followed up more than one year. All patients are men with the mean age of 28.7 years (21 to 47). The time interval between the injury and surgery ranged from 5 months to 84 months (average 22.9 months). 6 fractures were in the middle third of the bone, 2 in the proximal third and 1 in the distal third. In all cases, we evaluate articular surface and presence of humpback deformity. If the articular surface was maintained, the nonunion site was debrided and curetted by curette and power burr. Cancellous bone chips were harvested from the iliac crest and were used to pack the nonunion cavities maintaining articular surface. Internal fixation was accomplished with K-wires to stabilize fragment.

Patients were followed up with clinical evaluation and the radiographs. Range of motion, grip strength, and pain were all measured. The clinical outcome was evaluated at last follow-up visit according to the modified Mayo wrist scoring system.

Results: Solid union was achieved in 8 cases. One patient with distal pole comminuted fracture had partial nonunion.

Conclusions: Cancellous chip bone graft and K-wire fixation could be a technically simple method, providing good clinical results. If humpback deformity was not severe and articular surface was maintained, it may be a reasonable treatment of scaphoid nonunion.



FP441

Treatment of scaphoid pseudoarthrosis with vascularized bone graft from volar side of the radius

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Vascularized bone graft which is harvested from dorsal aspect of the radius for the treatment of scaphoid pseudoarthrosis is widely known as the technique of Zaidenberg. But there are few articles which report about the vascularized bone graft harvested from volar aspect of the radius. The grafting technique we report is based on the volar carpal artery which exists between radial and ulnar artery and communicate with anterior interosseus artery. Our operative procedure was mainly based on the technique described by Mathoulin et al. We report the results of anatomical study and clinical application of vascularized bone graft based on the volar carpal artery for the treatment of scaphoid pseudoarthrosis. (Materials and methods) We have treated 12 patients of scaphoid pseudoarthrosis with this technique). The average age was 30.7 and (range 15-64 yr) all were male patients. The approach we used was palmar scaphoid approach. The length of the skin incision was 5 to 7cm including both donor and graft site. Through the aponeurosis of pronator quadratus, volar carpal artery could be found and also be seen running toward the volar and ulnar side of the radius on the periosteum giving two or three distributions. The size of bone graft recommended to be under 1*1cm. Including pedicle. The vascularized bone was transferred to the fracture site and fixated with K wire. (Results) In all 12 cases bone union was obtained. Bone union was obtained 60 days on average after operation. Average casting period after operation was 21 days on average. (Discussion) We think that vascularized bone has much potential than non-vascularized bone for bone union. This procedure can add the vascularization for conventional bone graft from the radius. Early bone union of this series show the potential of this procedure.



FP442

Long term clinical outcome of vascularized pedicled bone graft for scaphoid non-union

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Treatment of scaphoid nonunion is a major challenge to the hand surgeon. Vascularized bone grafts from the distal radius have been shown to improve the rate of nonunion. The purpose of this study is to evaluate long term outcome of such procedure.

Materials and Methods: Between 1989 and 200, 28 patients with nonunited scaphoid fractures were treated with vascularized bone grafts from the distal radius using the 1,2 intercompartmental supraretinacular vessels. Patients' age averaged 38 years (15 to 63). There were 19 males and 9 females. The dominant hand was involved in 17 patients. Fractures involved the waist in 19 patients (68%); proximal pole in 8 (28%) ;distal pole in 1 (3%).

Fifteen patients (54%) did not receive any treatment before; six (21%) had a cast immobilization and 7 (25%) had previous ORIF. Time from injury to surgery averaged 43 months (3-260). Internal fixation was achieved with K-wires.

Results: All fractures healed. Average time to healing was 11 weeks (5-24).

Follow up averaged 7 ½ years (5 to 17). Sixteen patients (57%) had no pain; 8 (29%) had minimal pain; 3 (11%) had moderate pain and 1 (3%) had persistent pain.

Range of motion averaged 89% of the contralateral side. Grip strength averaged 91% of contralateral side. Only one patient had to change his job when he took an early retirement. The rest of the patients went back to their original jobs.

Mayo scoring system: Excellent 17 (61%); Good 7 (25%); fair 3 (11%); poor 1 (3%).

86% of the patients were satisfied with the outcome. The three patients who had moderate and persistent pain were found to have arthritic changes in the radioscapoid and lunocapitate joints.

In conclusion: Treatment of scaphoid nonunion with vascularized bone graft is associated with good short and long term outcome.



FP443

Vascularized bone grafts in scaphoid non-union

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Up to 35% of scaphoid fractures develop a nonunion. Conventional treatment, bone allograft and internal fixation of the nonunion has a high failure rate (40%). Vascularized bone grafts have several advantages, they provide bone conduction and induction avoiding the creeping substitution phenomenon. In the proximal third of scaphoid the use of vascularized bone graft gave bone healing rates of 88% v/s 47% with the conventional grafts for the treatment of nonunion and avascular necrosis. For the purpose of this work we studied the anatomy and surgical technique of the 1,2 intercompartmental supraretinacular artery (1,2 ISRA) and the bone supplied by the artery. This was carried out using fresh frozen cadavers. We designed a prospective study used the vascularized bone of the distal radius depends from the 1,2 ISRA as bone graft. Thirty male patients with a definitive diagnosis of scaphoid nonunion were operate on by the same surgeon. Functional and radiological follow up was performed. Twenty two patients who had a DISI and humpback deformity were successfully treated with complete restoration of normal anatomy. A bone union was achieved in 90% after an average of 9,38 weeks (5-12 weeks). The vascular bone graft failed in 3 of 17 cases with an avascular necrosis of the proximal third. Using the Steinman functional scale, 83,3% of the patients had an excellent and good result after a follow up of 40 months. Vascularized bone graft is a safe and successful procedure in the treatment of scaphoid nonunion rates in shorts periods of time, better functional results and earlier returns to work can be achieved.



FP444

Vascularised bone grafts for scaphoid non-union

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Review of the union rates following surgery for scaphoid non-union using vascularised Zaidenburg and Kuhlmann bone grafts.

All patients undergoing vascularised bone grafting for scaphoid non-union in one centre since 1991 with minimum 6 month follow-up were included. Most frequently Zaidenburg grafts were used for proximal pole fractures and Kuhlmann grafts for waist fractures. Union was assessed clinically and radiographically. Bony trabeculae traversing both graft:host interfaces on at least 2 views was taken to represent bony union. If there was doubt regarding union a CT scan was obtained.

Forty patients (38 male, 2 female), mean age 23 years. The site of the non-union was the proximal pole in 11 cases and the waist in 29. Zaidenburg technique in 18 cases and Kuhlmann in 22 cases. The graft and non-union were fixed with a screw (36 cases) or K wires (4 cases). Two cases were lost to follow up. Union was achieved in 36 of 38 cases (95%)(worst case scenario 90% if the two cases lost to follow up are assumed not to have united).

A recent meta-analysis supported the use of vascularised bone grafting in certain scaphoid non-unions. This study suggested union rates of 88% could be achieved using these techniques even in patients with an avascular proximal segment. Several previous studies have considered the results of the Zaidenburg procedure. The grossly pooled rate of union in these studies was 79%. Fewer studies have considered the Kuhlmann technique. A small number of cases were represented in this study but 100% union was observed. This study presents the results of using different vascularised grafts selectively in this difficult group of patients and supports a multi-centre, prospective, randomised study to assess the relative performance of vascularised and non-vascularised grafts. 300 patients would be required to confirm a 10% difference in union rates.



FP445

Arthroscopic replacement of necrosis of the proximal pole of the scaphoid by a partial, pyrolytic carbon, scaphoid implant

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Introduction: We report the results of placement by wrist arthroscopy of implant in pyrocarbon which adapts to the kinematics of the carpus to replace a necrotic proximal pole of scaphoid.

Material And Methods: All patients were operated on as outpatients under local regional anesthesia using a pneumatic tourniquet.

The arthroscope is positioned in the radiocarpal joint using the 4-5 radiocarpal opening. By a 3-4 radiocarpal surgical approach, the attachments of proximal pole are divided under arthroscopic control. The detached proximal pole is easily withdrawn with forceps. The implant is then put into the radiocarpal joint in place of the proximal pole by arthroscopy. Only the 3-4 radiocarpal surgical approach is closed, with a single stitch. A splint is not necessary. Mobility is started immediately, letting the patient choose himself the range of movements he wishes to make depending on his post-operative pain.

Results: We operated on 18 patients using this technique. The average age was 61 years old (between 42 and 81). Our average follow up is 37 months (between 12 and 59 months). There were one cases of volar implant dislocation. The range of motion was improved in all cases. Pain disappeared in 14 cases and was reduced in 2 cases. In two cases with disabling pain, it was necessary to perform a palliative treatment after implant removal.

Discussion: This salvage technique seems to us to be simple and useful in elderly people and could be a waiting therapeutic option in other cases.



FP446

Adaptative proximal scaphoid implant (APSI) for the treatment of proximal scaphoid pseudarthrosis

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Scaphoid fractures is the most common of carpal bones, being frequently undiagnosed. With its poor vascularization on the proximal pole, nonunion or vascular necrosis in this location is frequent.

The authors present the results of eight patients with vascular necrosis of proximal pole, treated with a new Adaptable Proximal Scaphoid Implant (APSI), between January 2005 and March 2006.

This mobile implant in pyrocarbon, available in three sizes, has a similar elasticity to bone, and theoretically permits restoration of variable geometry of carpal structure.

The authors conclude APSI is a good alternative for treatment of proximal scaphoid nonunion or vascular necrosis. It is a simple technique, with a small incision, obtaining good mobilities and stability of wrist, and restoring normal coherence of proximal carpal bones.



FP447

Activation of the primary somatosensory cortex during stereoscopic observation of tactile stimulation of the hand

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Background: Previous studies have shown a neural system in primates that supports imitation and action understanding by directly matching observed actions and their motor counterparts. This "mirror-neuron system" system has been found in the human premotor and motor cortices.

Purpose: To test whether the sensory cortical areas of the hand would be activated by observation of tactile stimulation of the hand.

Methods: We used functional magnetic resonance imaging (fMRI). While lying supine in the bore of the MRI scanner two sets of stimuli were presented to the control subjects: 1) tactile stimulation of the hand 2) stereoscopic visual observation of tactile stimulation of the hand. Functional activation was measured over two separate 180-scan run each consisting 20 seconds task/control cycles.

Results: The fMRI studies show the expected activation patterns in contralateral primary somatosensory cortex when the subject experiences tactile stimulation to the hand. The stereoscopic visual observation of tactile stimulation of the hand activated the matching areas in the primary somatosensory cortex in all of the subjects .

Conclusions: The functional studies show that observation of tactile stimulation of the hand activates the primary somatosensory cortex. These observations may have implications for the rehabilitation of individuals after a nerve injury.

FP447

Activation of the primary somatosensory cortex during stereoscopic observation of tactile stimulation of the hand

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FP448

Differentiation of bone marrow stromal cells into Schwann cells in adult rats

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Introduction: Although Schwann cells become the most commonly used cells in tissue-engineered nerve grafts , their clinical use is limited because it is difficult to obtain a sufficient number of cells. The purpose of study was to evaluate the differentiation potential of bone marrow stromal cells (MSCs) into Schwann-like cells to offer new therapeutic strategies for peripheral nerve regeneration.

Materials and Methods: MSCs were isolated and cultured from adult male Wistar rat. We administered several neurotrophic factors to rat MSCs in order to differentiate into cells with a phenotype similar to that of Schwann cells. To compare MSCs, differentiated MSCs, and Schwann cells cultured from rat sciatic nerve, Phase-contrast microscopic evaluation and immunohistochemistry of S-100, GFAP, known as markers of Schwann cells were done.

Results: Phase-contrast microscopy revealed that the differentiated MSCs were morphologically different from the undifferentiated MSCs and resembled Schwann cells. Most of the differentiated MSCs and Schwann cells were positive to S-100 and GFAP, but undifferentiated MSCs were negative to these Schwann cell markers.

Conclusion: Results in this study indicate that MSCs are capable of differentiating into Schwann-like cells which may be a promising candidate for cell transplantation in tissue-engineered nerve regeneration.



FP449

Tissue engineering for the peripheral nervous system: An experimental study of different materials in rats

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At the moment autologous nerve grafting remains the only reasonable technique for reconstruction of peripheral nerve defects. Unfortunately, this technique has a lot of complications and disadvantages. These problems are related to the autologous nerve that is harvested for this procedure. Donor site morbidity with loss of sensitivity, painful neuroma formation and of course the restricted availability of autologous nerves stimulates the idea for alternative techniques on that field. In this paper we describe our experience with different graft materials for reconstruction of a 2 cm nerve gap in a median nerve model in rats.

After implantation of various materials (biological/synthetic) the main experiments were conducted with a synthetic, biodegradable nerve conduit seeded with autologous Schwann cells. With this material we were able to reconstruct successfully a 2 cm gap in the rat median nerve. Regeneration with this material was found to be equally to an autologous nerve graft.

Keywords: epsilon-caprolactone, nerve repair, nerve conduit, rat median nerve, Schwann cells



FP450

Study of the peripheral motor re-innervation of the sciatic plexus of rabbits after surgical lesion

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The authors with the use of electrophysiological methods have compared nerve defects bridged with auto grafted nerve transplant, vein, PGA, and sylicon tubes. In all cases 20 mm segments were resected from the sciatic nerve. In every group 10-10 Canadian white rabbits were operated. EMG examinations were done on the peroneus longus muscle at 1, 2, 3, 6, 9 and 12 months after the operations. Besides the spontaneous activity suggestive of denervation, we analyzed the mean results of those 20 motor units with an average degree of innervations. As a control group we have used the healthy side's EMG data.

Results:

1. It has been proven true that a regenerating nerve is capable of bridging a 20 mm gap.
2. At the end of the 2 nd postoperative month the EMG has shown the first re- innervation signs in the cases of silicon and PGA tubes.
3. The start of regeneration in the case of nerve graft can be expected by the end of the 3 rd month.
4. On the 6 th and 9 th month there were significant differences among the groups with the PGA, the grafted nerve, and the vein transplants.
5. By the end of the 12 th month, significant differences could be measured electro physiologically among the different groups.



FP451

Quantitative evaluation of sensory loss in Charcot-Marie-Tooth disease

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Introduction: Sensory changes are part of the functional deficits in patients with Charcot Marie Tooth (CMT) disease. As both motor and sensory function influence hand dexterity, quantitative evaluation of these functions is needed in CMT patients. While literature has mainly focused on joint position, vibration and two-point discrimination, quantitative evaluation of touch using monofilaments has not been described in CMT disease. Aim of this study was to describe sensory loss in CMT and its relations with muscular strength and hand dexterity.

Methods: 46 of 51 eligible patients agreed to participate in the sensory testing using the Weinstein Enhanced Sensory Test (WEST). Sensory testing was performed on six locations of both hands. Inter- and intra-observer reliability was tested in 15 patients. Strength of three intrinsic muscles was measured using manual muscle strength testing (using the MRC scale) and using a hand-held dynamometer (the Rotterdam Intrinsic Hand Myometer; RIHM). Hand dexterity was measured using parts of the Sollerman hand function test assessing fine manipulation. Pearson and Spearman correlation test were used to study the relation between sensory loss, muscle strength and hand dexterity.

Results: 63% of the CMT patients reported problems manipulating small objects. Inter- and intra-observer reliability was 0.91 and 0.86. We found no significant differences in sensory function between the left and right hand, between proximal and distal locations, or between median and ulnar nerve innervated locations. There is a significant correlation between sensory function and strength of intrinsic muscles ($r = .57$, $p < .001$), with a skewed relationship. The Spearman correlation between hand dexterity and muscular strength respectively sensory function was .70 and .65.

Conclusion: Weinstein Enhanced Sensory Testing is a reliable method to test sensory function in CMT. Sensory function in CMT is not linearly related to the amount of muscular strength. The sensory loss in CMT does not show a specific pattern.



FP452

Modern ultrasound diagnosis of the peripheral nerve lesions of the upper extremity

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High level of mistakes in diagnostics and treatment mode and consequently poor outcome induces researchers to look up new ways of upgrading the medical care in managing patients with peripheral nerve lesions. The goal of our studies is to determinate resources of ultrasound in diagnostics of the upper extremity peripheral nerve lesions

We investigated 142 patients with lesions of 195 peripheral nerves of the upper extremity. Total nerve lesion was characterized by appearance of echo-dense area at the place of defect zone at ultrasound pattern. At the stump of the proximal nerve fragment we've found neuroma (oval-shaped hyperechoic substance with across diameter 1,5-3 times more than at nerve trunk). Later several weeks after trauma we observed some dystrophic changes of the distal fragment: decreasing of diameter, disappearance of differentiated structures.

Ultrasonography permits to measure sizes of nerve trunk area, which has to be compensated by a surgical manner. US allows to determinate the scope of both fragments of nerve. We name such amount as true diastasis, which involves a sum of following sizes: neural fragments' diastasis extension and extension of nonviable tissues of neural trunk fragments.

Amount of true diastasis is defined by formula: $DS = n + l + p + d$; where DS is true diastasis, n – longitudinal size of the proximal fragment's neuroma, l – extension of the diastasis between neural fragments, p – extension of the dystrophic proximal fragment, d – extension of the dystrophic distal fragment.

Ultrasonography can be used for diagnostics, for optimal surgical decision (neurorrhaphy, autoneuroplasty, dosed nerve distraction) and for surgery planning (e.g. autograft size estimation). In all cases sonographically revealed data were confirmed during the operation.

The findings of our research enable to state, that ultrasound is a high-informative method of diagnostics in case of peripheral nerve lesions.



FP453

Temperature strips: A reliable objective diagnostic tool in peripheral nerve injuries

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Introduction: Clinical assessment of acute peripheral nerve injuries is primarily subjective. We aimed to validate and test Thermotropic Liquid Crystal (TLC) temperature strips as new objective assessment tool for these injuries.

Methods: Three groups were prospectively recruited; control patients, patients with upper limb lacerations without Suspected Nerve Injuries (NSNI) and patients with upper limb lacerations with Suspected Nerve Injuries (SNI). 35 patients were included in each group. Cutaneous temperature differences were measured using TLC-strips applied to the affected nerve cutaneous segment and compared against non affected segments on both injured and non injured hands in all patients. Control and NSNI patients were compared to validate the technique. Temperature differences in suspected nerve injury patients were compared with the operative findings and compared with the accuracy of two point discrimination test (2PD).

Results: Temperature readings in the control and NSNI groups showed a significant variation in temperature caused by the injury itself ($p < 0.0001$). Thus comparison in SNI group was performed between affected and non affected areas in the same hand. Receiver Operating Curve (ROC) analysis in SNI group showed that a difference of more than 0.5 °C for temperature difference was diagnostic for nerve laceration with a sensitivity of 100% (95% CI = 0.82-1) and specificity of 93.3% (95% CI = 0.68-1). 2PD test showed sensitivity and specificity of 95% and 71.4%.

If TLC-strips had been used 14 patients, out of 15 (93.3 %) could have been treated by simple suturing in the A&E department, and avoided specialist hand surgery input.

Conclusion: TLC temperature strips can be more accurate and reliable than 2PD in assessing peripheral nerve injuries . This objective tool is cheap and can be easily used in the acute settings.



FP454

Cold intolerance in upper extremity nerve injury patients

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Introduction: Cold intolerance is an invalidating finding after upper extremity nerve lesions. The pathogenesis is still unclear. The aim of this study was to clarify the pathogenesis of cold intolerance and to investigate thermoregulation in cold intolerance patients.

Methods: 107 median or ulnar nerve injury patients completed the CISS (Cold Intolerance Symptom Severity) questionnaire on different time intervals. Sensory recovery was assessed by Semmes Weinstein monofilaments. Twelve patients (CISS>36) were selected to investigate thermoregulation in both hands. After immersion in a 15 ° C water bath, infrared thermo images were obtained at 0, 2, 5 and 10 minutes. Continuous thermo-registration during immersion and re-warming were performed. Additionally a large normative population study (n=148) was performed.

Results: Mean CISS of the normative study population was 13.8 (SD 10.6). Mean CISS score of the nerve injuries was 38.4 (SD 25.6). 36% of the patients reported sufficient symptoms to be classified as cold intolerance (CISS>36). Symptoms of cold intolerance do not decrease over the years. Ancova analysis, adjusted for age, gender and lesion of the artery, showed a very close relation between the level of sensory recovery and the level of cold intolerance ($p<0.01$). No difference was found between patients with or without vascular injury ($p=0.48$) Thermoregulation differed markedly between the affected and contralateral hand. The capacity to warm the hand appears to correlate with the reported degree of cold intolerance and degree of sensory recovery. All 12 patients with a CISS >36 lost their protective sympathetic response (hunting reaction). Re-warming of the injured hand was delayed and seemed to be associated with level of sensory recovery and CISS score.

Conclusions: For nerve injuries a neurogenic cause of cold intolerance appears most likely. Detailed investigation of the sympathetic response will provide more information about the pathogenesis of cold intolerance.



FP455

Comparison of complete transposition vs partial release and protection of the ulnar nerve during ORIF of a distal humerus fracture

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Introduction: Surgeons debate whether the ulnar nerve should be fully released and transposed, or partially released and protected when repairing a fracture of the distal humerus. Our hypothesis is that routine ulnar nerve transposition results in fewer postoperative problems related to the ulnar nerve than partial release and protection of the nerve.

Methods: A retrospective cohort study was performed reviewing treatment of the ulnar nerve in distal humerus fractures. 30 patients were treated with complete transposition and 12 with partial release and protection of the ulnar nerve. Follow-up averaged 22 months (minimum 6 months). The primary outcome was postoperative ulnar nerve palsy. Secondary outcomes were symptoms or signs of ulnar nerve dysfunction at follow-up and additional surgery to address ulnar nerve dysfunction.

Results: Six patients with subcutaneous anterior transposition had postoperative ulnar nerve palsy. Another four had delayed signs of ulnar nerve dysfunction. Among the 12 patients treated with partial release and protection of the ulnar nerve, there were no patients treated with partial release and protection of the ulnar nerve, there were no patients with post-operative ulnar nerve palsy. 3 patients experienced delayed onset symptoms or signs of ulnar nerve dysfunction.

Conclusion: The best method for handling the ulnar nerve during ORIF distal humerus remains debatable, but surgeons and patients should be aware of the risk for post-operative ulnar nerve palsy when the nerve is completely transposed.



FP456

Is splintage necessary following digital nerve repair?

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There is wide variation in the post-operative management of digital nerve injuries, and a review of the literature reveals little science and even less consensus. A prospective randomised study is currently underway comparing the sensory recovery with either free unsplinted mobilisation or controlled motion in an extension-blocking splint. Isolated digital nerve repairs were randomised to "splint" or "non-splint" arms, and the outcome at six months assessed using a large battery of sensory tests. There was no significant difference between the groups in any measure, including Semmes-Weinstein monofilament testing (ANCOVA $F_{1/21}=0.051$, $p=0.824$). However, numbers recruited are small and there is a high drop-out rate.

We have not shown any difference in outcome and are tempted to conclude that digital nerve injuries do not need to be splinted. This has financial benefits and avoids splint related complications. Recruitment to the study continues in order to raise its power.



FP457

Preventing neuroma formation by molecular neurosurgical approach

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Objective: Painful neuroma can develop after axonal injury and is often resistant to surgical interventions. In this experiment we investigated whether axonal transport of a neuron-specific toxin (OX7-saporin) led to selective loss of neurons in DRG and ventral horn of Spinal Cord.

Materials And Methods: Forty Sprague-Dawley rats were randomly assigned to 5 groups: Group A1 (A1), fluoro-gold (FG) was used to label left posterior tibial nerve while fluoro-ruby (FR) was used to label left peroneal nerve. Group A2 (A2), a reverse labeling method of A1 was used. Group B (GB), the same as A1 plus OX7-saporin injection. Group C (GC), the same as A2 plus OX7-saporin injection. Group D (GD), the same as A2 plus PBS injection. At 3 or 6 weeks post injection, the rats were sacrificed by transcardially perfusion. The peroneal, tibial, and sciatic nerves were harvested and processed for light and electronic evaluations. The DRG and spinal cord were harvested and serial sections were performed and observed with fluorescence microscope.

Results: There was typical neuromas formation by gross observation in GA. The same findings were found in GD. However, there was a tapered tip instead of neuromatous bulb in GB. Microscopically, the neuroma was composed of entangled mass of nerve fibers with a large amount of regenerating axons. In marked contrast, there was extensive degenerating change of nerve fibers in OX7-saporin treated rats. The degeneration was in a well-defined portion of sciatic nerve corresponding to the fascicles that form the posterior tibial nerve. There were a significant reduction of FG (GB) or FR (GC) labeled neurons both in DRG and spinal cord of OX7-saporin treated rats. Surprisingly, the neurons labeled by fluorescence were almost completely destroyed by OX7-saporin in spinal cord, while non-targeted neurons in DRG and spinal cord were kept intact.

Conclusion: The present study demonstrated that intraneural injection of OX7- saporin could not only effectively prevent neuroma formation by wiping out and/or inhibiting the regeneration of injured nerve fibers, but also be transported to the dorsal root ganglia and spinal cord, in where it could selectively ablate the targeted parent neurons. The suicide transport of neuron-specific toxins offers a potential molecular neurosurgical approach for the treatment of painful neuroma.



FP458

Bone marrow mesenchymal stem cells and platelet-enriched plasma are capable of repair and functional recover of the peripheral nerve

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Objectives: The purpose of this study was to demonstrate the effect of bone marrow stem cells (BMSC), platelet enriched plasma and the association of both preparations to promote peripheral nerve regeneration.

Materials and Methods: Forty-eight female adult Wistar rats were anesthetized under intra-muscular injection. A 10-millimeter segment of the nerve was resected and the defect immediately reconstructed. The animals were divided into five groups. In groups 1, 2, 3, and 4 the gap was bridged with a silicone flexible tube (length 14 mm and diameter 0.8 mm). Group 1: empty tube; Group 2: BMSC; Group 3: platelet-enriched plasma (PEP); Group 4: association of BMSC and PEP; Group 5: the gap was bridged utilizing the resected segment of the nerve as an autograft (AG). Platelet enriched plasma was prepared after cardiac puncture blood collection into a tube containing sodium citrate. BMSC were re-suspended to a density of 10^7 cells/ml.

Results: A Sciatic Function Index (SFI) was obtained for each animal. The SFI of different experimental groups were compared using analysis of variance and post-hoc Tukey's test. Groups were compared all together and two by two. Group 2 obtained the best scores at the walking track analysis. It was followed by groups 3 and 4 which were statistically equivalent. The next best result was observed in group 5 and, lastly, in group 1 that obtained the poorest scores.

Conclusions: Evidence of regenerative potential of the stem cells in some tissue injuries have given support to an enormous effort devoted to research and its effect in promoting end organ reinnervation after peripheral nerve injuries.

The harvesting of adult autologous stem cells for therapeutical use may allow researchers to elaborate clinical trials at reasonable costs, circumventing immunological reactions, without posing any ethical questions as with the use of embryonic stem cells.



FP459

Intramuscular innervation of upper-limb skeletal muscles: classification and clinical applications

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Aim of the study was to establish the pattern of intramuscular innervation of skeletal muscles and to establish a classification based on the observed morphology. The observations on muscle innervation were then applied clinically for splitting a single muscle into two separate functioning compartments for two functions in tendon transfer procedures

Methods: 150 skeletal muscles from 8 upper limbs were using the modified Sihler's staining technique. Based on the pattern of the intramuscular innervation and shape, the muscles were grouped into trapezoidal-shaped (Class I), spindle-shaped (Class II), and muscles that were combinations of these two classes (Class III). Bipennate, spindle-shaped muscles with the aponeurosis of the tendons of insertion extending proximally into the muscle belly and Class III muscles with multiple tendons of origin were deemed to be suitable for splitting into two functional compartments and a single split muscle could be used to serve two independent functions in tendon transfer procedures.

The concept was applied in splitting the flexor carpi ulnaris and the, flexor carpi radialis, long head of triceps and extensor carpi radialis brevis muscles into two functioning units in tendon transfer procedures and independent function was demonstrated clinically.

Conclusion: various skeletal muscles of the body can be classified based on the pattern of intramuscular innervation, this allows for splitting certain suitable muscles into two independent functional units. This concept has been successfully applied in clinical situations



FP460

Passive muscle-tendon amplitude does not reflect skeletal muscle functional excursion

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The purpose of this study was to quantify the gain in muscle mobility with progressive release of surrounding connective tissue structures.

Methods: Five different muscle tendons (extensor carpi radialis brevis, ECRB; extensor carpi radialis longus, ECRL; flexor carpi ulnaris, FCU; flexor digitorum superficialis, FDS; and pronator teres, PT) were released and secured to a clamp attached to a servomotor operated under length or force control to simulate the load placed on the tendon by an assisting surgeon. A constant load of 4.9 N was applied to the tendon, while the muscle-tendon unit was released surgically from the surrounding tissue in 1 cm increments. Mobility was plotted against release distance and analyzed by linear regression to yield the slope of the regression equation (mobility gain). One-way ANOVA was used to compare mobility gain among muscles.

Results: Mobility gain was small, consistent and linear for all muscles studied. The smallest mobility gain was for the FDS, and was a highly linear 0.27 ± 0.06 mm/cm released. The largest gain was for the PT, which gained 0.57 ± 0.06 mm/cm. In general, the mobility gain for the ECRB (0.20 ± 0.02 mm/cm) was similar to that of the ECRL (0.26 ± 0.03 mm/cm). The FCU muscle was difficult to mobilize and its gain was modest (0.25 ± 0.03 mm/cm). There was no significant correlation between mobility gain of forearm muscles during progressive release and the length of their fibers.

Conclusions: The small mobility and complete lack of correlation with fiber length provide strong evidence that mobility gain does not accurately reflect muscle excursion as it is typically described. This is different from the brachioradialis muscle, which demonstrated a large and highly nonlinear mobility gain. The general practice of "tensioning" muscles by first passively extending the muscle followed by choosing the attachment length as a particular portion of that passive relationship may be questioned.



FP461

Intraoperative measurement of muscle properties reveal a relationship between contracture formation and muscle remodelling

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Introduction: The development of muscle contractures represents a serious surgical and therapeutic challenge. Unfortunately, structural and functional changes that occur in muscles that cause the contracture are poorly understood. We developed a tool to measure muscle sarcomere length (L s) in children with cerebral palsy and then measured flexor carpi ulnaris (FCU) sarcomere length prior to tendon transfer surgery (n=17 children). Measurements from the FCUs of radial nerve injury patients were used as “control” values to represent normally-innervated muscle.

Methods: Prior to surgery, the degree of contracture was assessed by measuring the extent of passive wrist motion. Then, during surgery, the distal FCU was exposed and small fiber bundles isolated by blunt dissection. Laser diffraction was performed and sarcomere length was measured by using the ± 2 nd order spacing distance.

Results: Intraoperative L s were extremely long in spastic FCU muscles compared to normal FCUs from radial nerve injury patients ($4.6 \pm 0.3 \mu\text{m}$ vs. $2.9 \pm 0.2 \mu\text{m}$). Importantly, there was a highly significant correlation between the degree of contracture and the intraoperative sarcomere length ($r=0.70$, $p<0.005$). Specifically, the greater the contracture, the longer the measured L s. The relationship between degree of contracture (in degrees) and intraoperative L s was: $\gamma (^{\circ}) = 15.5 \bullet L s (^{\circ}/\mu\text{m}) + 130^{\circ}$.

Conclusion: There is a progressive remodeling of the muscle-tendon unit during contracture formation. These data suggest that the increase in sarcomere length may be due to progressive loss of serial sarcomeres during contracture formation. This would have the functional effect of pulling the wrist into flexion as sarcomeres are lost. The underlying mechanism for the muscular changes that occur secondary to upper motorneuron lesion is not known.



FP462

Patient participation in getting the tension right in tendon transfers and tendon grafting with the wide awake approach

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Introduction: Success in tendon transfers and tendon grafting is largely dependent on setting the tension of the tendon repair not too tight or too loose, but just right. Conventionally, these operations are performed with a tourniquet with general anesthesia or sedation. This approach negates active comfortable patient participation in setting the tension. The wide awake approach to tendon transfer/grafting is performed using pure lidocaine with epinephrine for hemostasis and pure local anesthesia without sedation and without a tourniquet. This allows patients to comfortably actively move the transfer or graft after initial temporary tendon suturing to see if the transfer/graft tension is optimal to provide as full a range of motion as possible.

Methods: The presenter will show intraoperative film clips of wide awake tendon grafting as well as EI to EPL and FDS4 to FPL tendon transfers and their results.

Results: The author performed tendon transfers and tendon grafting with tourniquet and sedation or general anesthesia for the first 16 years of his practice. In that time, he had experiences setting the tension of some of these transfers both too tight and too loose. Those who use the wide awake approach (Lalonde D, Bell M, Sparkes G, et al. 2005) have observed that having the patient comfortably actively move the tendon graft/transfer and observing the range of motion before the skin is closed has permitted intraoperative adjustments to be made which take a lot of the guesswork out of adjusting the tension of the graft or transfer.

Conclusion: Wide awake tendon transfer or tendon grafting offers some unique advantages to the standard approach of tourniquet and sedation or general anesthesia.



FP463

Half FPL 'lasso' to A1 pulley for dynamic metacarpophalangeal joint stabilization for 'Z' deformity of thumb & Froment's sign in irreversible ulnar / median-ulnar nerve paralysis

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Purpose : To develop a tendon transfer technique using 1/2 Flexor Pollicis Longus (FPL) to A1 pulley 'lasso' for dynamic thumb Metacarpophalangeal Joint (MCPJ) stabilization.

Background: Half FPL to Extensor Pollicis Longus (EPL) transfer for thumb 'Z' deformity correction functions as a dynamic tenodesis to restricts Interphalangeal joint (IPJ) motion . This corrects Froment's sign but leads to difficulty in rolling movements of thumb. A technique using ½ FPL 'lasso' to A1 pulley has been developed for dynamic stabilization of MCPJ of thumb without interfering with IPJ.

Method: In a prospective trial 20 mobile thumbs with irreversible ulnar or median & ulnar paralysis had ½ FPL 'Lasso' to A1 Pulley. The radial half of FPL was detached from IPJ & split proximally to the CMC joint. The tendon was looped to A1 pulley and attached to itself with a Pulvertaft weave with MCPJ flexed and IPJ extended. Active mobilization was begun at 48 hours. Position of MCPJ & IPJ during pinch at 6 months or prior to opposition transfer (supporting the CMC in abduction) were assessed using Outcomes measures (a) MCPJ: Hyperextension <10 0 Good and >10 0 Poor (b) IPJ flexion: Good 0-30 0, Fair 31-60 0 and poor >60 0.

Results : During pinch MCPJ position was good in all thumbs. IPJ flexion was good in 13, fair in 6 and poor in 1. IPJ range of motion ranged from 10-40 0 (average 25 0) at 6 months.

Conclusion: Half FPL 'Lasso' to A1 pulley can provide during pinch a dynamic MCPJ stabilization in 'Z' deformity of thumb and correct Froment's sign. The transfer can undergo immediate active mobilization protocol & retains active IPJ motion. In Median-Ulnar paralysis ½ FPL 'lasso' can be combined with claw deformity correction and then the Opposition transfer to the thumb requires a single transfer amenable to immediate mobilization.



FP465

How to develop corrective procedures for paralytic claw-fingers using Landsmeer's model

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JMF Landsmeer proposed the biarticular bitendinous tendon displacement model for explaining the behaviour of the finger. The basic proposition of this model may be expressed as the equilibrium equation $\mathbf{E}_{mcp} / \mathbf{F}_{mcp} = \mathbf{E}_{pip} / \mathbf{F}_{pip}$, in which \mathbf{E} and \mathbf{F} are force moments that respectively extend and flex the given joint. If the respective moment arms of the forces \mathbf{e} and \mathbf{f} are \mathbf{a} and \mathbf{b} at MCP joint, and \mathbf{c} and \mathbf{d} at PIP joint, the above equation may be expressed as $\mathbf{e.a} / \mathbf{f.b} = \mathbf{e.c} / \mathbf{f.d}$ simplified to $\mathbf{a/b} = \mathbf{c/d}$. Landsmeer also showed that in real life the ratio at the MCP joint is greater than that at the PIP joint, i.e., $\mathbf{a/b} > \mathbf{c/d}$. Given this asymmetry, he predicted that the system will collapse towards extension at MCP joint and flexion at PIP joint, i.e., "claw configuration". Correction of asymmetry will restore original equilibrium and restore the ability to hold the finger straight at the PIP joint in any position of the MCP joint.

The model suggests following options for correcting paralytic claw-fingers. They may be used singly or in some combination: (i) Decrease \mathbf{E}_{mcp} (by reducing \mathbf{e} or \mathbf{a} or both), (ii) increase \mathbf{F}_{mcp} (by adding to \mathbf{f} or \mathbf{b} or both), (iii) increase \mathbf{E}_{pip} (by adding to \mathbf{e} or \mathbf{c} or both), (iv) reduce the value of \mathbf{F}_{pip} (by reducing \mathbf{f} or \mathbf{d} or both), or, (v) abolish the biarticular system (by providing an independent flexor for PIP joint; or, abolish PIP joint). The above statements are translated into surgical procedures using our ingenuity and we can select or develop a corrective procedure of our choice.



FP466

Restoration of thumb opposition by a local muscular transfer

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Introduction: The techniques described to restore the thumb's opposition in median nerve palsy are based on tendon transfers but there are many drawbacks with these techniques due to the sacrifice of these tendons and the harmful peritendinous adhesions. The adductor pollicis muscle supplied by the ulnar nerve, has two heads; its carpal head can be used successfully to restore this opposition without any drawbacks.

Material and methods: The carpal head of the adductor pollicis which has the direction of the muscles of opposition can be easily detached from the internal sesamoid bone and freed completely from the metacarpal head and the flexor pollicis brevis, it is then attached to the external sesamoid bone after a path between the thumb's pedicles and the flexor pollicis longus sheath; two curved incisions in the inner and external parts of the metacarpophalangeal joint of the thumb allow this muscular transfer. From May 2005 to July 2006, 8 patients suffering from low median nerve palsy have benefited from this technique to restore the opposition. The pinch strength (F 1) and grasp strength (F 2) were measured at preoperative and at third postoperative month. The thumb was immobilized for 4 weeks then the patients were simply asked to move their thumbs toward the pulp of the other digits.

Results: With a mean follow-up of 6 months, the restoration of thumb's opposition was satisfactory in all these patients; it was similar to the opposition obtained with the flexor sublimis of the ring finger; F 1 didn't change and F 2 has increased by 10%; The thumb's adduction and abduction were normal.

Conclusion: This local muscular transfer seems as efficient as the classical tendon transfers in the restoration of thumb's opposition but without their drawbacks.



FP467

Reconstruction of radial nerve palsy: A new technique

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Standard flexor carpi ulnaris transfer has been used for radial nerve palsy for decades. This set of tendon transfers involves the use of pronator teres pro extensor carpi radialis brevis, flexor carpi ulnaris pro extensor digitorum communis, and palmaris longus to rerouted extensor pollicis longus. The major critic to this technique is that it cannot provide simultaneous wrist dorsiflexion and finger extension, because of the different amplitude of the wrist flexors compared to that of the finger extensors. Full active extension of the fingers can be achieved only by simultaneous volar flexion of the wrist, relying upon the tenodesis effect of the transfer. We believe that the negative effects of FCU transfer are closely related to its overstretching when passed onto the volar surface, causing an increase in sarcomere length, end-to-side multiple junctions with loss of power due to the wrap-around effect, and abnormal line of pull.

We modified the technique by increasing the muscle power and straight line of pull and therefore excursion by passing flexor carpi ulnaris through the interosseous membrane. This must be achieved by dissecting a longer segment of flexor carpi ulnaris muscle mass, preparing an adequate channel through the interosseous membrane, performing an end-to-end junction respecting the original sarcomere length, and allowing early movement to prevent any scarring. Great care must be taken to preserve all the neurovascular structures on both sides of the interosseous membrane.

We reviewed thirty patients treated with this technique with a follow up period from 6 months to 8 years. Simultaneous wrist and finger extension was possible in more than 80% of the patients. In the remaining cases, reasons for failure should be regarded as due to surgical difficulties, age and compliance of the patients or less than optimal postoperative rehabilitation.



FP468

The Steindler flexorplasty- current concept review and personal refinement

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Introduction: In spite of its important advantages the Steindler flexorplasty does not restore strong elbow flexion.

Patients and Method: Between 1984 and 1998 16 patients were operated using the modified Steindler technique. In one patient infection occurred and led to a loss of the tendon transfer. In another patient with an obstetrical brachial plexus lesion an anterior subluxation at the elbow joint occurred in the postoperative course and the transfer had to be given up.

Results: The remaining 14 patients showed a significant increase in elbow flexion power rated at 3 - 4 kg fixed at the wrist level (mean 3,1). Mean range of motion (Ex/Flex: 0/33/113°) showed an increase in extension lag compared to the literature. Only minor expression of the Steindler effect without any functional impairment was noticed.

Discussion: A significant increase in elbow flexion power can be achieved if the origin of the transferred muscles is fixed more proximally in about 9-10 cm distance to the elbow joint space, thus increasing the initial muscle tension at rest, and reducing the lever arm. Only patient with good active wrist and finger extension should be operated in order to avoid functional loss of the forearm/hand-unit by the sometimes nocive "Steindler-effect".



FP469

Reconstruction of active palmar thumb abduction in tetraplegia

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The purpose of this study was to describe a new concept to restore active palmar abduction of the thumb and prospectively and to evaluate the functional outcome of this procedure in tetraplegia.

Methods: Between 2000 and 2005, 15 tetraplegic patients (mean age 43.9 ± 4.8 , mean \pm SE) underwent tendon transfer of the extensor digiti quinti (EDQ) to the abductor pollicis brevis (APB) through the interosseus membrane (IOM) aside an average of 3 additional procedures per patients to restore key grip. The delay from injury (12 traumatic, 3 non-traumatic) was 54.2 ± 11.0 months. The operated upper extremities were categorized according to the International Classification as OCu: 4 to OCu: . The maximum distance between thumb and index tip during active or passive opening of the hand, the maximal angle of palmar abduction, strength of key and whole hand grip and active finger flexion ROM were measured prospectively.

Results: All patients were re-examined after an average time of 35.5 ± 6.5 months. The active thumb-index opening increased significantly from 2.5 ± 1.0 cm before to 9.0 ± 0.8 cm after surgery ($p < 0.001$). Nine patients without previous active opening of the first web space recovered a mean thumb-index opening of 9.1 ± 1.7 cm whereas this distance increased by an average of 2.9 ± 0.8 cm in 6 patients who actively opened their key grip 6.3 ± 1.6 cm prior to surgery. All but one patients were able to direct and coordinate pinch force of the thumb tip on the radial aspect of the index according to different functional tasks using restored APB function, including 5 patients whose EDQ strength had been rated as grade 3 before transfer.

Conclusions: When an active EDQ is present, we strongly recommend the utilization of the EDQ-to-APB transfer as a refinement of key grip reconstruction in tetraplegic patients.



FP470

Reconstruction in the upper extremity in the tetraplegic patients - A review after 5 years

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Introduction: Surgical reconstructions in the upper extremity of tetraplegic patients provide fairly large big effect for such handicapped patients.

Methods: The authors review objective characteristics such as a range of recovered movement, achieved myodynamia and subjective benefit for patients according to the ADL scoring system on a group of 38 reconstructions in the upper extremities of tetraplegic patients carried out between 2001 and 2006

Discussion: The crucial point of a surgical intervention is a motivated patient, good pre-operative preparation, clinical experience with the required procedures and special physiotherapy. Even a minimal motion or recovered force in a hand grip represents a big achievement for the quality of life of tetraplegic patient.

Conclusion: In all cases the patients considered the procedure a benefit for the quality of life and most of them wish to undergo a reconstruction in the other upper extremity.



FP471

Immunohistochemical evidence of nerve growth factor in Dupuytren's diseased palmar fascia

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Purpose: The pathognomic feature of Dupuytren's contracture is the myofibroblast. Previous studies have linked several growth factors, including TGF- β , to its production (Berndt et al., 1995; Badalamente et al., 1996; Magro et al., 1997). However, nerve growth factor (NGF) has recognized involvement in wound healing and has been shown to induce the myofibroblast phenotype in cultured fibroblasts. We hypothesized that NGF would be abundant in this disease entity.

Methods: With patient consent, 25 waste surgical specimens from Dupuytren's patients, as well as five from other, unrelated hand surgeries, were processed using immunohistochemistry to detect the presence of NGF. When available, patient demographics revealed that nearly all were males with a mean age of 61 years (range: 36-77). Serial sections were fixed, permeabilized with cold acetone, and quenched with 1% peroxide/PBS to remove endogenous peroxidase. Thereafter, sections were blocked in 2.5% serum/PBS, probed with antibodies, stained, and then digitally photomicrographed. Image analysis was then used to measure the percentage of area stained. Additionally, representative sections were probed for TrkA, the high affinity receptor for NGF, and alpha smooth muscle actin, a cytoskeletal marker of the myofibroblast phenotype. These alternate steps were used to infer competence of the tissue to respond to NGF, as well as its association with myofibroblast populations.

Results: The data show NGF abundance was over double that of controls (average stained area: 16.5% and 6.5%, respectively; $p=0.049$). Additionally, NGF was localized to areas expressing both TrkA receptors and alpha smooth muscle actin.

Conclusions: Tissue levels of NGF are elevated in Dupuytren's fibromatosis. Likely this is not a spurious finding as high affinity NGF receptors were present, suggesting tissue competence to respond to the growth factor. Finally, myofibroblasts were colocalized to areas of NGF detection. These data infer that NGF is linked to the pathological process.



FP472

Dupuytren's disease following acute injury in the ipsilateral upper limb in Japanese patients; Is it "false or non-Dupuytren's palmar fascial disease"?

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Dupuytren's disease is now disseminated all over the world. Genetic inheritance, trauma and associated diseases have been implicated as aetiological factors. The precipitating or aggravating role of trauma has been discussed for a long time. However, little information is available on Dupuytren's disease following acute injury in a Japanese population. We studied about Dupuytren's disease following acute injury in 16 hands of 14 Japanese patients.

The patients included six women and eight men with an average age at onset of disease of 56 years. Six right and six left hands were involved in. Five patients developed disease following various kinds of trauma, one following infection and eight following elective surgery. Six patients were diabetics and two had hypertension. Three patients had early onset of disease. Two patients had bilateral hand involvement. Two patients had knuckle pads. No patients had a positive family history of disease. There were only four patients who developed a definite flexion contracture. All four patients had at least one risk factor related to Dupuytren's diathesis.

In the present series, the patient age and sex are irrelevant. The disease was unilateral, confined to a single digital ray, and without ectopic lesions in most cases. Disease was presented predominantly in the ring or middle finger rays. Diabetes mellitus was the most frequently associated risk factor. Our results suggest that Dupuytren's disease following acute injury could be considered a separate entity from typical Dupuytren's disease and that diabetes mellitus is correlated its pathogenesis. However, the affected tissues show no histological difference. Thus it is not appropriate to name this condition "*False Dupuytren's contraction- traumatic form*" or "*Non-Dupuytren's palmar fascial disease*". We think Dupuytren's disease following acute injury should be considered as a subtype of Dupuytren's disease at the present time.



FP473

Dupuytren's contracture in women

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Introduction: Both genetic and environmental etiologies of Dupuytren's disease have been postulated. Certain populations show a particularly high prevalence of disease. The disease is less common in females than males. Reported male:female ratio ranges from 7:1 to 15:1. Epidemiological and clinical data about Dupuytren's disease in females are, however, limited. Considerably higher expression of androgen receptors in afflicted palmar fascia was reported. The study aims at characterizing the disease's patterns in females including those of non Northern-European origin.

Methods: Medical charts of 33 women with Dupuytren's disease were reviewed. 26 patients who fulfilled the criteria for surgical intervention, including a flexion contracture of either the MPJ or PIPJ of at least 30°, underwent limited fasciectomy. Follow-up ranged 1.5-10 years.

Results: Average age was 60.1 (Range 42-76). 23 were patients originating from North America and Europe. 10 were patients originating from Asia and North Africa. The small finger was involved in 18 cases, the ring finger in 10, and both small and ring fingers in 5 patients. Four reported a family history of the disease. 3 had diabetes. No history of alcohol consumption neither manual labor were reported. One had knuckle pads. 26 patients underwent limited fasciectomy. PIPJ and MPJ extension improved considerably with favorable functional outcome in all patients. Three had postoperative local hematoma. Five had recurrent disease; one underwent dermatofasciectomy and skin graft.

Conclusion: Male:female ratio in our series was 5.6:1. Females had relatively milder disease, older age of presentation, probably due to higher functional tolerance, and less recurrence rate. Clinical patterns of recurrence were similar in both genders. In addition to patients originating from Northern America and Europe, our series surprisingly included patients virtually from all Mediterranean communities including those originating from Asia and Africa.



FP474

Distally based U - flap for progressive Dupuytren 's disease

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Introduction: PIP joint contracture of 90 degrees, progression of the disease, scarring and alteration of one of the neurovascular bundles is a vicious combination when planning surgery in progressive Dupuytren 's disease. Different types of homo and heterodigital flaps are designed in such situation but still it is not easy to achieve reliable long term functional improvement while minimizing trauma to the finger.

Aim: We are presenting unique technique described by Stillwell of homodigital distally based U flap used for straightening of the affected finger.

Patients and methods: 13 patients and 14 hands were operated for progressive Dupuytren 's disease with above mentioned condition. 1 was lost for follow up. Contracture of each patient was measured, sensitivity and vascular condition of the finger were examined pre and postoperatively. Flexion contracture of 90-180 degrees vicious palmar scarring and alteration of one or both neurovascular bundles were observed preoperatively. Patients were followed-up from 2 to 5 years postoperatively.

Results: All fingers improved in function with decrease of contracture under 50 degrees of active extension lack in 11 cases while preserving full fist in 8 cases. No neurovascular deterioration was observed. 1 significant deterioration caused by recurrence of the disease appeared in the group.

Conclusion: Presented technique gives reliable long term improvement in difficult cases of heavily altered fingers caused by progressive Dupuytren 's disease. It gives quality coverage of the finger after surgery, preserves range of motion and is minimally traumatizing operated finger.



FP475

The palmar intermetacarpal flap in Dupuytren's contracture

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Inroduction: skin defect resulting from fasciectomy in patients presenting with Dupuytren's contracture is often located on the palmar aspect of the metacarpo-phalangeal (MP) joint. A small diamond-shaped flap, distally based, may be harvested from any of the palmar intermetacarpal spaces, vascularised by the adjacent collateral digital arteries to cover and provide padding of the palmar aspect of the MP joint or the proximal phalanx.

Material: eight upper limbs from fresh specimens were dissected and/or radiographed after infusion with dye blue, coloured gelatine or a radio-opaque mixture to identify perforating branches supplying the flap.

Eleven patients were operated on with this procedure. They presented with a 30 to 50° MP joint contracture and a 10 to 40° PIP joint contracture. The procedure included total fasciectomy, arthrolysis of the PIP joints and excision of the diseased skin. The flap was taken from the adjacent commissure, free from the disease.

Results: dissections and radiographs showed the digital collateral arteries to constantly provide perforating branches supplying the flap. It was then possible to raise a diamond-shaped flap in every intermetacarpal space, vascularised by two perforating branches, arising from the adjacent collateral digital arteries. The flap could potentially be rotated up to 180° clockwise or counterclockwise.

The clinical cases confirmed the flap to be easy to raise, average time for dissection being 2mn. A thin layer of subdermal soft tissue was always present and preserved at the deep side of the flap. Healing of the flap was uneventful in all cases.

Conclusion: the anatomical study showed the vascularisation of the flap to be constant and the clinical study confirmed the technique to be easy to handle and reliable.



FP476

Dupuytren's disease: 5 Year outcomes following segmental aponeurectomy, fasciectomy and dermofasciectomy

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Introduction: There is a wide spectrum of Dupuytren's Disease best dealt with by a range of surgical procedures rather than blanket fasciectomy. The disease tends to progress, producing "local recurrence" in the operated digit and so recurrent flexion contracture. We assessed the disease control attained by our surgery.

Method: We identified three consecutive groups of 30 patients each who undergone segmental aponeurectomy or fasciectomy or dermofasciectomy with at least five years follow-up. They were assessed for persistent cord interruption/recurrence and for recurrent flexion contracture.

Results: Some 60% of segmental aponeurectomies had persistent cord interruption, the other 40% having reformed intact cords with recurrent flexion contracture. Some 40% of fasciectomies had developed recurrent disease and recurrent flexion contracture. 7% of dermofasciectomies developed recurrent disease but this had not yet resulted in recurrent flexion contracture.

Conclusions: Recurrence rates for both disease and flexion contracture are similarly high after segmental aponeurectomy and fasciectomy. Only dermofasciectomy offers good local disease control. Fasciectomy, we believe, is the least satisfactory procedure, being associated with significant morbidity and often early recurrence. Our tendency is to carry out a higher proportion of segmental aponeurectomies and dermofasciectomies, turning away from the traditional operation of fasciectomy.



FP477

Iontophoresis with dexamethasone in volar hand scars

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Palmar scars after hand surgery are frequently indurated, tender and at times limit finger movement. We have found iontophoresis with Dexamethasone a useful adjunctive therapy in addressing these issues.

We present a series of 52 patients with scars involving volar finger or palmar skin after hand surgery. All patients had firm, inflexible scars resistant to manual pressure and/or contracture. Thirty-two patients underwent six treatments over 2 weeks with iontophoretic delivery of Dexamethasone (6mg in 1.5ml) at 40mA-Min per treatment. All other treatments in the form of electro or thermal modalities were discontinued. Twenty patients, acting as controls, continued to receive other forms of conventional scar management. The scars were assessed pre-treatment, after the third and sixth treatments and two weeks post treatment. The scars were assessed using the Vancouver scale for vascularity (0 = normal to 3 = purple), pliability (0 = normal to 5 = contracture), pain, itch, range of movement and tenderness. Scars were classified as early (<3 months post operatively) or late (>3months post operatively).

Results: Pretreatment mean pliability score was 3.17 which reduced to 2.19 by 2 weeks and continued to improve even once treatment had ceased, reducing to 1.5 by 4 weeks. Vascularity improved rapidly initially from a mean score of 1.63 to 0.79 at 2 weeks and 0.76 by 4 weeks. Scar tenderness also rapidly improved in the treatment group. In the control groups, especially with vascularity, little improvement was noted in the first 2 weeks but by four weeks, they had improved as well. Late scars, which had not shown any improvement for many months, improved their pliability and vascularity by over 45% within the month.

Conclusion: This study showed that Iontophoretic treatment of scars despite their age will more rapidly mature a scar and therefore minimize the unpleasant consequences of hypertrophic scar.



FP478

The "Bilhaut-Cloquet" technique for treatment of thumb duplication

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The presentation of thumb duplication is variable depending on the level of bifurcation, the relative sizes of the two thumbs and their possible symmetry along a longitudinal axis. Resection of the supernumerary thumb often leads to disappointing results when both thumbs are hypoplastic. The principle of the "Bilhaut-Cloquet" procedure involves central resection of the duplication followed by fusion of the remaining lateral portions, in order to obtain a thumb of satisfactory volume. Thirteen children with unilateral thumb duplication were treated using the "Bilhaut-Cloquet" procedure. Nine cases involved duplication of the distal phalanx (Wassel type II). Five of these duplications were symmetrical and four were asymmetrical with an associated proximal delta phalanx. In these cases, a corrective osteotomy of the delta phalanx was performed at the same time. Four cases involved symmetrical duplications of both proximal and distal phalanges (Wassel type IV). The mean age at time of surgery was 11.5 months. Patients were reviewed with a mean follow-up of four years. The aesthetic aspect of the nail was judged as good in 12 cases. In one case, the aesthetic aspect of the nail was judged as fair due to a prominent longitudinal ridge. Bony fusion was obtained in all cases but one. The alignment was corrected in all cases but four, involving asymmetrical duplications. Joint mobility was limited in all patients. The "Bilhaut-Cloquet" technique leads to a satisfactory volume of the thumb in selected cases. Good correction of preoperative angular deformity is obtained in symmetrical cases. A precise technique of bone and nail approximation yields good functional and aesthetic results. The "Bilhaut-Cloquet" technique is indicated in balanced and symmetrical duplications, when the two thumbs are severely hypoplastic. It can be used either in the distal or proximal phalangeal types of thumb duplication.



FP479

Ulnar cleft hand without finger defect

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Purpose: We have often encountered cases with ulnar cleft hand without absence of digits. There is no appropriate expression and precise classification for this congenital hand deformity. We try to clear the clinical features and related conditions of this deformity.

Material and Methods: We examined 14 cases, 21 hands, 10 male and 4 female with ulnar cleft hand without absence of digits. The right side was affected in 2, the left in 5, and the bilateral in 7. The associated deformities of the affected hand and those of opposite hands were observed.

Result: As the associated deformity of the affected hand, in the little finger, there were hypoplastic in 19 hands, extension contracture in 18 hands, nail deformity in 14 hands, symphalangism in 8 hands. Hypoplasia of the hypothenar muscle was observed in 5 hands and polydactyly of the little finger in one hand. The associated deformities of the opposite hand were polydactyly of the little finger in 2 hands, ulnar deficiency in one hand, and partial duplicated change of ring finger distal phalanx in one hand.

Discussion: There were various severities and types of the associated deformities of the hand with ulnar cleft hand without absence of digits. It was characteristic that there were various degrees of the depth of the cleft, the type of nail deformity and the limitation of range of motion of the little finger, and combined hand anomaly of the opposite side. Hand and nail deformities in this series were similar to those of ulnar-mammary syndrome.

Conclusion: The teratologic sequence of the variety of hand deformity with ulnar cleft hand without absence of digits was seemed to be as a distinct entity of congenital hand deformity.



FP480

Long term follow up of composite nonvascularised toe phalanx transfers for aphalangia

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The results of 21 nonvascularised toe phalanx transfers in 13 patients were reviewed radiologically with respect to function, physeal patency, growth and donor site morbidity at a mean follow up of 7.4 years (2.9 – 13.6 years). Physeal patency was maintained in four of 18 surviving transfers. The length of the transferred phalanx averaged 75% of the comparable toe phalanx and 44% of the contralateral digit proximal phalanx. Most patients had good or simple use of the hand with active joint motion. There was universal shortening of the donor toe with hypoplasia of the middle and distal phalanges. This review suggests that transfer of a nonvascularised toe phalanx provides a reliable but limited means for increasing length of a digit, stabilising soft tissue nubbins and improving function. Longer follow up has shown more modest gains in growth than in some previous reports.



FP481

Nonvascularised middle toe phalanx transfer in the treatment of hand symbrachydactyly

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Congenital hypoplasia and aplasia of fingers results in decrease of hand function and deformity.

Aims: The aims of the research were to assess: usefulness of toe middle phalanx, correlations between phalanx length increase and gender, age, influence of the transfer for foot function and development.

Material and methods: 44 patients with hypoplasia and aplasia of fingers were treated in our Department in 1987-2000. 158 phalanges were transferred. The age at the operation 7 months to 9 years (average 27 months), 25 female and 19 male. Follow-up was from 2 to 14 years (average 56 months). Age groups were formed: below 13 months, 13 to 24 months, older. Two groups were specified according to operation method: with and without collateral ligaments. In the follow-up length increase, range of motion and stability of the joint formed, finger axis and hand function were evaluated. Plain X-rays with grid were used to measure length and width both transferred phalanx and metacarpal. Dynamic electronic pedobarography was used for foot function. Cosmetic values, structure and function both hand and foot operated and activities of daily life were assessed with questionnaire.

Results: 98% of phalanges grown. In the whole group increase was from 0 to 6mm (average 3mm). It was from 0 to 200% of initiative length (average 70%). Complications rate was (3%) including instability and luxation. Pedobarography showed no difference between operated and nonoperated foot.

Conclusions: Free toe middle phalanx transfer improves function and appearance of the hand and increases length and stability. Transferred phalanx grows, which correlate with: age only in the first year, size of phalanx at the operation. Transfer doesn't influence foot function.



FP482

Upper Extremity in Apert Syndrome

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Introduction: Apert syndrome is characterized by craniosynostosis, midface hypoplasia, and symmetric syndactyly of the hands and feet. This review of Apert syndrome, based on our clinical experience with 41 cases, provides a clinically relevant congenital anomalies of upper extremity in Apert syndrome.

Patients and methods: Forty cases of Apert syndrome have been treated at our Institute since 1968 till 2006. They were evaluated in terms of type of syndactyly, radial inclination of thumbs, coalition between 4 th and 5 th metacarpals, polydactyly atypical with Apert syndrome and elbow and shoulder joint disorders.

Result and Discussion: Sex ratio was 18 males and 23 females. Twenty-six out of 41 cases were evaluated in terms of Syndactyly by Upton's classification (Upton J, 1991) following radiological and clinical findings. by, in Type 1 was found in 18 hands (34.6%), Type 2 in 14 hands (26.9%) and Type 3 in 20 hands (38.5) and all cases showed bony syndactyly, Bilateral postaxial polydactyly of the hand was found in one case, in which coalition of 4 th and 5 th metacarpals was observed at the age of .2 years and 3 months. The range of motion of the elbow joint was frequently limited and complete fusion of humero-ulno-radial joints was observed in 2 cases, 4 elbow joints (7.7 %). The genomic mutation in Pro253Arg was found in one of the four. All shoulder joint subluxation was observed in all cases, there was no case which interferes with activities of daily living.



FP483

Lunate trabecular structure - Risk factors for Kienböck's disease

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Introduction: The cause of Kienböck's disease is unknown. Negative ulnar variance and lunate shape (eg Zapico 1) may be mechanical predisposing factors, possibly by increasing lunate load and creating "fault plates", or planes of weakness, in the lunate trabecular pattern. It has been suggested, but not documented, that lunate trabeculae run perpendicular to the proximal and distal articular surfaces. The aim of this study is to assess the relationship between ulnar variance, lunate shape, lunate trabecular pattern and bone density.

Methods: Standard 90/90 PA radiographs of 29 cadaveric wrists were taken for ulnar variance and lunate shape. The lunates were harvested and CT scans (1mm) taken. DICOM files were analysed using Mimics (Materialise, Belgium) to measure bone density in Hounsfield units in all planes. MicroCT scans (SkyScan, Belgium) (40 μm) in the coronal plane were measured for trabecular angle at the proximal and distal joint surfaces and the 'tilting angle' (between scaphoid and radius joint surfaces) at 25%, 50% and 75% slices. All measurements were carried out by 2 independent observers and data was analysed using one-way ANOVA tests with SPSS for Windows.

Results: Negative ulnar variance was noted in 11/29, neutral 13/29 and positive 5/29. Lunate shape according to Zapico was 0/29 Type 1, 24/29 Type 2 and 4/29 Type 3. There was a significant positive correlation (0.69) between ulnar variance and shape ($p < 0.001$). The average trabecular angle (72-100 $^\circ$) measured 84 $^\circ$ at the proximal and 89 $^\circ$ at the distal joint surfaces and tilting angle was 114 $^\circ$ (90-132 $^\circ$). There was no interobserver error. There was a negative correlation (-0.34) between tilting angle and proximal trabecular angle ($p < 0.001$). Lunate bone density was significantly lower in the ulnar positive specimens compared to ulnar negative and neutral ($p < 0.001$). Within the lunate, the proximal and distal regions were most dense ($p < 0.02$) and in the ulnar positive specimens, the central and ulnar side were least dense ($p < 0.005$), due to impingement cysts.

Discussion: This study supports the proposal that lunate trabeculae run perpendicular to proximal and distal articular surfaces, thereby creating trabecular angles, potential fault plates or planes of weakness, if those surfaces are not parallel (eg Zapico type 1). The study also quantifies the previous finding that load transmission through the lunate and hence lunate bone density is related to ulnar variance and that this is higher in ulnar negative wrists.



FP484

The importance of wrist arthroscopy for staging and treatment of Kienböck's disease

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The Kienböck's disease or osteonecrose of the lunate, still today is a challenge as for the knowledge of its causal factors, staging and treatment. Historically, is described as a pathology of inexorable course, initiating with the gradual collapse of the Lunate, until the total carpal disarrangement. The used classification for its staging, is the proposed for Lichtmann, that divides in 4 radiographic types, based on the progression of the necrosis of the lunate. Although its usefulness, we know that it does not have an accurate correlation with the clinical condition of the patient, therefore we believe that it has other anatomical alterations, beyond those visualized in the radiographic evaluation. Aiming to get more information, on the anatomical alterations of the wrist with osteonecrose of the lunate, we previously carry out the arthroscopic examination of the wrist to the accomplishment of the surgical treatment. We evaluated a total of 14 patients, in stage 3, according the Lichtmann's classification. The clinical evaluation and x-ray of wrist, was presented to an experienced surgeon of hand, that made a surgical planning. Later on the the arthroscopic findings were presented, and he was asked if he would change its previous planning. The results showed, that the information obtained with the arthroscopic examination, had been important to know the real conditions of wrist joint, in particular the lunate bone, thus offering subsidies for a change in relation to the established initial planning only with the radiographic examination. We believe that the wrist arthroscopy in the Kienböck disease, offers information that is going to help in the choice of optimum surgical treatment.



FP485

Effect of distal scaphoid and triquetrum excision on radioscapholunate arthrodesis: A cadaveric study

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Purpose: Radioscapholunate (RSL) arthrodesis has been shown to be an effective treatment for arthritis limited to the radiocarpal joint. It preserves wrist motion at midcarpal joint while relieving pain. The main shortcoming of this procedure has been restricted residual wrist range of motion (ROM) compromising clinical outcome. The aim of the study was to assess the effect of excision of distal scaphoid and triquetrum on wrist motion following RSL arthrodesis.

Methodology: Ten cadaveric wrists had range of motion measured before and after RSL arthrodesis and after sequential distal scaphoid and then triquetral resection. The mean and standard deviation of the change in motion were calculated for each step. The two-tailed Student's *t*-test with $p < 0.05$ was used to determine the statistical significance of the changes.

Results: Distal scaphoid excision after RSL arthrodesis resulted in 25° (35%, $p < 0.01$) increase in flexion-extension (F-E) arc and 11° (34%, $p < 0.01$) increase in radioulnar (R-U) arc. Subsequent excision of triquetrum further increased F-E arc by 13° (13%, $p < 0.05$) and R-U arc by 9° (21%, $p < 0.01$).

Conclusion: In the cadaveric wrists, distal scaphoid excision resulted in significantly improved R-U arc and F-E arc. Subsequent triquetral excision further improved wrist ROM. Modification of RSL fusion to include distal scaphoid and triquetrum excision should be considered to improve residual wrist motion.



FP486

Triscaphe fusion in the treatment of stage IIIb Kienböck's disease -Comparison of lunate preservation and excision

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Purpose: Although good results have been reported for triscaphe fusion in advanced Kienböck's disease, some cases have been required lunate excision later. However, the necessity and effect of lunate excision on clinical results remains unclear. The purpose of this study was to evaluate the effectiveness of lunate excision in triscaphe fusion for the treatment of Lichtman stage IIIb Kienböck disease by comparing the results of lunate excision and lunate preservation .

Methods: 26 patients with Lichtman stage IIIb Kienböck's disease underwent triscaphe fusion. Median follow up period was 38 months (range, 12 to 112 months) . 15 patients received only triscaphe fusion and 11 patients received triscaphe fusion with simultaneous lunate excision. Lunate excision was indicated for the patients who had pain and limited wrist motion, particularly the dorsiflexion because of impingement associated with a severely collapsed lunate . To compare the clinical results, range of motion and modified Mayo wrist score were analyzed. Based on the plain radiographs at the last follow-up, carpal height ratio, ulnocarpal distance ratio, radioscapoid angle and presence of degenerative change were also evaluated.

Results: Mean extension was more preserved in lunate excision group than lunate-preserving group (94% vs 86%). Mean modified Mayo wrist score was 71.8 in lunate-preserving group and 65.0 in lunate excision group. Several radiologic indices did not show significant difference between two groups, but degenerative change of the radioscapoid joint was more common in lunate excision group than lunate-preserving group (45.5% versus 13%).

Conclusion: Excision of the lunate in patients with advanced Kienböck's disease when performing the triscaphe fusion can eliminate the posterior impingement due to the collapsed lunate, but this should be carried out carefully because degenerative change of the radioscapoid joint is frequently observed.



FP487

Lunatoplasty with cement for the treatment of advanced Kienböck's disease

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Kienbock disease is of unknown aetiology and commonly results in osteonecrosis of lunate bone. If not treated in proper time carpal collapse and wrist osteoarthritis occur.

Treatment varies from simple immobilization or attemptives of lunar revascularization to its excision or arthrodesis procedures. Surgical options are controversial.

The authors use several techniques depending on the disease stage. In advanced stages, to delay or prevent carpal desorganization, the authors present a series of patients treated by lunaroplasthy using cement. There were no major complications. The patients were satisfied.



FP488

Scaphocapitate arthrodesis in the treatment of stage IIIB and IV Kienböck's disease

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The purpose of our study was to present the technique of scaphocapitate arthrodesis combined with lunate excision in the treatment of stage IIIB and IV Kienböck's disease. Twenty-seven wrists in twenty-five patients were included in this study. The necrotic lunate bone was excised through a dorsal approach, while scapho-capitate arthrodesis was achieved via an incision at the anatomical snuff box and using 1-3 Herbert screws (2 screws in most of the cases) The average age at the time of surgery was 27 years. The mean follow-up period was 48 months. Evaluation included measurement of wrist range of motion, grip strength, assessment of pain, and evaluation of radiographic parameters. Postoperatively, wrist extension and flexion averaged 65 and 37 degrees, respectively. Radial deviation averaged 19 degrees and ulnar deviation averaged 21 degrees. Grip strength averaged 72% of the contralateral side. Pain was absent in most of the patients, and all patients denied sensations of crepitation and pain at extremes of motion. No patients showed progression of radioscaphoid arthritis on follow-up radiographs. We conclude that scaphocapitate arthrodesis combined with excision of the lunate is a viable option in the treatment of stage III and IV Kienböck's disease.



FP489

The long term follow-up of modified Graner procedure for the patients with advanced Kienböck's disease

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Kienböck's disease is caused by aseptic necrosis of the lunate. When the disease becomes advanced, carpal collapse, joint incongruity, and osteoarthritis develop. We performed lunate excision, capitate osteotomy and intercarpal fusion (the modified Graner procedure) on fifteen patients with grades 3 b and 4 Kienböck's disease. This report is a review of these patients.

The subjects ranged in age from twenty-six to fifty-four years. We evaluated the results more than ten years postoperatively (125-187 months: mean 142.7 months). Therapeutic results were evaluated based on the Evans' criteria.

For most patients, pain had disappeared after surgery. For only one patient, the intensity of the pain was reduced to a mild level. The grip strength of the affected side had recovered to about 80% of the unaffected side twelve months after surgery. The long-term results for the fifteen patients were evaluated as good in eleven, fair in two and poor in two. In the range of motion at the wrist joint and the grip strength postoperatively, mean palmar flexion was 40.3 °, mean dorsiflexion was 36.3 °, and mean grip strength on the affected side was 83.7 % of that on the unaffected side. Postoperative radiographs showed that the carpal bone parameters (carpal height index and radio-scaphoid angle) had improved. Although radiographic osteoarthritic changes occurred in all patients, except for moderate limitation of range of motion at the wrist joint, these findings did not affect their level of pain, grip strength, or activity of daily living.

Lunate excision, capitate osteotomy and intercarpal fusion (the modified Graner procedure) is a reliable form of treatment for patients with advanced Kienböck's disease for at least ten years postoperatively.



FP490

C7 nerve double neurotization in the treatment of total brachial plexus avulsion injury: An experimental study in rats

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Objectives: To test the feasibility of rescuing 2 impaired nerves by C7 nerve transfer (C7 nerve double neurotization)

Materials And Methods: Using adult male Sprague-Dawley rats (200-250g), a C7 nerve double neurotization model is established. At postoperative 2, 4, 6, 8, 12th weeks the recovery underwent electrophysiological, muscle-nerve morphological, histological examinations and is compared with conventional C7 single neurotization.

Results: Maximum amplitude and nerve-muscle latency of evoked motor action potential of reinnervated biceps and flexor digit profundus M, twitch and maximum tetanic muscle contractile tension, muscle weight, numbers of myelinated nerve fibers distal to the nerve coaptation site, cross-sectional area of muscular fiber show that: In the early postoperative period (2, 4, 6 weeks), nerve regeneration in double neurotization group is not as good as single neurotization. As the postoperative interval prolongs, most of the parameters of nerve regeneration in group A approximate to those in the single neurotization groups and normal control group, ie, the result of double neurotization is close to that of the single neurotization. This indicates C7 nerve contains enough nerve fibers to provide sufficient regeneration for 2 recipient nerves.

Conclusion: Compared to single neurotization, C7 nerve double neurotization has the advantage of restoring 2 nerve function at same time. This implicates its future clinical application in treatment of severe brachial plexus avulsion injuries.



FP491

Tracing the spinal segmental origin of the brachialis branch of musculocutaneous nerve: An electrophysiological study and case report

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To expand the indication for brachialis branch of musculocutaneous nerve (BBMCN) transfer and test an innovative method to study the spinal transection segment origination of a specific nerve or of the nerve fibers innervating a given muscle on the healthy upper limb of a live human. We carried out an intraoperative electrophysiological study on 30 cases of contralateral C7 nerve root transfer and performed one case of BBMCN transfer on a patient with spinal cord transverse injury at transection of C7 segment. The results of the electrophysiological study showed that BBMCN is comprised of fibers from C5, C6 and C7 spinal transection segment, while more are from C5, C6 segment. After 28 months of follow-up, the recovery of functional finger flexion was observed on the patient with transverse injury at transection of C7 segment. Taken together, C5, C6 spinal transection segments are the major origination of the BBMCN fibers and the intraoperative electrophysiological study during contralateral C7 transfer is a more direct and functional method to trace spinal transection segment origination of a specific nerve or of the nerve fibers innervating a given muscle on the healthy upper limb of a live human.



FP192

Anatomical bases of the 2nd toe composite dorsal flap for simultaneous cutaneous and tendinous reconstruction of the dorsal aspect of the fingers

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Coverage of the dorsal aspect of the fingers is difficult, especially when the soft tissue defect is large and involves extensor apparatus and joints. Tendinous and/or articular reconstruction is not usually performed simultaneously with cutaneous repair.

The aim of this study were 1) to precise the proper territory of the 1 st common dorsal metatarsal artery of the 1 st web space the medial dorsal digital artery, and 2) to enumerate the anatomical structures, which could be harvested "en-bloc" in order to design composite flaps.

The proper territory of the 1 st common dorsal metatarsal artery was studied from 22 anatomical specimens after selective injection of the arterial (and sometimes venous) network.

Its cutaneous area measured 75mm x 40mm in average. The extensor apparatus of the 2 nd toe was supplied by 1 st common dorsal metatarsal artery and its lateral branch to the 2 nd toe on about 75mm, by 2.7 branches in average. The medial dorsal digital artery was the main source of blood supply to the PIP joint, capsule, ligaments, head of proximal phalanx and base of middle phalanx.

It is then possible to design composite flaps including both skin and extensor apparatus, and total or partial PIP joint, if necessary, based on the 1 st common dorsal metatarsal artery and the medial dorsal digital artery, without important prejudice to the 2 nd toe. The average length of the arterial pedicle (60mm) makes easy its suture to the dorsal tarsal arch or the dorsalis pedis artery. Harvesting technique of such a flap is described; it has to be adapted to both the type and the extent of the defect.

Its use is conform to the nowadays classical principle of "All in one stage with early mobilization", thanks to adequate coverage whose vascularization does not depend on local vascularization, and which brings its own vascular supply.



FP493

Long-term results after contralateral C7-transfer in adult brachial plexus lesions

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Introduction: Since 1995 contralateral C7-Transfer become a new source of axon donor in complete brachial plexus lesions in our institution.

Material and Method: Between 1995 and 2001 18 adult patient were treated. As shown by GU we are using a two stage procedure with exploration and extraplexuell neurotization of the suprascapular neve using 1/2 spinal acessory nerve. Depending on the intraoperative findings the musculocutaneous nerve is neurotized by the phrenic nerve at the time of primary moperation or secondarily neurotized by the contralateral C7 root. If the musculocutaneous nerve could be neurotized by the phrenic nerve C7-transfer is used to reinnervate the median nerve. If ever possible the vascularized ulnar nerve graft or if not avilabe two sural nerves are used. Neurotization of the musculocutaneous nerve was carried out in 8, and of the median nerve in 10 patients. There are 6 patients in the MC group and 4 patients in the Median group with more than 3 years of follow-up. Criterias for evaluation used are, donor site morbidity, classification), time for recovery, time for autonomization, and functional result. Successful elbow flexion is achieved if muscle power > M3, successful median nerve motor function is achieved if a primitive power grip pattern is achieved.

Results: All patients were complaining of paresthesia in the dorsal part of P3 of the thumb, index and middle finger. There was complete sensory at the 3 month postoperative examination. There was no clinical evident motor loss at the donor extremity. A successful elbow flexion, i.e. muscle power > M3 was achieved in all 6 patients after 9 to 15 months. 4 of 6 patients are able to use this function individually. In the other two patients a start command must be given voluntarily from the contralateral side (contraction of the latissimus dorsi muscle). A functional primitive grip pattern could be achieved in 1 out of 4 patients after 18 months. In three patients although there is movement this mouvement must be judged "academic" at the present state.

Discussion: The C7-transfer proved to be a save transfer if at the time of operation no fascicles innervating wrist and finger extension are taken. Provided adequate biceps muscle organ function active elbow flexion can be reconstructed in most of the patient. However for median nerve reinnervation motor results are moderate up to now.

Conclusions: Active elbow flexion is necessary for minaual work. Knowing the different possibilites of nerval reconstruction and secondary tendon transfers should make reconstruction of active elbow flexion possible in almost every partial brachial plexus and in most complete brachial plexus lesions.



FP494

Functioning free gracilis transfer for elbow flexion – The Leeds experience

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Elbow flexion is essential for controlled upper limb function. In the presence of a suitable range of passive movement, volitional flexion may be restored by functional muscle transfer. The gracilis is the first line free functional flap to restore elbow flexion in the Leeds Hand Unit.

Over a 15 year period (1991 to 2005) forty seven free functional gracilis muscle transfers were undertaken to restore lost elbow flexion in 27 paediatric (median age 5.5 years, range 1.9-6.8), and 15 adult patients (median age 31.0 years, range 23.3-40.0). Indications were predominantly congenital abnormalities and brachial plexus injuries. The majority of flaps were attached proximal to the humerus by mitek anchors, woven into the biceps tendon distally, and innervated using intercostal nerves or Oberlin transfer when available. All surgery was performed by the senior authors. Outcome was assessed independently of the operating surgeon.

Functional elbow flexion was restored in 70%, and technical details evaluated. Flap loss was 6%. Donor morbidity was minimal, and in no case was upper limb function worsened.

In appropriate cases, with a multi-disciplinary team approach involving surgeons, occupational therapists and physiotherapists, free functional gracilis muscle transfer can restore sufficient elbow flexion to enhance upper limb function.



FP495

Brachial plexus injuries - Diagnosis, treatment and neurotization

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Purpose: To demonstrate that brachial plexus injuries, if treated properly, can give satisfactory results.

Methods: Of 45 patients, 40 cases involved the C5-C6 nerve roots, 3 involved the C5-C6-C7, and 2 cases with total paralysis. All patients had exploration of the brachial plexus with insertion of nerve grafting from the nerve roots to the peripheral nerves. Two patients had neurotization, namely using five intercostal nerves, and through nerve grafting neurotization was performed.

Summary: Excellent 25%; Good 48%; Fair 37%.

Conclusion: If the operation is not delayed for more than three months, a very devastating condition can be improved markedly.



FP496

Pectoralis major transplantation to restore elbow flexion in war injured paralytic patients

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We had several cases of muscle and peripheral nerve injuries resulting in loss of elbow flexion. In seven war victim patients, five with biceps brachili muscle loss and one with pure injury of the musculo-cutaneous nerve and atrophic muscle. We modified Carroll and Kleinmann's original pectoralis major muscle technique by:

- 1- Eliminating the parasternal incision starting from 7 th sternocostal joint and continuing laterally to the 7 th rib;
- 2- Fixation of the elbow in 90 degrees instead of 135 degrees; and then adopted it for use in all seven patients to restore elbow flexion. The entire pectoralis major muscle with the rectus sheath was transplanted to the tendon of hypertrophic scar.

Summary of Patient history:

Case No.	Cause of injury	Level of injury	Nerves involved at the onset	Nerves involved prior to operation
1	Shell fragment	Brachial Plexus	Median, Ulnar, MC, Axillary	Ulnar, Radial, MC, Axillary
2	'' ''	'' ''	'' ''	MC
3	'' ''	'' ''	Not known	Radial, MC, Axillary
4	'' ''	Axilla	MC	MC
5	'' ''	arm	-----	-----
6	Car accident in Battlefield	Brachial Plexus	Median, Ulnar, MC, Radial, Axillary	MC
7	Motorcycle accident in Battlefield	'' ''	Not known	Radial, MC, Axillary

Results: Motion and power were well restored in five patients, satisfactory in one patient and unknown in the other case, since the patient was lost to follow up.



FP464

Immediate active mobilization versus immobilization for opposition tendon transfer in the hand

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Purpose: To test the hypothesis that Immediate active Mobilization of Opposition tendon transfer will achieve similar outcomes to the standard practice of immobilization in a cast.

Method: Prospectively, 20 hands with median nerve paralysis underwent opposition tendon transfer with Flexor Digitorum Sublimis of Ring finger followed by immediate post-operative active mobilization for rehabilitation of the transfer 48 hours after surgery. Historical records of identical paralyses with opposition tendon transfers post-operatively immobilized in a cast for 3 weeks were used for comparison. Thirteen hands with combined median-ulnar nerve paralysis had MCP stabilization procedure (along with claw deformity correction of digits) prior to opposition transfer. Outcomes of opposition transfer for this study were assessed as suggested by Rath 1 (i) the status of tendon transfer attachment to the thumb during immediate mobilization to detect tendon pullout (ii) results of opposition transfer for both groups using identical outcome measures (range of post-operative active abduction of the thumb, pattern of pinch & pinch strength) and (iii) by comparing the results of both groups.

Results: There were no incidences of tendon pullout during immediate active mobilization of opposition tendon transfer. There were no differences in outcome between the 2 groups at late follow-up > 6 months (average 10 months) with all opposition transfers in both groups achieving good results. Immediate post-operative active mobilization reduced rehabilitation time by an average of 19 days. Earlier return to activities of daily living were a further benefit to the patient. Three thumbs with fair result of MCP stabilization were graded as good opposition transfer as the position of MCP joint was not included in the outcome measures of opposition transfer.

Conclusions : This study supports the hypothesis and suggests similar outcomes can be achieved in reduced time by immediate mobilization of opposition tendon transfer. Santosh Rath 2006 JHS (Am) 31A(5)