



# 2024 Congress of Korean Society for Surgery of the Hand

- Pushing the Boundaries -

November 2, 2024 | CHA Bio Complex

**Abstract book(E-book)**

# 건강:사랑

한결같이 지켜온 믿음과 신뢰!  
변함없는 사랑으로 지역민의 건강에  
최선을 다하겠습니다.

건강재건, 행복재건, 미래재건



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## 효능·효과

\*EGb 761®은 독일 슈바베(Schwabe)사만의 특허추출공법을 이용하여 최적의 유효성분 배합비로 표준화한 Ginkgo Biloba Extract입니다.<sup>2</sup>

Ref) 1.H Wohlmut et al., Phytomedicine. 2014 May;21(6):912-8. 2. Kressmann S et al. J Pharm Pharmacol. 2002 May; 54(5):661-9.

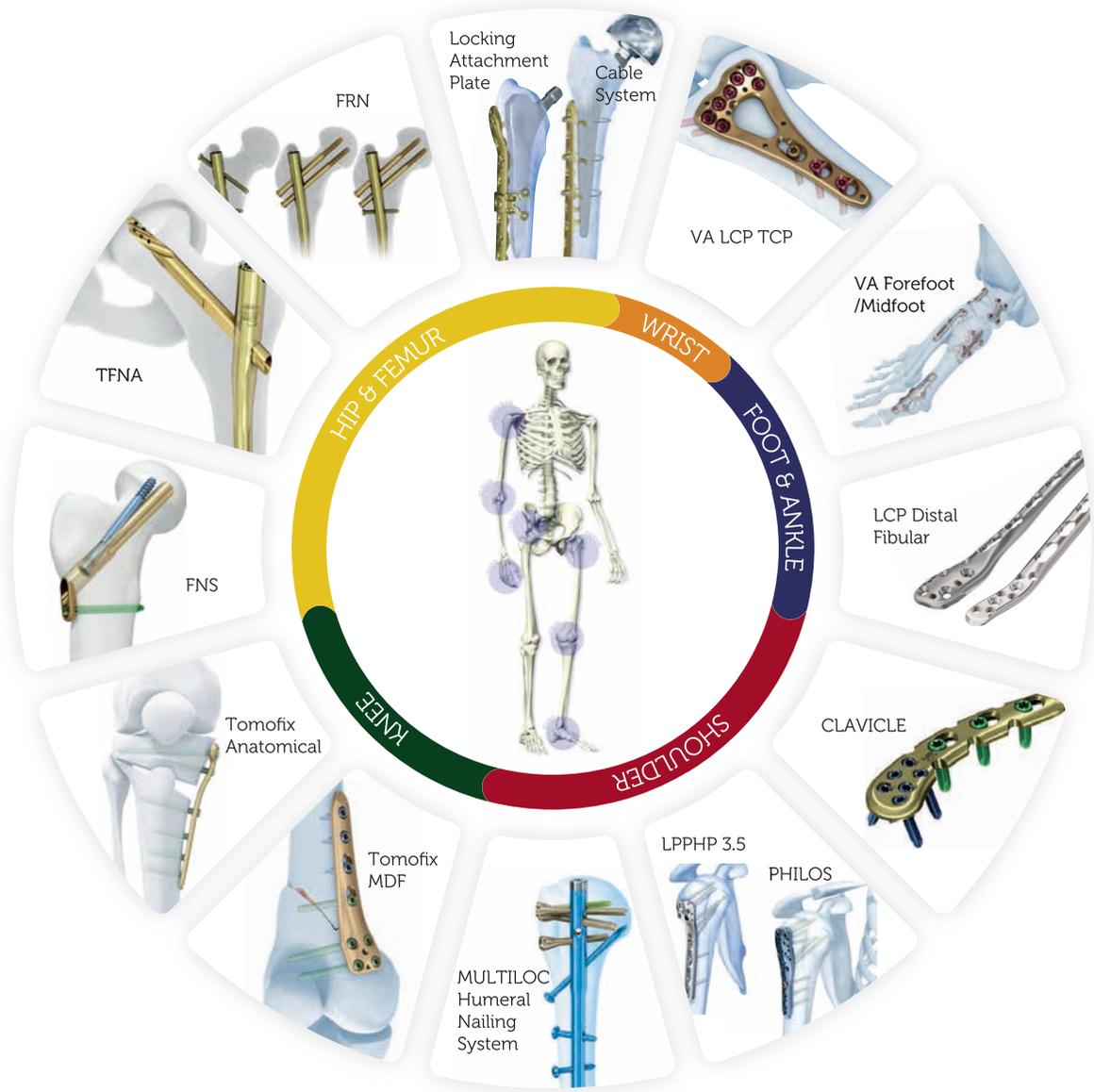
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1. 말초동맥 순환장애(간헐성 파행증(이따금 짚뚱거리))의 치료
2. 어지러움, 혈관성 및 퇴행성 이명(귀울림)
3. 이명(귀울림), 두통, 기억력감퇴, 집중력장애, 우울감, 어지러움 등의 치매성 증상을 수반하는 기질성 뇌기능장애의 치료

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\* 제품에 대한 자세한 정보는 제품설명서 또는 식품의약품안전처 의약품 통합정보시스템 (<http://nedrug.mfds.go.kr>)을 확인해주시기 바랍니다.



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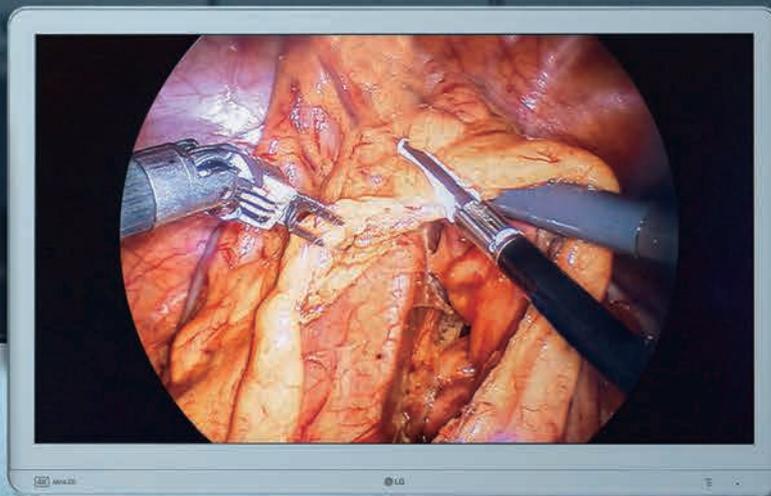
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성분 및 함량 Rabeprazole Sodium 10mg + Sodium Bicarbonate 400mg

효능·효과 위궤양, 십이지장궤양 / 미란성 또는 궤양성 위식도역류질환 / 위식도역류질환의 장기간 유지요법 용법·용량 위궤양, 십이지장궤양 : 증상에 따라 1일 2정 투여 (위궤양 8주, 십이지장궤양 6주까지) / 미란성 또는 궤양성 위식도역류질환 : 1일 2정 (또는 4정) 4-8주간 투여, 8주간 투여 후에도 치료가 되지 않는 경우, 추가로 8주간 1일 2정 (또는 4정) 경구 투여 (1일 4정 투여는 중증의 점막 손상이 확인된 환자에 한함) / 위식도역류질환의 장기간 유지요법 : 1일 2정 투여 **특허등록번호** 10-2021-0118637 **보합약가** 534원 **상병코드** 위식도역류병 K21, 위궤양 K25, 십이지장궤양 K26 \*기타 제품에 대한 자세한 사항은 본사 의약품정보부(02-512-9981)로 문의하시기 바랍니다.

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ActiClot은 트롬빈과 식물성 전분 성분의 흡수성 지혈제로, 혈액 내 피브리노겐의 피브린 전환을 촉진하여 빠른 지혈을 유도하며 전분 성분이 물리적 장벽을 제공함으로써 출혈을 억제합니다.

바른생각을 가진 사람들의 바른병원



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## 정형외과



무릎, 어깨  
척추, 수부, 족부

서울대출신  
정형외과전문의  
분과별 진료

철저한  
감염예방 시스템

외상  
관절  
척추

대학병원급  
최첨단 시설  
(클린룸, MRI  
CT, 수술현미경)

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수부전문의 상주

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연구하는 병원  
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검색

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대표번호 : 041) 415 - 0001 팩스 : 041) 415 - 0049

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예수 그리스도의 사랑과 아름다운 소식을 전하는 병원  
이웃의 아픔과 기쁨을 함께 나누는 가족같은 병원



# 수병원

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영상의학센터 / 종합검진센터 / 가정의학과

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수부외상센터  
수부 절단 / 골절

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무지외반증  
하지골절  
발목인대손상

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문의전화

063-251-7200

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정형외과 수부세부 전문의 서영석 병원장	정형외과 전문의 최장석 의료원장	정형외과 전문의 장형서 의무원장	정형외과 전문의 전형민 센터장	정형외과 전문의 공재연 진료부장	정형외과 수부세부 전문의 양태영 미세수부센터소장	신경외과 전문의 이현우 과장	영상의학과 전문의 김병호 부원장	마취통증의학과 전문의 김현민 과장	마취통증의학과 전문의 최동남 과장		

재활의학과		내과		가정의학과-검진센터	
재활의학과 전문의 권도철 연구부장	내과 전문의 서장훈 부장	가정의학과 전문의 김근배 센터장	건강검진센터 진단의 김지혜 과장		



수부미세수술연구소/골절외상센터/척추센터/  
인공관절센터/소화기센터/종합건강증진센터

## 센텀종합병원

CENTUM GENERAL HOSPITAL

정형외과										
정형외과 전문의 박종호 이사장	정형외과 전문의 손찬모 원장	정형외과 전문의 조재영 부원장	정형외과 전문의 임문성 교육부장	정형외과 전문의 이운성 진료부장	정형외과 전문의 김호진 과장	정형외과 전문의 정동욱 과장	정형외과 전문의 서재승 과장	정형외과 전문의 박재훈 과장	정형외과 전문의 박준호 과장	

정형외과		신경외과		간담도췌장외과			내과			
정형외과 전문의 이준성 과장	신경외과 전문의 이선일 센터장	신경외과 전문의 강주영 부장	신경외과 전문의 이동혁 과장	간담도췌장외과 전문의 박광민 의무원장	간담도췌장외과 전문의 이상엽 과장	간담도췌장외과 전문의 노영훈 과장	내과 전문의 함상영 센터장	내과 전문의 박정호 부장	소화기내과 전문의 김경희 센터장	

내과		비뇨의학과		유방외과		가정의학과		성형외과		정신건강의학과		재활의학과	
신경내과 전문의 황길수 과장	내과 전문의 김동현 과장	신경내과 전문의 김상근 과장	류마티스내과 전문의 문동희 과장	비뇨의학과 전문의 박남철 병원장	유방외과 전문의 최희숙 과장	가정의학과 전문의 이현우 과장	성형외과 전문의 오재욱 과장	정신건강의학과 전문의 장준호 과장	재활의학과 전문의 권도철 연구부장				

치과		마취통증의학과		영상의학과		영상의학과		영상의학과		영상의학과		영상의학과	
치과 전문의 홍길수 과장	마취통증의학과 전문의 노주석 부원장	마취통증의학과 전문의 김순수 과장	마취통증의학과 전문의 정성훈 과장	영상의학과 전문의 이장희 센터장	영상의학과 전문의 황일중 과장	영상의학과 전문의 이기남 과장	영상의학과 전문의 최은석 과장	영상의학과 전문의 정현희 과장	영상의학과 전문의 이영자 과장				

직업환경의학과		소아청소년과		진단검사의학과		응급의학과	
직업환경의학과 전문의 김은아 과장	소아청소년과 전문의 김민지 과장	진단검사의학과 전문의 류성은 과장	응급의학과 전문의 김성권 센터장	응급의학과 전문의 김서영 과장			



관절센터/척추센터/수부미세수술센터/비뇨의학과센터/간센터  
인공신장실/제외총격파치료/종합건강증진센터

# 소중한 당신의 **손과발**을 위한 선택 부산마이크로병원이 함께 합니다



## 진료분야

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- 관절질환(어깨/무릎)
- 골절 및 외상

### ■ 미세수술

- 손가락 · 발가락 재접합술
- 사지 재접합술
- 칼 · 유리 등에 의한 손상

### ■ 수부질환

- 상지 및 수부 골절 · 외상
- 사고 후유증에 의한 기능장애 및 변형
- 인대 및 관절 손상
- 수부종양

### ■ 족부질환

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- 인대 및 관절 손상
- 당뇨발
- 족부변형
- 족부종양

### ■ 관절질환

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- 무릎관절
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# 보건복지부 지정 관절·수지접합 전문병원 제5기 지정



## 수부에서 시작하여 정형외과 세분화를 추구합니다

### 수부센터



수부세부전문의  
백구현 명예원장



수부세부전문의  
김진호 대표원장



수부세부전문의  
이춘훈 원장



수부세부전문의  
이재훈 원장



수부세부전문의  
김홍군 원장



수부세부전문의  
박진성 원장



수부세부전문의  
이정석 원장



수부세부전문의  
이준하 원장



수부전문의  
민경태 과장

### 전문 의료진 36명의 진료협진 시스템

[정형외과 · 신경외과 24명]

수부 **9명**

관절 **6명**

척추 **6명**

족부 **3명**

### 첨단의료장비

MRI 3대(3.0T 2대, 1.5T 1대) / 64채널 CT  
C-arm / Microscope / 혈류검사기  
고압산소 치료 멀티 챔버 / 뇌혈류초음파(TCD)  
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- 소아외상 및 골절
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연간 수술 1만여 건, 외래 20만 명 진료



# NO. 1



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Certified Hand Surgery Specialist Training Hospital



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Department of  
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**Hyeung Gyo Seo**  
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Plastic Surgery1



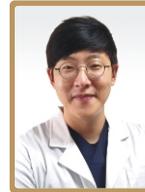
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Plastic Surgery3



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Department of  
Plastic Surgery5



**Yong Hwan Kim**  
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Orthopedic Surgery5



**Sang Woo Kim**  
Department of  
Orthopedic Surgery1

### SERVICES

#### Hand Surgery & Plastic Surgery

##### <Reconstructive Surgery >

Institute of Micro & Hand Surgery

- ◎ Hand reconstructive surgery and micro surgery  
Hand replantation, Hand trauma, Post-traumatic deformity  
Contracture and scar, Carpal tunnel Syndrom, tenosynovitis
- ◎ Congenital Hand  
Syndactyly, polydactyly, Constriction band syndrome  
Symphalangism, Hypoplastic hand
- ◎ Facial reconstructive surgery  
Facial contouring, Facial bone fracture, Facial rejuvenation

#### <Cosmetic Surgery Clinic>

- ◎ Cosmetic surgery
- ◎ Laser Clinic

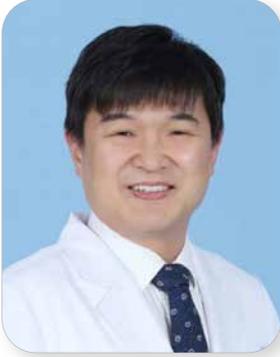
#### Orthopedic Surgery

- ◎ Joint Clinic  
Arthroscopy and Arthroplasty  
Degenerative arthritis and Rheumatoid arthritis
- ◎ Musculoskeletal and spine Clinic
- ◎ Fracture, dislocation and traumatology

#### Radiology

- Health screening program
- Diagnostic medicine

# INVITATION



존경하는 대한수부외과학회 회원 여러분,

올해 초부터 의료계를 흔들었던 의료개혁 문제가 아직도 진행 중인 가운데 어려운 여건에서도 진료와 연구에 노력해 주신 우리 회원 여러분들 덕분에 24년도 추계학술대회를 맞이 하게 되었습니다.

이번 학회에서도 회원과 많은 해외 석학들의 발표가 알차게 준비되어 있습니다. 그동안 쌓아온 지식을 공유하면서 뜻깊은 대화의 장이 되는 소중한 시간이 될수 있을 것입니다. 또한 우리 수부외과가 날로 발전하며, 그 중요성이 강조되고 있는 만큼, 이번 학회를 통해 최신 연구와 지식을 공유하고, 실질적인 임상 적용 방안을 모색할 수 있는 기회가 되길 바랍니다.

이번 학회를 위해 열정적으로 발표를 준비해 주신 연자, 그리고 학회 준비를 위해 수고해 주신 모든 관계자들께도 깊은 감사의 말씀을 드립니다. 올해도 11월에 개최되는 대한수부학회에서는 의료 개혁의 후유증도 말끔히 정리되어 만나기를 기대합니다.

회원 여러분, 분당에서 만나기를 고대하고 있습니다.

2024년 11월

대한수부외과학회 회장 김성언

# INVITATION



존경하는 대한수부외과학회 회원 여러분,

대한수부외과학회 학술대회는 매년 국내외 명망있는 연자를 포함하여 수많은 발표자가 다양한 연제로 참여하는 국제적인 행사 규모로 항상 수부 상지 영역에서 선두 학회의 위상을 높이고 있습니다.

여러 가지 사회 여건으로 일부 학술행사가 위축된 부분이 없지 않지만 2024년 정기 학술대회는 이를 극복해 최대한 풍성한 학회가 진행되도록 최선을 다해 준비했습니다. 해외 연자들의 초청 강연, 다양한 주제를 심도있게 다룬 심포지엄, 각 분야 증례에 대한 열띤 토론의 장, 수많은 교실에서의 연제 발표 등 여러 프로그램이 준비되어 있으므로 학회 회원을 포함한 관련된 모든 분들이 적극적으로 참여하는 성대한 행사가 될 것으로 기대합니다.

모든 분들의 건강과 안녕을 기원하며 밝고 활기찬 모습으로 학문적 교류와 덕담, 즐거움을 서로 나눌 수 있는 학술대회를 고대하고, 아낌없는 성원을 보내주신 모든 회원님들과 최선의 준비를 위해 노고를 아끼지 않은 학술위원회와 총무님, 그리고 여러 조언과 도움을 주신 모든 위원님들께 깊이 감사를 드리는 바입니다.

대단히 고맙습니다.

2024년 11월

대한수부외과학회 이사장 한 수 홍

# Program at a glance

	<b>Room A</b> International Conference Room	<b>Room B</b> Auditorium	<b>Room C</b> B230	<b>Room D</b> B203: Workshop	<b>Room E</b> B217: Meeting Room
08:40-09:40	<b>Symposium 1</b> AI & Chat GPT in Hand surgery	Free Paper 1	Free Paper 2		
09:40-10:40	Free Paper 3	International Session 1	Free Paper 4		
10:40-11:00	<i>Coffee Break</i>				
11:00-12:00	Free Paper 5	International Session 2	<b>Symposium 2</b> Show me the way (TFC foveal tear in US)		
12:00-12:50	Invited Speaker 1 <b>Room A</b>				
12:50-14:00	Luncheon Symposium <b>Room A</b>				
14:00-14:50	Invited Speaker 2 <b>Room A</b>				
14:50-15:40	Industrial Session	KSSH 'W Grand Lecture'	Free Paper 6	<b>Hands-on Workshop 1</b> UCT medical: distal radius fracture	
15:40-16:00	<i>Coffee Break</i>				
16:00-17:00	Free Paper 7	Travelling Fellowship	<b>Symposium 3</b> Show me the way (Skin coverage)	<b>Hands-on Workshop 2</b> UCT medical: scaphoid fracture	<b>APFSSH Meeting</b>
17:00-18:00	Free Paper 9	Free Paper 8	Free Paper 10		
18:00-18:30	<i>General Meeting</i>				

08:00–08:30 Registration

08:30–08:40 Opening Remarks

President, KSSH **Seongeon Kim**  
Chairman, KSSH **Soo-Hong Han**

### 08:40–09:40 Symposium 1: AI & Chat GPT in Hand surgery

Moderator: Plast Reconstr Surg. Konkuk Univ. **Dong-Hyeok Shin** / Orthop Surg. Yeseon Hosp. **Jae Hoon Lee**

How doctors can utilize ChatGPT in their daily practice and medical research applications

Department of Electrical and Computer Engineering, Seoul National Univ. **Jaeyoung Do** ..... 36

How to use ChatGPT in daily work and its application in medical research

CEO of GPT Korea Co., Ltd **Sungki, Lim** ..... 37

### 09:40–10:40 Free Paper 3 (Hand II)

Moderator: Orthop Surg. Ajou Univ. **Kyeong Jin Han** / Plast Reconstr Surg. Hanayng Univ. **Seung Suk Choi**

Advancing Fingertip Regeneration: Outcomes from a New Conservative Treatment Protocol

Plast Reconstr Surg. Ewha Womans Univ. **Daihun Kang** ..... 43

Impact of Conventional Anesthesia and WALANT techniques on Postoperative Pain in Open Carpal Tunnel Release and Single A1 Pulley Release

Orthop Surg. SNU Seoul Hosp. **Sang Ho Kwak** ..... 48

Clinical Conditions Associated with Abnormal Morphology of Subsesamoid Joint of Thumb MP Joint

Department of Hand Surgery, Yeseon Hosp. **Goo Hyun Baek, Jin Ho Kim, Chung Hoon Lee, Jae Hoon Lee, Hongkyun Kim, Jin Sung Park, Jung Suk Lee, Joonha Lee and Kyoung-Tae Min** ..... 50

Comparative outcomes analysis of Pyrocarbon arthroplasty and Arthrodesis for advanced arthritis of the proximal interphalangeal joints

Orthop Surg. Yonsei Univ. **Won-Taek Oh, Hyun-Kyo Kim, Do-Hyun Kim, Jae-Yong Cho, Il-Hyun Koh, Yun-Rak Choi** ..... 52

Clinical outcome of modified Wassel-Flatt type IV radial polydactyly: Analysis of subtype and morphology

Ulsan Univ. **Wonsun Lee** ..... 54

Characteristics and association of trigger thumb with congenital malformation and developmental milestones in children: Nationwide analyses of a birth cohort

<sup>1</sup>Department of Anatomy and Cell Biology, Seoul National Univ., <sup>2</sup>Orthop Surg. Inje Univ., <sup>3</sup>Orthop Surg. CHA Univ., <sup>4</sup>Department of Pediatrics, CHA Univ., <sup>5</sup>Multi-omics Research Center, CHA Future Medicine Research Institute, CHA Univ. **So Young Kim<sup>1</sup>, Hyun Il Lee<sup>2</sup>, Ha-Na Yoo<sup>3</sup>, Bo Eun Han<sup>4,5</sup>, Man Yong Han<sup>4</sup>, Soonchul Lee<sup>3</sup>** ..... 56

Development of a Machine Learning-based Differential Diagnosis Tool for Chronic arthritis of the hands

<sup>1</sup>School of Medicine, Kyungpook National Univ., <sup>2</sup>Orthop Surg. Kyungpook National Univ. **Woo Hyun Kim<sup>1</sup>, Jin Seo Park<sup>1</sup>, Sung Min Jung<sup>1</sup>, Hyun Joo Lee<sup>2</sup>** ..... 57

10:40–11:00 *Coffee Break*

### 11:00–12:00 Free Paper 5 (Microsurgery)

Moderator: Orthop Surg. Seoul National Univ. **Young Ho Lee** / Orthop Surg. Pusan National Univ. **Sang Hyun Lee**

Reverse homodigital dorsolateral flap for coverage of finger defects

Chuncheon Sacred Heart Hospital **Soo Joong Choi** ..... 60

Clinical Effectiveness of Vascularized Fibular Free Graft for Forearm Bone Defect W Institute for Hand and Reconstructive Microsurgery, W Hosp. <b>In-Ho Ga, Ho-Jun Cheon, Dong-Ho Kang, Soo-Jin Woo, Sang-Hyun Woo</b> .....	61
Analysis of Surgical Outcomes in Peripheral Nerve Torsion <sup>1</sup> Orthop Surg. Ansan Hosp, Korea Univ. College of Medicine, <sup>2</sup> Department of Physical Medicine and Rehabilitation, Korea Univ. College of Medicine <b>Chi-Hoon Oh<sup>1</sup>, Young Jeon<sup>1</sup>, Ki Hoon Kim<sup>2</sup>, Dong Hwee Kim<sup>2</sup>, Jong Woo Kang<sup>1</sup></b> .....	64
Customized Full-Length Toe-to-hand Transfer with a Simultaneous Reconstruction of the Donor foot GoodGeon Hospital for Hand and Reconstructive Microsurgery <b>Myung-Jae Yoo</b> .....	65
Results of reconstruction of suprascapular nerve, axillary nerve, and musculocutaneous nerve using simultaneous transfer of spinal accessory nerve and median/ulnar nerve in upper arm type brachial plexus injury Seoul National Univ. <b>Ji Sup Hwang</b> .....	66
Reconstruction of suprascapular nerve, axillary nerve, musculocutaneous nerve, median nerve motor and sensory branch using simultaneous transfer of spinal accessory nerve and intercostal nerve in preganglionic whole-arm type brachial plexus injury Seoul National Univ. <b>Ji Sup Hwang</b> .....	67
The iRASP Flap; Sensory and Functional Outcomes, 10 years of Experience Gangnam Jaejun Plastic Clinic <b>Jae-Won Yang</b> .....	69

12:00–12:50 **Invited Speaker 1** Moderator: Orthop Surg. CHA Univ. **Soo-Hong Han** / Orthop Surg. Chung-Ang Univ. **Jae Sung Lee**

Peripheral nerve regeneration (basic science) Kanazawa University (Japan) <b>Kaoru Tada</b> .....	72
Simultaneous Stiles-Bunnell Tendon Transfer for the Second Toe Transfers Chang Gung Memorial Hospital (Taiwan) <b>Yu-Te Lin</b> .....	73

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Seoul National Univ. <b>Kee Jeong Bae</b> .....	80
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14:00–14:50 **Invited Speaker 2**  
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The Sensation of Touch and The Real Function of the Hand St. Vincent's Hospital (Australia) <b>Anthony Berger</b> .....	82
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Moderator: Orthop Surg. The Catholic Univ. of Korea **Yang Guk Chung** / Naeun Pil Hosp. **Jong Pil Kim**

Advancements in Mini C-arm Technology: The Role of Fixed-Angle C-arm Tomosynthesis (FACT) Seoul National Univ. <b>Yohan Lee</b> .....	86
Allo nerve manufactured by supercritical method (DOF) Ulsan Univ. <b>Shin Woo Choi</b> .....	89
I love it, open Cast ! Chungnam National Univ. <b>Soo Min Cha</b> .....	91

15:40–16:00 *Coffee Break*

16:00–17:00 **Free Paper 7 (Elbow)** Moderator: SM Christianity Hosp. **In Hyeok Rhyou** / Orthop Surg. Korea Univ. **In Cheul Choi**

- Technique for Arthroscopic Lateral Ulnar Collateral Ligament Reconstruction for Posterior Rotatory Instability of the Elbow  
Asan Medical Center **Jia Guo** ..... 93
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- Articular Impaction of Olecranon Fracture Associated with Poor Postoperative Clinical Outcome  
Orthop Surg. Ewha Womans Univ. **Ji-Sup Kim** ..... 104
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Orthop Surg. Dong-A Univ. **Sung Yoon Jung** ..... 108
- The challenge of trans-ulnar basal coronoid fracture-dislocations : A surgical strategy based on the pattern of coronoid fracture  
<sup>1</sup>Orthop Surg. Chung-Ang Univ. Gwangmyeong Hosp., <sup>2</sup>Orthop Surg. Chung-Ang Univ. Seoul Hosp.  
**Hyung-Seok Jung<sup>1</sup>, Hyun-Cheul Nam<sup>1</sup>, Min Su Chu<sup>2</sup>, Jae-Sung Lee<sup>2</sup>** ..... 112

17:00–18:00 **Free Paper 9 (Basic Research & Miscellaneous I)** Moderator: Orthop Surg. Ulsan Univ. **Jae Kwang Kim** / Orthop Surg. Konkuk Univ. **Seoung Joon Lee**

- Comparison of Clinical Outcomes Between Ultrasound-Guided Needling with platelet-rich plasma Injection and Arthroscopic Debridement for Refractory Lateral Epicondylitis  
<sup>1</sup>Orthop Surg. Shinsegae Seoul Hosp., <sup>2</sup>Orthop Surg. Sungkyunkwan Univ. **Ki Tae Kim<sup>1</sup>, Jeong Keun Kim<sup>2</sup>, Min Jong Park<sup>2</sup>, Jae Woo Shim<sup>2</sup>** ..... 115
- The characteristics and costs of traumatic extremity amputation versus replantation at a single center in the Republic of Korea: a retrospective observational study  
<sup>1</sup>Orthop Surg. Sungkyunkwan Univ., <sup>2</sup>Orthop Surg. Inje Univ., <sup>3</sup>Orthop Surg. SNU Seoul Hosp., <sup>4</sup>Orthop Surg. Dong-A Univ., <sup>5</sup>Department of Trauma Surgery, Regional Trauma Center, Pusan National Univ., <sup>6</sup>Orthop Surg. Pusan National Univ.  
**Dong Hee Kim<sup>1</sup>, Hyo Seok Jang<sup>2</sup>, Sang Ho Kwak<sup>3</sup>, Sung Yoon Jung<sup>4</sup>, Chulho Lee<sup>1</sup>, Chan Ik Park<sup>5</sup>, Kyoungwon Park<sup>6</sup>, Sang Hyun Lee<sup>6</sup>** ..... 117
- Reduction methods and treatments of Isolated volar dislocation of distal radioulnar joint: a case series  
MS Reconstruction Hosp. **Hyo-Kon Kim** ..... 119
- Which reconstructive technique is most appropriate for scapholunate dissociation? Preliminary cadaveric biomechanical evaluation  
<sup>1</sup>Orthop Surg. The Catholic Univ. of Korea, <sup>2</sup>Department of Anatomy, The Catholic Univ. of Korea  
**Il-Jung Park<sup>1</sup>, Ho Youn Park<sup>1</sup>, Soo-Hwan Kang<sup>1</sup>, Joo-Yup Lee<sup>1</sup>, Dai-Soon Kwak<sup>2</sup>** ..... 121
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The Catholic Univ. of Korea **Ho Youn Park, Dai-Soon Kwak, Il-Jung Park, Jin-Woo Lee, Seung Hyo Kim, Joo-Yup Lee** ..... 123
- Comparison of the hepatotoxicity of low-molecular-weight versus unfractionated heparin for anticoagulation therapy after digital replantation  
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18:00–18:30 Awards ceremony and General meeting

08:00–08:30 Registration

08:30–08:40 Opening Remarks

President, KSSH **Seungeon Kim**  
Chairman, KSSH **Soo-Hong Han**

### 08:40–09:40 Free Paper 1 (Hand I)

Moderator: Plast Reconstr Surg. Keimyung Univ. **Dae Gu Son** / Orthop Surg. Hanyang Univ. **Joo Hak Kim**

Novel figure-of-eight reconstruction with free tendon graft for unrepairable collateral ligament of the thumb metacarpophalangeal joint

Kyung Hee Univ. Hosp., <sup>1</sup>Yeseon Hosp., <sup>2</sup>Kyung Hee Univ. Hosp. at Gangdong **Jong Hun Baek, Jae Hoon Lee<sup>1</sup>, Ki Hyeok Ku<sup>2</sup>** ..... 129

Wrist and Hand Tuberculosis (Case Series)

Soonchunhyang Univ. **Ki Jin Jung** ..... 131

Improving Surgical Decision Making: A Reliable Method for Assessing Volar Subluxation in Bony Mallet Finger

Orthop Surg. Chungnam National Univ. **Seung Hoo Lee** ..... 132

Surgical management of delayed presentation of mallet finger fracture by Two-extension block technique with dorsal counter force technique

Orthop Surg. Chungnam National Univ. **Seung Hoo Lee** ..... 133

Ligament Reconstruction Tendon Interposition Arthroplasty in the Trapeziometacarpal Joint Osteoarthritis of the Thumb

Orthop Surg. Soo Hospital, Presbyterian Medical Center<sup>1</sup>

**Byung Ho Lee, Han A Lee, Jun Mo Lee, Byeong Heon Choi<sup>1</sup>, Kyung Tae Kim<sup>1</sup>** ..... 135

Static External Fixator and Concomittant K-wire Fixation for Pilon Type Fracture of the Proximal Interphalangeal Joint of the Finger

Orthop Surg. Eulji Univ. **Seong Ju Choi** ..... 136

Changes of force generation by two types of finger striking methods

<sup>1</sup>Plast Reconst Surg. Armed Forces Capital Hosp., <sup>2</sup>Department of Anatomy, College of Medicine, Ewha Womans Univ., <sup>3</sup>Division of Trauma and Acute Care Surgery, Department of Surgery, Seoul National Univ.

**Kun Hwang<sup>1,2</sup>, Hun Kim<sup>3</sup>** ..... 137

### 09:40–10:40 International Session 1 (Brachial Plexus)

Moderator: Orthop Surg. Korea Univ. **Jong Woong Park** / Raon Plastic Surgery **Seungeon Kim**

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Siriraj Hospital, Mahidol University (Thailand) **Yuwarat Monteerarat** ..... 142

Spinal Accessory to Suprascapular Nerve Transfer: Anterior vs Dorsal approach

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- Paediatric Hand Injuries      Yong Loo Lin School of Medicine, National University Hospital (Singapore) **Alphonsus Chong** ..... 145
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<sup>1</sup>Department of Orthopedics, E-Da Hospital, I-Shou University, Kaohsiung, Taiwan  
<sup>2</sup>School of Medicine, College of Medicine, I-Shou University, Kaohsiung, Taiwan  
<sup>3</sup>Ph.D. Degree Program of Biomedical Science and Engineering, National Chiao Tung University, HsinChu, Taiwan.  
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<sup>1</sup>Orthop Surg. Korea Univ., <sup>2</sup>Biomedical Research Center, Korea Univ. Guro Hosp.,  
<sup>3</sup>Department of Biomedical Informatics, Korea Univ., <sup>4</sup>Department of Emergency Medicine, Ewha Woman's Univ. Mokdong Hosp.  
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08:30–08:40 Opening Remarks

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Chairman, KSSH **Soo-Hong Han**08:40–09:40 **Free Paper 2 (Wrist I)**Moderator: Busan Micro Orthopaedic Clin Hosp. **Byeong Seon Kong** / Orthop Surg. The Catholic Univ. of Korea **Joo Yup Lee**

Radiographic and Clinical Results after Ulnar Shortening Osteotomy alone or Ulnar Shortening Osteotomy with TFCC Foveal Repair in the patients with Ulnar Impaction Syndrome combined with TFCC foveal tear

<sup>1</sup>Department of Orthopedic Surgery, East Avenue Medical Center, Manila, Philippines, <sup>2</sup>Orthop Surg. Korea Univ. Anam Hosp.**Ma. Loren Josephine Lantin<sup>1,2</sup>, Yeongyoon Koh<sup>2</sup>, In Cheul Choi<sup>2</sup>, Jong Woong Park<sup>2</sup>** ..... 179

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Arthroscopic Transosseous Foveal Repair of the Triangular Fibrocartilage Complex Tears Associated with Symptomatic Ulnar Styloid Non-union

<sup>1</sup>Yeseon Hosp., <sup>2</sup>Kyung Hee Univ. **Jae Hoon Lee<sup>1</sup>, Jung Suk Lee<sup>1</sup>, Jong Hun Back<sup>2</sup>, Ki Hyuk Koo<sup>2</sup>** ..... 19009:40–10:40 **Free Paper 4 (Wrist II)**Moderator: Orthop Sug. Yonsei Wonju Univ. **Jin Rok Oh** / Plast Reconstr Sug. DongGuk Univ. **Su Rak Eo**

Physical performance level is associated with patient-reported outcomes after operation for distal radius fracture in female patients

Orthop Sug. Asan Medical Center, Univ. of Ulsan College of Medicine

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<sup>1</sup>Soonchunhyang University, <sup>2</sup>Chungnam National University **Jae-Hwi Nho<sup>1</sup>, Ki Jin Jung<sup>1</sup>, Soo Min Cha<sup>2</sup>, Byung Sung Kim<sup>1</sup>** ..... 195

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<sup>1</sup>Orthop Sug. Korea Univ. Ansan Hosp., <sup>2</sup>Orthop Sug. CHA Bundang Medical Center, <sup>3</sup>Orthop Sug. Armed Forces Daejeon Hosp.**Chi-Hoon Oh<sup>1</sup>, Segi Kim<sup>2</sup>, Cheungsoo Ha<sup>3</sup>, Soo-Hong Han<sup>2</sup>** ..... 197

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<sup>1</sup>Orthop Sug. Korea Univ. Ansan Hosp., <sup>2</sup>Orthop Sug. CHA Bundang Medical Center, CHA Univ.,  
<sup>3</sup>Orthop Sug. National Health Insurance Service Ilsan Hosp., <sup>4</sup>Orthop Sug. Yonsei Univ.**Chi-Hoon Oh<sup>1</sup>, Cheungsoo Ha<sup>2</sup>, Chae Kwang Lim<sup>3,4</sup>, Sungwoo Lee<sup>3,4</sup>, Soo-Hong Han<sup>2</sup>, Jun-Ku Lee<sup>3,4</sup>** ..... 199

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Radiologic and clinical results of volar wedge cancellous bone graft and headless compression screw fixation for treatment of scaphoid waist nonunion with humpback deformity  
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- Is the 'Safe Zone' Identified in Preoperative Computed Tomography Helpful for Choosing Optimal Implant for Fixation of Radial Head Fracture? : Conventional Cortical Screw versus Headless Compression Screw versus Locking Plate  
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<sup>1</sup>Vision AI Business Team, LG CNS, <sup>2</sup>Orthop Surg. Hosp. of Chung-Ang Univ., <sup>3</sup>Orthop Surg. Chung-Ang Univ. Gwangmyeong Hosp.  
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<sup>1</sup>Orthop Surg. Dusan Hospital, <sup>2</sup>Plast Reconstr Surg. Dusan Hospital, <sup>3</sup>Plast Reconstr Surg. Ewha Womans Univ.  
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Table Instructor: **Jung Il Lee, Sang Ho Kwak, Seong Ju Choi, Jae-Yong Cho, Chi-Hoon Oh**

15:40–16:00 *Coffee Break*

16:00–17:00 **Hands on Workshop 2 (APTUS UCT medical) Scaphoid plating**

Table Instructor: **Jung Il Lee, Sang Ho Kwak, Seong Ju Choi, Jae-Yong Cho, Chi-Hoon Oh**

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<sup>1</sup>Orthop Surg. Samsung Changwon Hosp. Sungkyunkwan Univ., <sup>2</sup>Orthop Surg. Medical Research Institute, Pusan National Univ. **Dong Hee Kim<sup>1</sup>, Jin Woo Jin<sup>1</sup>, Chul Ho Lee<sup>1</sup>, Sang Hyun Lee<sup>2</sup>** ..... 282
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<sup>1</sup>Orthop Surg. Institute of Hand and Microsurgery, Dusan Hosp., <sup>2</sup>Orthop Surg. Regional Rheumatoid and Degenerative Arthritis Center, Chungnam National Univ., <sup>3</sup>Orthop Surg. Institute of Hand and Microsurgery, W Hosp. **Yong Hwan Kim<sup>1</sup>, Soo Min Cha<sup>2</sup>, In Ho Ga<sup>3</sup>** ..... 291
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<sup>1</sup>Orthop Surg. Inje Univ. Sanggye Paik Hosp., <sup>2</sup>Department of Radiology, Inje Univ. Sanggye Paik Hosp.,  
<sup>3</sup>Orthop Surg. Da Hosp., <sup>4</sup>Orthop Surg. National Medical Center  
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<sup>1</sup>Plast Reconstr Surg. Saeson Hosp., <sup>2</sup>Orthop Surg., Saeson Hosp. **Hyun Rok Lee<sup>1</sup>, Jeewoong Kim<sup>2</sup>** ..... 319
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**Room A**

# **Symposium 1: AI & Chat GPT in Hand surgery**

Plast Reconstr Surg. Konkuk Univ. **Dong-Hyeok Shin**  
Orthop Surg. Yeson Hosp. **Jae Hoon Lee**

# Large Language Models in Healthcare

Department of Electrical and Computer Engineering, Seoul National Univ.

Jaeyoung Do

OpenAI의 ChatGPT에서 시작된 대형 언어 모델 (Large Language Models, LLMs)의 기술적 발전은 기업, 학계, 일반 대중의 상상력을 혁신적으로 사로잡고 있습니다. 현재의 LLM 트렌드는 어떤 주제에 대해서도 일정 수준 이상의 성능을 보여주는 General LLM을 넘어 특정 도메인에 특화된 Domain-Specific LLM으로 향하고 있습니다. 이번 세션에서는 의료 데이터의 대부분을 차지하며, 기하급수적으로 수가 증가하고 있는 비정형 텍스트 의료 데이터를 활용하여 의료 특화 LLM을 만들 때 고려해야 할 사항과 연구 방향을 논의합니다. 특히 임상 의료진 수준의 추론 능력을 가진 의료 특화 LLM을 만들기 위해서 필요한 요소인 Treatment Algorithm에 대해 소개하고 그 중요성에 대해 알아보하고자 합니다.

# 생성AI의 이해와 의료 분야에서의 활용 방안

CEO of GPT Korea Co., Ltd

Sungki, Lim

01

## 생성 AI의 개념과 발전 현황

생성 AI란 무엇인가? | 3

### 생성 AI의 개념

사용자의 지시사항에 따라 원하는 형태의 데이터를 출력하는 인공지능 기술

> 미리 정해진 결과물 중 알맞은 것을 제공하는 것이 아닌 사용자의 상호작용을 통해 적절한 결과물 생성

**프롬프트**  
자동차가 달리고 있는 이미지를 생성해주세요.

출력하신 결과는 자동차의 이미지를 더 좋게 합니다. 초광이나 추가 이미지가 필요한 경우 알려 주시길 바랍니다.

\*생성 API 없었다면? 직접 촬영하거나 직접 만든 이미지를 사용

생성 AI란 무엇인가? | 4

[결과물 형태에 따른 분류]

**대화 생성 AI**

: 사용자와 대화하여 텍스트형 결과물 제공

ChatGPT, Claude AI, Bard, Clova X 등

**이미지 생성 AI**

: 사용자가 요청한 이미지 결과물 제공

미드저니, 레오나르도 AI, 스테이블 디퓨전, Firefly 등

**멀티모달 (Multi-Modal) AI**

: 이미지/오디오/텍스트 등 2개 이상의 형태를 동시에 학습하여 시각, 청각 등에 대한 다양한 정보를 사용자와 주고 받는 AI

출처: Intel Labs

**오디오 생성 AI**

: 음악이나 음성 형태의 결과물 제공

가우디오랩, 스테이블 오디오, 캡컷 등

**비디오 생성 AI**

: 움직이는 이미지(영상) 결과물 제공

스테이블 비디오 디퓨전, gen-2, 케이비 AI 등

메타 AI, 구글 제미니 등이 있으며 ChatGPT도 달리, 워드 등 탑재

생성 AI 발전과정 | 5

-2022년 4분기	2023년 1분기	2023년 2분기	2023년 3분기	2023년 4분기
OpenAI, GPT-3.5 공개 (2022.12.01)	GPT-4 출시	코딩엔터프라이즈 출시	DALL-E 3 출시	GPT-5 출시
미드저니, 달리 출시	NEW BING 출시	구글 버드 공개	헤이퍼플로버X 출시	Assistant API 출시
다양한 AI 스타트업 등장	국내 생성AI 열풍 시작	금융권, AI 도입 본격화	삼성SDS, AI 기반 B2B 솔루션 공개	삼성전자, 생성형AI 기술 '가우스' 공개
		AWS, '생성 AI 혁신센터' 발표	Adobe, 이미지 AI 솔루션 Firefly 공개	

분기별 출시 서비스

### 생성 시발전과정 | 6

~2024년 1분기 GPT 스토어 | 2024년 2분기 GPT-4o | 2024년 3분기 GPT-o1 | 2024년 4분기 GPT-고급응용모드 | 2025년 - 지속적 진화와 확장

GPT 스토어 오픈 (2024.01)	GPT-4o 공개	GPT o1-Preview, o1-mini 공개	아미존 '시 알렉사' 출시 예정	GPT를 출시 예정
Llama 3 출시	클라우드 3.5 Sonnet 출시	클라우드 엔터프라이즈 풀본 출시	애플 인텔리전스 공개 베타	애플 '시'에 ChatGPT 통합 예정
메타, 베플의 AI 챗봇 최신 라마3 기반 '메타 AI' 탑재	Search GPT 공개	SKT & 퍼플렉시티 협업	ChatGPT 고급 옵션 기능	온타리오 AI의 시대
	GPT-4o Mini 공개	AEO 시대의 시작	리아 3.2 출시	

분기별 출시 서비스

### 주요 생성 시 모델 소개 | 7

기업	Open AI	Anthropic	코파일럿	Perplexity	구글
서비스 명칭	GPT-4o	Claude 3.5	Copilot	perplexity	Gemini
특징	- 대화형 생성 AI - 멀티모달: 이미지 인식 + α - 실시간 정보 검색 가능 - 이미지 OCR + 후속질문 가능해지면서, 행동 맞춤형(AOI)에 더 가까워짐	- 한국어에 특화된 초대규모 언어 모델(LLM) - 문서 및 코드 작성에 특화	- MS365 기반 AI 솔루션 - MS의 대표적 업무용 협업 도구인, 엑셀 등에서 사용률과 사용자 편의성 증대 - Artifact 기능을 통한 데이터 시각화 용이	- 검색 엔진형 AI - 실시간 검색 가능 제공	- 멀티모달: 이미지, 텍스트, 오디오, 동영상 코드 등 다양한 유형에 걸쳐 처리 가능 - 230억 개의 국가 및 지역에서 서비스 이용 가능
활용 전망 및 예상 변화	- GPT-4o (1분당 100만 토큰, 3000개의 이미지 생성 가능) - 기존 텍스트 중심 환경에 넘어 오고, 영상 등 다양한 미디어 인식 및 출력 가능	- Open AI 연구원 출신이 공동 설립한 스타트업으로, 출시 1년 만에 기업가치 30조 이상 - 애플, 구글 등의 주요 주주로서 SKT 밸류, L.O.J를 통해 투자	- 업무용 시 서비스인 MS365 코퍼 에디션과 연계하여 서비스 제공이 기대되며, 특히 - 협업 도구 '프린트', '엔비 베이스'와도 연계하여 '엑셀' 등 다양한 업무 코퍼레이션 산업	- 업무용 시 서비스인 MS365 코퍼 에디션과 연계하여 서비스 제공이 기대되며, 특히 - 40개의 언어 지원이 가능하며, 구글 검색 기능을 활용한 디버깅 도구 등으로 활용 범위를 확대 - 출시 1년 만에 기업가치 5~6배 상승	- Gemini 1.5 Pro - 40개의 언어 지원이 가능하며, 구글 검색 기능을 활용한 디버깅 도구 등으로 활용 범위를 확대 - 온타리오 AI의 시대

### LLM의 대표 선두 주자 ChatGPT | 8

## OpenAI가 개발한 대화형 인공지능 챗봇 ChatGPT

"Generative Pre-trained Transformer"의 약자로 자연어 기반의 인공지능 모델  
GPT-3.5(무료), GPT-4o, GPT-4o mini, o1-preview and o1-mini 모델이 있으며, 무료 사용자도 제한적으로 유료 모델 사용 가능  
다양한 언어를 활용한 실시간 음성 대화가 가능하며, 텍스트에서 감정표현을 이해하고 적절한 응답 제공

### LLM의 대표 선두 주자 ChatGPT | 9

## GPT의 새로운 모델 스스로 생각하는 AI 'GPT - o1'

o1 - Preview와 o1 - mini

생각의 사슬(CoT) 기능을 활용한 추론 특화 AI

물리학, 화학, 생물학에서 박사 과정 학생과 비슷한 수준에 도달  
O1-Preview: 광범위하고 일반적인 지식을 활용하여 어려운 문제를 추론하도록 설계된 모델  
o1-Mini: STEM 주제에 대하여 비용 효율성이 매우 높은 모델로 코파일럿에 특화

### 코파일럿으로 앞당기는 AI 업무 혁신 | 10

## 마이크로소프트와 오픈시

마이크로소프트는 오픈시와 전략적 파트너십을 체결하여 상호 협력관계로 인공지능 기술 발전에 기여하고 있음

- 투자 지원: 마이크로소프트는 오픈시의 주요 투자자 중 하나로 1,000억 달러 이상을 투자
- 클라우드 컴퓨팅: 오픈시는 마이크로소프트의 클라우드 컴퓨팅 플랫폼인 애저(Azure)를 사용하여 대규모 인공지능 모델 훈련
- 기술 협력: 마이크로소프트는 오픈 시의 기술을 자사의 제품과 서비스에 통합하는 방법 모색 -> 코파일럿

### 코파일럿으로 앞당기는 AI 업무 혁신 | 11

## GPT-4 기반 검색 분야 특화 모델 마이크로소프트 대화형 인공지능 코파일럿

- 기존엔 Bing, 새 Bing(New Bing) 등으로 불림 -> 2023년 12월 1일 코파일럿으로 리브랜딩
- Word 파일에서 체킹을 통한 콘텐츠 요약 및 문서에 대한 질의응답 수행 가능
- Excel 및 Powerpoint 등 MS 365 앱을 이용한 문서 초안 작성 가능
- 코파일럿은 웹/모바일 앱 코파일럿, 365 코파일럿 형태로도 제공되어 사용 가능 (연, 일부 기능 제외)

코파일럿으로 앞당기는 AI 업무 혁신 | 12

### MS 코파일럿의 주요 기능

요약

검색

글 작성

코파일럿은 전반적인 컴퓨팅 작업에 도움

AI 비서 코파일럿

MS Edge: 검색 결과, 장편 페이지, 유튜브, PDF, 블로그, ...

MS 365: 워드, 파워포인트, 엑셀, 아웃룩, 팀즈

코파일럿으로 앞당기는 AI 업무 혁신 | 13

MS Edge + 코파일럿

기사의 요약 생성 예시

PDF 기반 블로그 글 작성 예시

MS 365 + 코파일럿

아웃룩 메일 내용 요약 결과 예시

워드 파일 기반 프레젠테이션 만들기 결과 예시

02

## 의료분야에서의 생성 AI 활용 사례

AI 활용 사례: 의료 영상 분석 및 진단 보조 | 15

### 의료 영상 분석 및 진단 보조

AI 진단의 효과성 등이 다수 논문을 통해 입증되었으며, 응급상황 예측 서비스 모델이 정부 개발 진행 중

**루닛 인사이트:** 영상진단을 통해 암 진단의 정확도 향상, 맞춤형 치료 보조

**루닛 스킵프:** 환자의 생체지표 분석해 항암제 사용 적합 여부 판단 솔루션

AI 활용 사례: 자가 관리 및 예방 | 16

### 자가 관리 및 예방

임상시험수탁기관(CRO) 오라클 헬스(Oracle Health), 개인 맞춤형 건강 관리 조건 제공

국내 최대 임상시험 수탁기관, 오라클 헬스 사이언스 클라우드 도입

ORACLE

오라클 헬스, 임상 시험 설계 및 준비 시간을 줄여 효율성 증대

AI를 활용해 만성 질환, 정신 건강, 임신 관리 등 다양한 건강 문제를 관리 플랫폼 제공

AI 활용 사례: 신약 개발 | 17

### 신약 개발

CADD(Computer Aided Drug Discovery) 방식에서 생성형 방식으로 빠르게 변화 중

생성형 AI에 대한 바이오 업계의 인식

62%

제약바이오 업계 CEO 62%가 최우선 투자 대상으로 선정

100곳

전 세계 100개 이상의 제약바이오 기업이 생성형 AI로 신약 개발 속도 높임

- '바이오네모(NVIDIA BioNeMo)'를 통해 컴퓨터 기반 신약 개발
- 약물 연구개발을 위한 새로운 종류의 계산 방법을 제공
- 신약 개발 생태계에 12개 이상의 생성형AI 모델과 클라우드 서비스 제공

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### 의료 행정 및 운영 효율화

의료 행정의 수기 업무 등 다양한 행정 관련 업무를 시로 자동화

**AI 문진 Ubie**

환자가 증상을 입력하면  
AI가 추가 질문을 생성하여 진료 기록에 반영  
→ 환자 대기 시간 20분 절감, 약 기입 오류 감소

**Medical AILAB의 AI 처방전 검토**

처방전을 자동으로 검토하여  
수정이 필요한 처방을 높은 정확도로 식별  
→ 처방전 확인 인력 최소화

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03

## AI 활용 방법 및 주의사항

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### 사용자의 요구와 선호에 맞춰 생성하는 특화 AI 모델

ChatGPT의 GPT Store에 등록된 서비스를 활용하거나 직접 제작이 가능

**특화 AI 모델이란?** 사용자의 특정한 요청에 따라 특정한 기능을 수행하도록 커스터마이징된 모델 또는 커스텀 챗봇

**GPT**

특정 주제에 대해 전문 스타일 요소를 결합한 ChatGPT의 기능을 적용할 수 있습니다.

Research & Analysis

**사용자 맞춤형 생성**

- 업무 목적, 특성에 따른 AI 맞춤 설정 가능하여 다양한 분야에 적용
- 노코딩, 로우코딩
- GPTs 생성에 적합하거나 전문적인 코딩 지식이 필요한 분야
- 판매/배포 가능
- 다른 사용자와 공유, GPT 스토어를 통해 GPTs 판매 가능

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### 의료 관련 논문 탐색과 내용 요약 GPT

ChatGPT의 Scholar GPT를 이용한 논문의 검색과 내용 요약

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### 환자 설명용 자료 제작

전문적인 지식이 없는 환자가 쉽게 이해할 수 있는 설명용 자료의 제작에 활용

**드물게 알려진 질환의 발생 기원을 환자가 이해하기 쉽게 설명해주세요**

손목에 있는 힘줄은 마치 고무줄처럼 뻗을 때의 움직임은 줄이지고 생각할 수 있어요. 이 힘줄은 손가락을 움직이게 하는 중요한 역할을 해요.

이 고무줄이 썩어 버리면 움직일 수 있도록 고무줄 주변에 튜브 같은 보호막이 있어요. 하지만 손목을 과도하게 사용하면 움직일 땀뻘이 뱉혀버려요. 이 보호막과 힘줄이 마를 때 움직이기 힘들어 생길 수 있어요.

이렇게 염증이 생기면 손목과 엄지손가락을 움직일 때 통증이 생기고, 특히 엄지손가락을 움직일 때나 손목을 돌릴 때 불편함이 생길 수 있어요

**수근관의 해부학적 구조를 일반인이 이해하기 쉽게 설명해주세요**

손목에는 손가락을 움직이게 해주는 힘줄들과 감싸주는 중요한 신경이 있어요. 이 신경과 힘줄들이 손목을 지나갈 때, 마치 터널처럼 생긴 공간을 통해 지나가요.

이 터널을 '수근관'이라고 해요. 터널의 벽과 밑 벽은 손목뼈로 이루어져 있고, 천장은 튼튼한 인대로 덮여 있어요.

이 터널이 좁아지거나 신경에 압박이 생기면 손가락과 손목에 저림이나 통증 같은 증상이 나타날 수 있어요. 특히 이 신경이 눌리면 '수근관 증후군'이라고 불리는 문제가 생길 수 있어요.

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23 | SI 활용 방법

### 의무기록 작성 보조

환자 상담 내역 등 정리되지 않은 자료의 문서화를 위한 보조 수단으로 활용

**다음 환자 상담 내용을 SOAP 형식으로 정리해주세요**

(환자지정 정보 제외)

환자: 35세 남성, 주부  
주증상: 무척 수근부 통증 및 저림감  
현병력: 2달 전 업무 중 팔 사용시 증상 악화  
이력적 검사 결과:  
- Timel sign 양성  
- Phalen test 양성  
- 무지구부러 환자까지 저림감  
- 야간통 호소  
:

**AI 활용 프롬프트 예시**

**[초진기록 작성]**  
다음 수부 외상 환자의 초진 기록을 작성해주세요.  
특히 [손상 부위]의 신경/혈관/근골격 상태를 체계적으로 평가하고, 응급 처치와 향후 치료 계획까지 포함해주세요.  
[환자 정보 및 pertinent 결과 입력]

**[수술기록 작성]**  
[수술명]의 수술 기록을 작성해주세요.  
수술 시간, 마취 방법, 피부 부위, 단계별 수술 과정, 사용된 기구와 봉합사, 배액관 사용 여부, 표본 검사 의뢰 여부 등을 포함해 상세히 기록해주세요.  
[수술 중 관찰된 소견과 시행된 처치 입력]

AIWEB

AI 활용 시 주의사항 | 24

### AI 활용 시 주의사항 - 개인정보 보호

의료법 및 개인정보 보호법 준수를 위해 데이터 일부의 삭제 혹은 가공 필요

#### 개인 식별정보 삭제



개인을 특정할 수 있는 고유 정보는 삭제하여 활용

#### 입력 데이터의 변환



원본 데이터를 인명(가명)화하여 개인을 식별할 수 없도록 변환

AIWEB

**Room A**

# **Free Paper 3**

## **Hand II**

Orthop Surg. Ajou Univ. **Kyeong Jin Han**  
Plast Reconstr Surg. Hanayng Univ. **Seung Suk Choi**

# Advancing Fingertip Regeneration: Outcomes from a New Conservative Treatment Protocol

Plast Reconstr Surg. Ewha Womans Univ.

Daihun Kang

Fingertip injuries with volar pulp tissue defects present a significant challenge in management. This study aimed to evaluate the efficacy of a conservative treatment protocol using artificial dermis and semi-occlusive dressing for these injuries. A single-center, prospective study was conducted on 31 patients with fingertip injuries involving volar pulp defects. The treatment protocol included wound debridement, application of artificial dermis (Pelnac<sup>®</sup>), and semi-occlusive dressing (IV3000<sup>®</sup>). Outcomes were assessed using subjective questionnaires and objective measures, including fingerprint regeneration, sensory function, pain, and cosmetic appearance. The mean treatment duration was 45.29 days (SD = 17.53). Complications were minimal, with only one case (3.22%) directly attributable to the treatment. Fingerprint regeneration was considerable (mean score = 2.58, SD = 0.67). Sensory disturbances were minimal, with no significant differences across injury types. Post-treatment pain was low (mean = 0.45, SD = 0.67), and cosmetic satisfaction was high (mean = 4.09, SD = 0.94). Overall patient satisfaction was high (mean = 4.41, SD = 0.67), regardless of injury severity. The conservative treatment protocol using artificial dermis and semi-occlusive dressing is a promising strategy for managing fingertip injuries with volar pulp defects. This approach minimizes surgical morbidity and achieves excellent functional and aesthetic outcomes.



Figure 1. Application of artificial dermis and semi-occlusive dressing for fingertip injury. (A) Preoperative view of a middle finger pulp injury. (B) Intraoperative view showing the application of artificial dermis (Pelnac<sup>®</sup>) to the defect, followed by a semi-occlusive dressing (IV3000<sup>®</sup>).

Table 1. Participant Demographics and Injury Characteristics

Characteristic	Total (N=31)	Bone Exposure	No Bone Exposure	Tendon Exposure	No Tendon Exposure
Gender					
Male	25 (80.6%)	17	8	8	17
Female	6 (19.4%)	5	1	2	4
Age (years)					
Mean ± SD	43.29 ± 15.00	43.11 ± 17.22	43.36 ± 14.44	40.50 ± 14.73	44.61 ± 15.30
Affected Fingers					
Thumb	3 (9.7%)	2	1	3	0
Index	13 (41.9%)	8	5	8	4
Middle	6 (19.4%)	4	2	4	2
Ring	8 (25.8%)	6	2	4	4
Little	5 (16.1%)	3	2	3	2

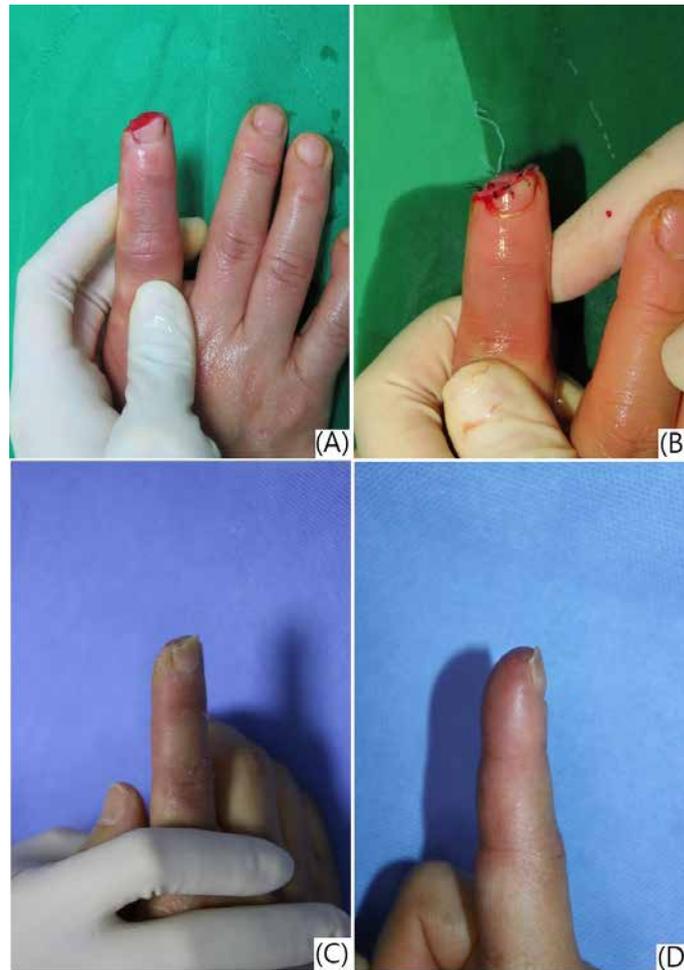


Figure 2. Treatment progression and outcomes following artificial dermis application and semi-occlusive dressing for a fingertip injury. (A) Preoperative view of the right index fingertip injury with distal phalanx and soft tissue defect. (B) Immediate postoperative view after debridement and application of artificial dermis. (C) Five weeks post-treatment, showing the regeneration of pulp tissue and early restoration of the fingerprint pattern under the semi-occlusive dressing. (D) Seven weeks post-treatment, demonstrating complete wound healing with well-formed fingerprint ridges, restored sensation, minimal pain, and satisfactory cosmetic appearance.

Table 2. Complications and their management

Complication	No. of patients (%)	Management
Hook nail deformity	6 (19.35%)	Observation and patient education
Scar contracture	1 (3.22%)	Steroid injection and Silicone gel ointment
Onychomycosis	1 (3.22%)	Antifungal medication
Nail splitting	1 (3.22%)	Observation and patient education



Figure 3. Reconstruction of a thumb tip defect using artificial dermis application and semi-occlusive dressing, resulting in nail splitting. (A, B) Preoperative pictures showing a soft tissue defect of the right thumb side wall with tendon and bone exposure. (C) Appearance after artificial dermis grafting. (D) Follow-up photograph 7 weeks after the treatment, demonstrating good healing of the defect site but with observable nail splitting.



Figure 4. Clinical progression of fingertip regeneration following treatment with artificial dermis and semi-occlusive dressing, demonstrating variability in outcomes. (A) Preoperative view of severe injuries to the left ring and little fingers with complete soft tissue loss and exposed distal phalanges. (B) Four weeks post-treatment, showing significant granulation tissue formation and coverage of the exposed bone. (C) Seven weeks post-treatment, demonstrating slower progression of wound healing, with no exposed bone and partial restoration of the fingerprint ridges. However, trophic changes in the nail bed are evident due to the shortened distal phalanges. (D) Ten weeks post-treatment, revealing complete wound healing with residual scarring on the ring finger and near-complete regeneration of the fingerprint on the little finger. Hook nail deformities are present in both fingers as a consequence of the shortened distal phalanges, which could not be lengthened by the treatment protocol.

# Impact of Conventional Anesthesia and WALANT techniques on Postoperative Pain in Open Carpal Tunnel Release and Single A1 Pulley Release

Orthop Surg. SNU Seoul Hosp.

Sang Ho Kwak

In hand surgery, conventional local anesthesia with a tourniquet and WALANT (Wide Awake Local Anesthesia with No Tourniquet) are widely used techniques. The WALANT technique offers several advantages over the conventional method, particularly regarding postoperative pain management. In this study, we compared postoperative pain and the amount of pain medication required between these two techniques in patients undergoing either open carpal tunnel release or single-digit A1 pulley release.

## Methods

Between 2016 and 2019, a total of 184 patients treated with the conventional technique (n=129 for unilateral open carpal tunnel release; n=55 for single-digit A1 pulley release) and 172 patients treated with the WALANT technique (n=94 for unilateral open carpal tunnel release; n=78 for single-digit A1 pulley release) were included in the study. We compared surgical time, pain-free time post-operation, sleep disturbance, additional pain medication, visits to other hospitals for pain relief, peak pain duration, and pain levels at the first follow-up and two weeks post-operation between the two techniques.

## Results

In patients undergoing unilateral open carpal tunnel release, the conventional technique was associated with longer surgical times, shorter pain-free periods post-operation, more sleep disturbances, prolonged peak pain duration, greater use of additional pain medication, and higher pain levels at the first follow-up, compared to the WALANT technique. However, pain levels two weeks post-operation did not significantly differ between the two techniques. For patients treated with single-digit A1 pulley release, the conventional technique resulted

in shorter surgical times, shorter pain-free periods, and longer peak pain duration compared to WALANT technique.

## Discussion

The WALANT technique demonstrated several advantages over the conventional technique in terms of postoperative pain for unilateral open carpal tunnel release. However, for single-digit A1 pulley release, the advantages of WALANT were limited to pain-free time and peak pain duration. Our findings suggest that the impact of these two techniques on postoperative pain may vary depending on the type of surgery.

# Clinical Conditions Associated with Abnormal Morphology of Subsesamoid Joint of Thumb MP Joint

Department of Hand Surgery, Yeson Hospital, Bucheon, Korea

Goo Hyun Baek, Jin Ho Kim, Chung Hoon Lee, Jae Hoon Lee, Hongkyun Kim, Jin Sung Park, Jung Suk Lee, Joonha Lee and Kyoung-Tae Min

## INTRODUCTION

The sesamoid bones of thumb are the last bones of hands to ossify. Sesamoid bones of metacarpophalangeal joint of thumb, begin to ossify at the age of 8 years in girls and 9 years in boys. The ossification is completed at the age of 13-14 years in girls and 15 years in boys.<sup>1</sup> These bones are articulating with 1<sup>st</sup> metacarpal head as synovial joints. Radial condyle of 1<sup>st</sup> metacarpal head which is articulating with radial sesamoid is convex and narrower, while ulnar condyle broader and flattened. Although it is more logical to name these joints as radial or ulnar sesamoido-1<sup>st</sup> metacarpal joint of thumb, it is called radial or ulnar subsesamoid joint.<sup>2</sup>

As sesamoid disorders of the thumb, trauma (fractures or dislocations), degenerative arthritis (posttraumatic or idiopathic), tumors (GCT, ABC, chondroma) and avascular necrosis have been reported in the literatures.

Eight patients with subsesamoid problems of the thumb are reported.

## MATERIALS AND METHODS

Since October 2020, 8 patients with arthritis or trauma of subsesamoid joint of the thumb were treated at the department of hand surgery of Yeson Hospital. There were 3 males and 5 females whose age was average 35 (range, 29-55) years. Prominent radial tuberosity of 1<sup>st</sup> metacarpal were confirmed by CT, MRI and/or simple radiographs. Radiographic studies of both thumbs were done in 6 patients, and showed prominent radial tuberosity of 1<sup>st</sup> metacarpal of both thumbs. Two patients only had radiographic study of affected thumb, and bilateral involvement was not confirmed. All the patients complained painful LOM, and 4 of them were treated by excision of fused radial sesamoid bone. In one patient, ulnar subsesamoid joint were painful who showed hypoplastic ulnar sesamoid and its arthritic change. Radial sesamoid showed no symptom, and ulnar sesamoid was excised. One patient who had hyperextension injury of the thumb MP joint, showed dislocation of ulnar

sesamoid and subsequent locking, and open reduction was performed. Two patients had conservative treatment only.

## RESULTS AND SUMMARY

Clinical features of the prominent radial tuberosity of 1<sup>st</sup> metacarpal of the thumb, are reported. Although we could not find any reference on this entity, it may not be rare than we think.

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# Comparative outcomes analysis of Pyrocarbon arthroplasty and Arthrodesis for advanced arthritis of the proximal interphalangeal joints

Orthop Surg. Yonsei Univ.

Won-Taek Oh, Hyun-Kyo Kim, Do-Hyun Kim, Jae-Yong Cho, Il-Hyun Koh, Yun-Rak Choi

## Introduction

Both arthroplasty and arthrodesis could be surgical options for intractable advanced arthritis of the proximal interphalangeal (PIP) joints of the hand. Arthroplasty could offer PIP joint movement and better functional and cosmetic outcomes can be expected than arthrodesis. However, operation-related complications and reoperation after arthroplasty make surgeons reluctant to undergo this procedure. Here, we compared clinical outcomes and complications between Pyrocarbon arthroplasty and arthrodesis for advanced arthritis of the PIP joints.

## Methods

We retrospectively reviewed patients with advanced PIP arthritis who had either pyrocarbon arthroplasty(Group A) or arthrodesis(Group F) and followed up at least two years after the operation. For clinical outcomes, VAS pain, VAS cosmetic appearance, PIP flexion, PIP flexion contracture, grip strength, and DASH score were assessed. On posteroanterior and lateral views of simple radiographs in every outpatient visit, subsidence of the proximal and distal implant(mm) and migration of the implants(grade 0 to 3) were also evaluated. We also reviewed postoperative complications and reoperation rates.

## Results

Twenty-two patients were enrolled (Group A: 13, Group F:9), and the mean follow-up period was 59.2 years. VAS pain, PIP flexion, flexion contracture, grip strength, and DASH score showed no statistical difference between the two groups. VAS cosmetic score was higher in Group A ( $73.5 \pm 8.8$ ) than in Group F ( $62.2 \pm 10$ ) ( $p=0.011$ ). There were three cases of implant migration grade 2 and three cases of grade 1 in group A, although there was

no revision case. All cases achieved union in Group F. Each group had four complications, and reoperation rates were 23.1% in Group A and 33.3% in Group F ( $p=0.655$ ).

### Conclusion

Pyrocarbon joint replacement arthroplasty for advanced arthritis of the PIP joints showed better cosmetic satisfaction compared to arthrodesis, although other clinical outcomes and reoperation rates were similar between the two operations.

# Clinical outcome of modified Wassel–Flatt type IV radial polydactyly: Analysis of subtype and morphology

Ulsan Univ.

Wonsun Lee

## Purpose

This study assessed the differences in clinical outcomes among the subtypes of type IV radial polydactyly and evaluated the distribution of the duplication range according to subtype.

## Methods

This retrospective study included 85 patients with 89 affected thumbs, who were treated at a single center from October 2017 to May 2023. The patients were classified according to the modified Wassel–Flatt classification, and only those with type IV radial polydactyly were included. The collected data included demographics, surgical techniques, clinical outcomes, and radiological outcomes. Clinical outcomes were analyzed using the Japanese Society for Surgery of the Hand scoring system.

## Results

The most common subtype of radial polydactyly was IV-B, accounting for 50 patients. Types IV-C and IV-D accounted for 17 and 22 patients, respectively. The median age at the time of surgery was 10 months, and the median follow-up was 24 months. Type IV-D demonstrated significantly lower total JSSH scores and functional parameter scores than types IV-B and IV-C. Regarding functional parameters, type IV-D exhibited significantly poorer outcomes in terms of interphalangeal joint stability and alignment, as well as range of motion; however, metacarpophalangeal joint stability and alignment did not differ significantly among the types. Moreover, type IV-D exhibited lower JSSH scores for subjective and appearance parameters than type IV-B. Type IV-D also exhibited significant differences in the distribution of the duplication range compared with type IV-B and IV-C. It had a more distal duplication level.

## Conclusions

Type IV-D radial polydactyly requires more complex surgical interventions and has less favorable outcomes than types IV-B and IV-C. It exhibits poorer functional outcomes, particularly in the interphalangeal joint and range of motion assessments. Furthermore, type IV-D exhibits differences in the duplication range compared with other subtypes, and has a more distal duplication level.

# Characteristics and association of trigger thumb with congenital malformation and developmental milestones in children: Nationwide analyses of a birth cohort

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<sup>5</sup>Multi-omics Research Center, CHA Future Medicine Research Institute, CHA Univ.

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Despite extensive research on pediatric trigger thumb, nationwide data on patient characteristics, coexisting birth defects, and development remain limited. This cohort study, using Korean National Health Insurance data, analyzed 1.9 million births (2009-2012) followed to age 6. We identified 10,167 trigger thumb cases and matched them 1:10 by sex and birth year with controls. Baseline features, congenital malformations (ICD-10, Q00-Q89), and development at ages 4-6 (Korean Developmental Screening Test) were compared. Logistic regression assessed comorbidity risk, expressed as odds ratio (OR), while generalized estimating equations evaluated the association between trigger thumb and developmental outcomes. The trigger thumb group (average diagnosis age: 31.3 months, 46.6% male) had 32.6% of surgery rate at an average age of 43 months. Trigger thumb group had significantly higher rates of musculoskeletal (OR 5.80, 95% CI 5.38-6.26), lens (OR 2.76, 95% CI 1.19-6.42), and circulatory system malformations (OR 1.27, 95% CI 1.09-1.49) compared to controls. However, assessment using the Korean Developmental Screening Test revealed no significant delays in development, including gross and fine motor skills. Pediatric trigger thumb is linked to increased congenital malformations but doesn't seem to hinder development. Screening for coexisting conditions and reassuring parents about development are crucial.

**Keywords:** trigger thumb, big data, co-morbidity, congenital, development, pediatric

# Development of a Machine Learning-based Differential Diagnosis Tool for Chronic arthritis of the hands

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## Background

Discerning the causes that trigger arthritis is directly linked to appropriate therapeutic approaches. Identifying these causes through clinical symptoms or laboratory tests can be challenging. Recently, Artificial intelligence (AI) adopted in various medical fields showed significant diagnostic accuracy. The aim of this study is to develop an artificial intelligence program trained on conventional radiograph, a first-line imaging technique for arthritis, for early diagnosis of arthritis.

## Methods

A total of 807 hand radiographs from 109 hand arthritis patients who were referred for taking conventional radiography at Kyungpook National University Hospital from January 2000 to July 2023 were used for training in this retrospective study. Machine Learning used 802 conventional radiographs from 109 patients, each diagnosed with only one of Rheumatoid arthritis (RA), Gouty arthritis (GA), Septic arthritis (SA), Tuberculous arthritis (TA), or Non-tuberculous mycobacterial arthritis (NA). Multiple layers using preprocessed data derived specific features for each arthritis to create a model predicting probabilities of the diseases. Diagnostic accuracy of Five-class model (RA/ GA / SA / TA / NA) and two binary discrimination models (RA, GA/ SA, TA, NA and SA/ RA, GA, TA, NA) were evaluated.

## Results

In Five-class model, which distinguishes each type of arthritis, an accuracy of 64.2% was observed. In First binary discrimination model based on infectious status, an accuracy of 70.4% was obtained. In case of Second binary discrimination model, distinguishing between SA and others yielded an accuracy of 86.4%.

## Conclusion

The machine learning model exhibited notable proficiency in distinguishing hand arthritis, particularly in distinguishing between SA and others, implying its potential usefulness in offering advice to clinicians about therapeutic interventions and additional tests that may be required.

**Keywords:** Conventional radiography; Machine-Learning; Convolutional neural network; Rheumatoid arthritis; Gouty arthritis; Tuberculous arthritis; Non-tuberculous mycobacterial arthritis; Septic arthritis

**Room A**

# **Free Paper 5**

## **Microsurgery**

Orthop Surg. Seoul National Univ. **Young Ho Lee**  
Orthop Surg. Pusan National Univ. **Sang Hyun Lee**

# Reverse homodigital dorsolateral flap for coverage of finger defects

Chuncheon Sacred Heart Hospital

Soo Joong Choi

## Background

Reverse homodigital island flap based on dorsal branches of the proper digital artery is one of the most popular procedure to reconstruct distal finger defects.

We report our experiences of the flap to cover the finger defects.

## Materials and methods

From Jan 2010 to Dec 2022, we performed 13 reverse homodigital island flap (11 males and 2 females) for finger reconstruction. The mean age was 56.8 years old (25~84).

Etiologies were 5 crushing injury, 3 squamous cell carcinoma, 2 amputation, one open laceration, one snake bite and one sepsis due to vasopressor.

Flap survival and active range of motion and complications were evaluated.

## Results

All flaps were survived. 2 flaps showed congestion but without tissue loss.

Donor defects were covered by FTSG (11 cases) and 2 primary closure.

Associated procedures were 2 K-wire fixation and one bone graft.

Active ROM was 54.3 degree for DIPJ and 95 degree for PIPJ.

## Conclusion

Reverse homodigital dorsolateral island flap is good and reliable method for finger small defect coverage.

# Clinical Effectiveness of Vascularized Fibular Free Graft for Forearm Bone Defect

## W Institute for Hand and Reco

W Institute for Hand and Reconstructive Microsurgery, W Hosp.

In-Ho Ga, Ho-Jun Cheon, Dong-Ho Kang, Soo-Jin Woo, Sang-Hyun Woo

### Introduction

Fracture healing is a complex process influenced by various factors such as the type of injury, the patient's overall condition, and the surgical methods used. It is reported that about 5-10% of all fractures result in nonunion. Treatments for nonunion include nail dynamization, exchange nailing, bone grafts, bone morphogenetic proteins, cell therapy, bone transfer, and augmentation plating. Among these, bone grafts can be broadly categorized into vascularized and non-vascularized types.

For open fractures with small bone defects, non-vascularized bone grafts (NVBG) are generally used. However, about 20% of these cases do not achieve bone union and require additional surgery. While NVBG is typically used for defects less than 4 cm, successful outcomes have been reported for larger defects as well. Nonetheless, when the bone defect is large due to primary wounds, chronic osteomyelitis, or bone tumors requiring bone resection, and the defect size exceeds 4-5 cm, NVBG may lead to partial resorption of the graft. This weakens the graft site, increasing the risk of future fractures.

For large bone defects, treatments such as vascularized bone grafts, Ilizarov lengthening, and the Masquelet technique are used. Ilizarov lengthening has the drawback of requiring the maintenance of a large Ilizarov apparatus for an extended period. The Masquelet technique involves inserting a methylmethacrylate cement spacer into the defect site for 2 months to allow pseudomembrane formation, followed by a second surgery to perform an autologous cancellous bone graft. In contrast, vascularized bone grafts offer several advantages: they can be combined with internal fixation using a locking plate, typically achieve union with a single surgery, and provide simultaneous coverage for soft tissue defects around the bone defect.

In this presentation, I will discuss the results of cases where vascularized bone grafts were performed for upper extremity bone defects at our institution.

## Method

From January 2010 to August 2024, we investigated patients who underwent vascularized bone grafting for upper extremity bone defects or chronic osteomyelitis at our institution. We collected data on patient demographics, including age, sex, and medical history, as well as details on the donor site, injury type, recipient site, graft size, fixation method, presence of union, and the time to complete union.

## Result

Since 2011, a total of 13 cases of vascularized bone grafts have been performed. The average age of the patients was 50.5 years, with ages ranging from 32 to 67 years. All cases involved the use of vascularized fibular free grafts for defects in the forearm. There were 7 cases of reconstruction for radius bone defects and 5 cases for ulnar bone defects. In one case, both the radius and ulna were reconstructed simultaneously. In terms of primary injury mechanisms, 8 cases involved open fractures associated with crushing injuries, 3 cases were due to incomplete amputation, and 1 case was a bone defect that occurred after a burn. Among the 13 cases, 8 cases developed osteomyelitis (OM) after the primary injury. In these instances, bone debridement and the insertion of antibiotic-impregnated bone cement were performed before the vascularized fibular free graft was applied.

Excluding one case performed relatively recently (in June 2024), for which the union status cannot yet be assessed, the outcomes of the 12 cases were analyzed. On average, free vascularized fibular graft reconstruction was performed 25 months after the initial injury. Among these, 2 cases underwent free vascularized fibular bone grafting within one month (10 days and 20 days post-injury). The average defect size before surgery was 76.75 mm, with a minimum of 52 mm and a maximum of 172 mm. Complete union was achieved in 10 out of 12 patients, taking an average of 13.6 months.

## Discussion

This study investigated the union rate in patients with large bone defects, for whom NVBG was not feasible, by performing vascularized fibular free grafts. In most patients (10 out of 12), union was achieved; however, 2 cases did not result in union. One of these cases involved an incomplete amputation with a 6 cm bone defect. VFFG was performed 20 days post-injury, along with skin coverage. However, infection was observed, leading to the early removal of the plate, which resulted in non-union at the proximal site. The other case involved a patient who developed OM following an open fracture, leading to resection and VFFG. It is believed that inadequate resection and fixation in the distal area, along with improper periosteal circulation due to circumflex wiring, were contributing factors to the non-union. The union rate achieved through VFFG is 83.3%, demonstrating good results for bone union. However, it is crucial to adhere to fundamental principles for successful bone union, regardless of VFFG. For instance, effective infection control must be maintained, bone biology should be preserved as much as possible during surgery, and a fixation method that ensures stable support should be chosen.

Four cases involved patients who had undergone multiple ORIF and NVBG surgeries at other hospitals for osteomyelitis and large defects but presented with non-union at our facility for further treatment. In one of these cases, an external fixator was initially used to attempt lengthening; however, a refracture occurred at the relatively weak lengthening site. Subsequently, VFFG was performed, and the patient was able to use the limb satisfactorily afterward. This highlights that in cases of NVBG or lengthening with large defects, the relative weakness at those sites can lead to refractures. VFFG can serve as an appropriate alternative in such situations. This study has several limitations. First, all cases were performed on the forearm, and there were no cases involving the lower extremity or upper arm at our institution, making it difficult to predict outcomes for VFFG in other anatomical locations. Second, the surgeries were performed by a total of four different surgeons. Since fracture management may vary among surgeons, there is a possibility of inconsistent results regarding union rates and times following VFFG.

### **Conclusion**

VFFG is a valuable method for achieving union in cases of large bone defects in the forearm. However, if the fundamental principles of bone procedures are consistently adhered to, it is believed that union can be achieved in nearly all situations.

# Analysis of Surgical Outcomes in Peripheral Nerve Torsion

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## Background

The majority of peripheral nerve torsion needs surgical treatment. However, It is still unknown which surgical techniques are appropriate for certain nerve conditions and how are the surgical outcome of specific surgical techniques. We aimed to analyze the clinical outcomes of peripheral nerve torsion in patients with neuralgic amyotrophy according to the degree of nerve torsion and surgical method, and to verify the appropriate time for surgery and type of surgical approach.

## Materials and Methods

We retrospectively reviewed the history, neurological symptoms, physical examinations, findings of ultrasonographic images and electrodiagnostic studies, and the surgical appearances including the degree of the torsion in 9 patients with peripheral nerve torsion. Also, surgical outcomes after 2 years were evaluated.

## Results

Five patients had radial or posterior interosseous nerve torsions, while others had median or anterior interosseous nerve torsions. All the torsions were located at the level above the elbow. Initial severe muscle weakness was found in the nerve torsion over 180 degrees. Favorable recovery from severe muscle weakness was correlated with short duration from the symptom onset to the surgery.

## Conclusion

In case of severe weakness due to the suspected peripheral nerve torsion, we suggest early surgical exploration to select appropriate surgery (neurolysis or neurorrhaphy) according to the nerve torsion degree.

**Keywords:** neuralgic amyotrophy, nerve torsion, surgery, ultrasonography, neurorrhaphy

# Customized Full-Length Toe-to-hand Transfer with a Simultaneous Reconstruction of the Donor foot

GoodGeon Hospital for Hand and Reconstructive Microsurgery

Myung-Jae Yoo

## Purpose

To report the indications, advantages and disadvantages of customized full-length toe-to-hand transfer with simultaneous reconstruction of the donor foot.

## Methods

From May 2020 to May 2024, there were 29 cases for customized full-length toe-to-hand transfer with simultaneous reconstruction of the donor foot (by bone graft and peroneal artery perforator flap). We retrospectively reviewed the success rates, hand function test, the Disabilities of the Arm, Shoulder and Hand (DASH) score and Subjective Satisfaction Scores for Patients' Self-Assessment. We compared the clinical result of between the conventional toe-to-hand transfer and customized full-length toe-to-hand transfer with simultaneous reconstruction of the donor foot.

## Results

The success rates for conventional toe-to-hand transfer and customized toe-to-hand transfer with simultaneous reconstruction of the donor foot are not significantly different at over 97 percent each. There is no statistical difference in the clinical score. But in patient's subjective satisfaction, customized toe-to-hand transfer with simultaneous reconstruction of the donor foot is significantly different.

## Conclusion

Customized full-length toe-to-hand transfer with simultaneous reconstruction of the donor foot is the method of simultaneous reconstruction for digital loss (recipient of hand and donor of foot). Aesthetically and functionally, it is a reconstructive method with high patient satisfaction.

**Keywords:** Toe to hand transfer, Digital loss

# Results of reconstruction of suprascapular nerve, axillary nerve, and musculocutaneous nerve using simultaneous transfer of spinal accessory nerve and median/ulnar nerve in upper arm type brachial plexus injury

Seoul National Univ.

Ji Sup Hwang

## Background

In patients with upper-arm type brachial plexus injury (BPI), shoulder and elbow functions are impaired. This study shows the result after simultaneously performed double Oberlin procedure and spinal accessory nerve (SAN) transfer in patients with upper-arm type BPI.

## Methods

Eight patients (seven male and one female) with the average age of 42 years were treated using simultaneous double Oberlin procedure and SAN transfer. The average interval between the BPI and the surgery was 4.4 months. The results of motor recovery were recorded using the modified British Medical Research Council grading system. The average duration of follow-up was 2.5 years.

## Results

At the last follow-up, average shoulder abduction was 75 degrees and forward flexion 50 degrees. Elbow flexion graded M5 in five patients and M4 in three patients.

## Conclusions

Simultaneous double Oberlin procedure and SAN transfer showed favorable outcome in recovery of shoulder and elbow function. It could be a good surgical option for upper-arm type BPI, and should be considered before performing free muscle tendon transfer.

# Reconstruction of suprascapular nerve, axillary nerve, musculocutaneous nerve, median nerve motor and sensory branch using simultaneous transfer of spinal accessory nerve and intercostal nerve in preganglionic whole-arm type brachial plexus injury

Seoul National Univ.

Ji Sup Hwang

## Introduction

Traumatic brachial plexus injury (BPI) is rare, but challenging. Motor and sensory deficits manifested in the preganglionic whole-arm type are devastating to the patients. Transfer of spinal accessory nerve (SAN) and intercostal nerve (ICN) has each shown favorable outcomes. At our institute, we used both nerves for restoration of shoulder, elbow and hand function in patients with preganglionic whole-arm type BPI. This is a report of ten patients.

## Methods

Ten patients with the average age of 30 years were treated using simultaneous transfer of SAN and ICN. The average interval between the BPI and the surgery was 4.4 months. The SAN was divided and one branch was transferred to suprascapular nerve. The other branch was transferred to axillary nerve with sural nerve as intervening nerve graft. Three motor rami of the ICN were transferred to musculocutaneous nerve, three to four motor rami to median nerve motor branch, and five to six sensory rami to median nerve sensory branch. Superficial radial nerve was used as intervening nerve graft for transfer to the median nerve. The results of motor and sensory recovery were recorded using the modified British Medical Research Council grading system and the modified Highet's scale, respectively. The average duration of follow-up was 3.9 years.

## Result

Sensibility in the median nerve distribution of the hand was restored in all patients, and the results were classified as S3 in seven patients and S2+ in three. The average shoulder abduction was 50degrees, and elbow flexion graded M4. Finger flexion of M3 was found in five patients, and M2 in five patients.

## Conclusion

Simultaneous transfer of SAN and ICN showed favorable outcome in recovery of both motor and sensory function. It could be a good surgical option for patients with preganglionic whole-arm type BPI, and should be considered before performing free muscle tendon transfer.

# The iRASP Flap; Sensory and Functional Outcomes, 10 years of Experience

Gangnam Jaejun Plastic Clinic

Jae-Won Yang

## Background/Objectives

The iRASP Flap was originally introduced in 2010 as a sensory flap incorporating the palmar cutaneous branch of the median nerve (PCMN). This flap was indicated to cover a palmar defect of the finger. Its sensory and functional results have been evaluated.

## Methods

A total of 45 patients underwent iRASP surgery since 2014. Patient medical records were reviewed. Semmes-Weinstein Monofilament Test (SWMT), static and moving two-point discrimination tests (S2PD and M2PD) were examined to evaluate sensory outcomes. Grip Strength (GS) and Jebsen-Taylor Hand Function Test (J-T HFT) data were collected for functional assessment. Trends in sensory and functional recovery were examined. It was analyzed whether age, PCMN type, neurorrhaphy methods, and flap revision procedures affected sensory recovery. Patients' subjective sensory recovery scores (SSRS) were expressed as percentages by telephone survey during a long-term follow-up period ranging from one year to 10 years.

## Results

We selected 20 patients with all measurements of the SWMT, S2PD, and M2PD in the early (within 3 months), intermediate (3-6 months), and late (6-12 months) postoperative periods and 23 patients with GS and J-T HFT results. Sensory and functional test results tended to improve over time. There was no significant difference in sensory recovery according to PCMN types, neurorrhaphy methods, and flap revision or not. There was no significant difference in functional recovery by finger region and in the SSRS over time.

### Conclusion

The iRASP flap demonstrates continuous recovery of sensation and function up to one year after surgery. With excellent sensory and functional results of up to 70-80%, this flap is considered an excellent method to cover palmar soft tissue defects in the digit.

**Room A**

# Invited Speaker 1

Orthop Surg. CHA Univ. **Soo-Hong Han**  
Orthop Surg. Chung-Ang Univ. **Jae Sung Lee**

# Application of adipose derived stem cells for peripheral nerve defects

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Kaoru Tada<sup>1,2</sup>, Mika Akahane<sup>1</sup>, Akari Mori<sup>1</sup>, Kensyo Suzuki<sup>1</sup>, Satoru Demura<sup>1</sup>

Autologous nerve graft is the gold standard for treating peripheral nerve defects. However, its clinical outcomes, particularly in the lower limbs, remain suboptimal. This presentation addresses the challenges associated with autologous nerve grafting and explores the potential of adipose-derived stem cells (ADSCs) to improve nerve regeneration.

Autologous nerve grafts serve as the primary treatment for nerve defects, bridging gaps and facilitating nerve regeneration by mimicking the conditions of nerve injuries. Despite being the most reliable option, autologous nerve graft presents challenges such as limited blood supply and the need for multiple nerve sutures. While autologous nerve graft can lead to meaningful recovery, particularly in the upper limbs, its effectiveness in the lower limbs is often less successful.

To improve outcomes, we explored the application of ADSCs, which have self-renewal and differentiation capabilities, and secrete growth factors that promote nerve regeneration. Initial studies using ADSCs in combination with artificial nerve grafts and allogeneic processed nerve grafts showed some positive results, but did not outperform autologous nerve graft.

Building on this, we developed an “enhanced” autologous nerve graft by incorporating ADSCs. The use of ADSC cell sheets in a rat model with a sciatic nerve defect significantly improved functional recovery, including muscle weight and nerve conduction. We also explored systemic administration of ADSCs via intravenous injection, which similarly enhanced outcomes compared to autologous nerve graft alone.

In conclusion, autologous nerve graft remains the gold standard, but its outcomes are not yet fully satisfactory. The integration of ADSCs, whether administered locally or systemically, holds promise for improving nerve regeneration and addressing current limitations in peripheral nerve repair.

# Simultaneous Stiles-Bunnell Tendon Transfer Enhances Intrinsic Function of Second-Toe Transplantations

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Shwu-Huei Lien, O.T., B.S.  
Chih-Hung Lin, M.D.  
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Keelung, Taiwan



**Summary:** Claw finger is a sequela of fingers without intrinsic function. Claw toe deformity is common after toe transfer, as simultaneous intrinsic reconstruction has yet to be reported in the literature. The authors present their experience of simultaneous tendon transfer during second-toe transplantation. Seven second-toe transfers were performed in five metacarpal-like and metacarpal hands. The Stiles-Bunnell tendon transfer was incorporated into toe transfers. Toe lumbrical tendons were repaired to the flexor digitorum sublimis of the same recipient digit. The active motion values of the proximal interphalangeal joint were  $61 \pm 9.5$  degrees and  $36 \pm 6.4$  degrees in the middle and ring fingers, respectively. The extension lag overall was  $19.9 \pm 9.9$  degrees. The transferred toe proximal interphalangeal joints had minimal extensor lag with the metacarpophalangeal joint in flexion position. The flexion sweep of the toe was improved by the intrinsic reconstruction. The patients were able to use the transferred toes for sophisticated daily activities. From the results seen, simultaneous intrinsic reconstruction appears to enhance the dexterity and thus function of transferred toes. (*Plast. Reconstr. Surg.* 140: 1229, 2017.)

**CLINICAL QUESTION/LEVEL OF EVIDENCE:** Therapeutic, IV.

From a recent review by Waljee and Chung, function of the transferred toes can easily be restored, but the aesthetic appearance is more difficult to achieve.<sup>1</sup> Claw deformity of the transferred toes affects not only appearance but also dexterity and grip power. To correct the claw appearance of the transferred toes, Wei et al.<sup>2</sup> suggested releasing the extensor digitorum longus attachment from the capsule of the metatarsophalangeal joint, suturing the extensor digitorum brevis to the dorsal expansion or to the interosseous musculotendinous structure whenever possible, and tightly repairing the extensor digitorum longus to the extensor digitorum communis, in order, in extension before the flexors were repaired. Kirschner pin fixation of the proximal and distal interphalangeal joints was recommended for 1 and 4 weeks respectively, and 1 year of night splinting

in extension was recommended. Despite these measures, we found that the claw deformity was often not fully corrected with these techniques.

Not until our recent study<sup>3</sup> investigating the extensor mechanism of the second toes in 2013 did we further categorize toes into two groups according to the varying central slip characteristics. In type 1 toes, which represent more than 87.7 percent of patients, the central slip was attenuated before its insertion into the middle phalangeal base. Extrinsic extensors, including extensor digitorum longus and extensor digitorum brevis, could not extend the proximal interphalangeal joint without the co-contraction of the intrinsic muscles (i.e., the lumbricals and/or interosseous muscles).

**Disclosure:** *The authors have no financial interest to declare in relation to the content of this article.*

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In type 2 toes, which represent less than 12.3 percent, the central slip had an identifiable insertion point into the middle phalanx. Retraction of the extensor digitorum longus and/or extensor digitorum brevis alone could extend the proximal interphalangeal joint well in type 2 toes. We present our experience of simultaneous tendon transfer during second-toe transplantation as a novel combination of techniques to further enhance the function and use of the transplanted second toe.

**MATERIALS AND METHODS**

Since 2013, we have incorporated intrinsic reconstruction with second-toe transplantations simultaneously in the same procedure in seven toes of five metacarpal and metacarpal-like hands.<sup>4</sup> All patients operated on were male patients and were aged 17.5 to 44.7 years (median, 36.9 years). Double second-toe transfers were performed to reconstruct the middle and ring fingers in two patients, and a single second toe was transferred to the middle finger and the ring finger, respectively, in three patients.

**Surgical Indications**

The technique was considered only when the proximal interphalangeal joint of the toe was included for the transfer. The ideal stump length of the recipient finger chosen was between the proximal half of the proximal phalanx and the metacarpal neck. This technique is not absolutely

contraindicated in recipient stumps longer than the distal half of the proximal phalanx. Nonetheless, whole-toe transfers to the long stump result in a change in the vector of pull exerted by the tendon transfer, which might not extend the proximal interphalangeal joint effectively (Fig. 1). Besides, a toe transfer with an over-distally placed proximal interphalangeal joint creates awkward finger flexion and interrupts grasping motions.

**Surgical Technique**

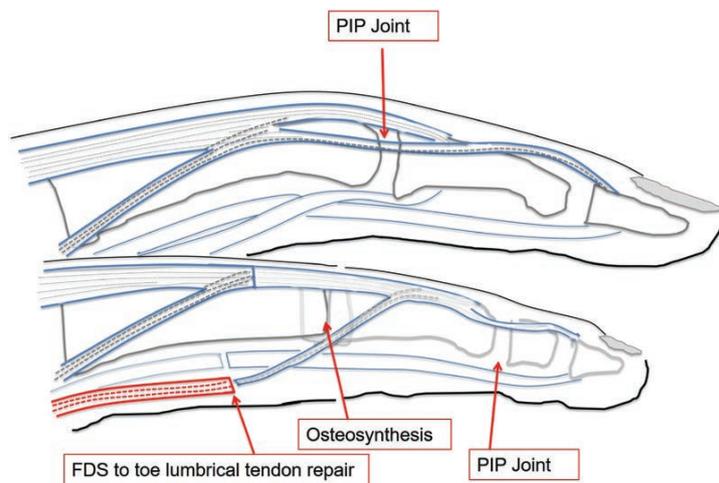
**Recipient-Site Preparation**

Principles of recipient-site preparation are similar to those of a standard toe transfer. To prepare for a simultaneous intrinsic reconstruction during a toe transfer, the donor tendon at the recipient site should be available and expendable. The flexor digitorum sublimis of the same recipient digit was used in our cases.

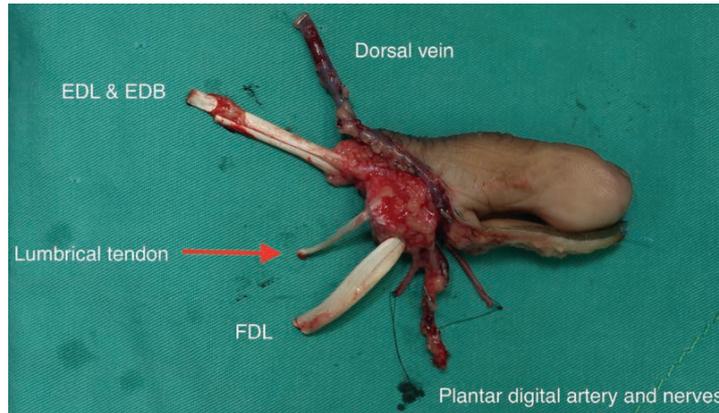
**Donor-Site Preparation**

We followed the same principles of toe dissection described by Wei and el-Gammal.<sup>5</sup> After inclusion of the donor vein from the dorsal foot, donor artery dissection was initiated from the first web, where the communication branch between the dorsal and the plantar metatarsal arteries was identified. Retrograde dissection of the donor artery to the length required was performed.

The lumbrical tendon and muscle was identified on the tibioplantar surface of the second toe (Fig. 2). To examine the extensor mechanism of



**Fig. 1.** Diagram illustrating the inset of a second toe onto an excessively long proximal phalanx bone stump, resulting in the appearance of a “balanced digit” in extension but difficulty performing flexion because of the change in the vector of pull of the lumbrical and overall arc of flexion. *PIP*, proximal interphalangeal; *FDS*, flexor digitorum sublimis.

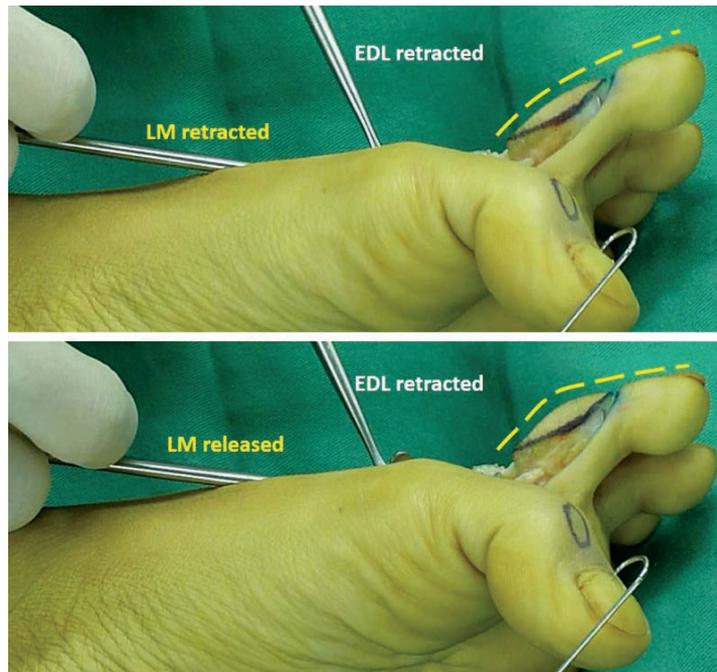


**Fig. 2.** Intraoperative photograph of the harvested lesser toe. Note the lumbrical tendon shown highlighted with an arrow. EDL, extensor digitorum longus; EDB, extensor digitorum brevis; FDL, flexor digitorum longus.

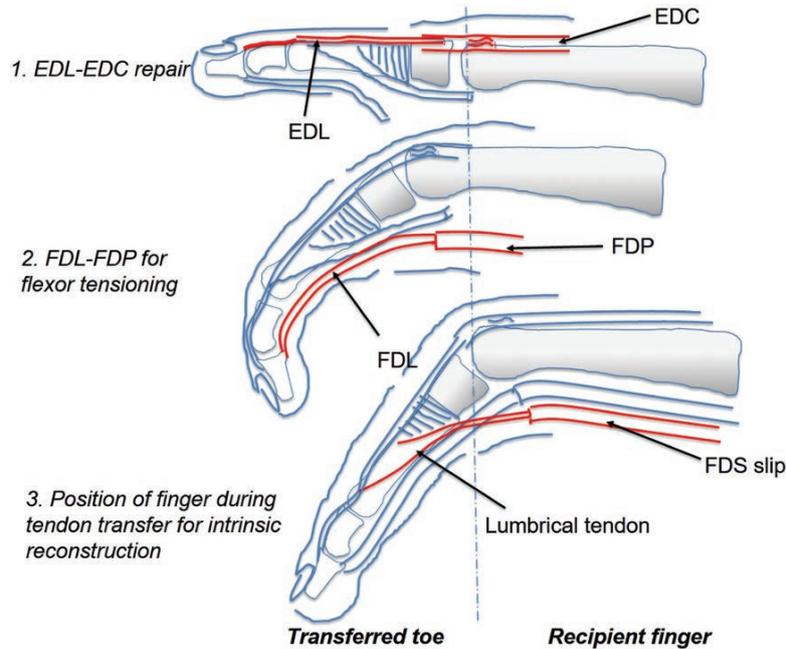
the donor toe, the extension of the proximal interphalangeal joint was observed while retracting the extensor digitorum longus with and without retracting the lumbrical tendon (Fig. 3). Tendon transfer was performed in type 1 toes transplanted.

### Stiles-Bunnell Transfer for Toe Intrinsic Reconstruction

After completing osteosynthesis, the extensor tendon was tightly repaired to extend the transferred toe (Fig. 4). The flexor tendon was then



**Fig. 3.** Serial photographs demonstrating the added straightening of the lesser toe proximal interphalangeal joint with simultaneous extensor digitorum longus and lumbricalis tendon retraction (above), compared with extensor digitorum longus alone (below). Note the difference in proximal interphalangeal joint extension while pulling the extensor digitorum longus (EDL) with (above) and without (below) retraction of the lumbricalis tendon (LM).



**Fig. 4.** Schematic diagram depicting the three major steps in this technique, addressing the extensor, flexor, and lastly the tension of the intrinsic repair following tendon transfer. *EDL*, extensor digitorum longus; *EDC*, extensor digitorum communis; *FDL*, flexor digitorum longus; *FDP*, flexor digitorum profundus; *FDS*, flexor digitorum sublimis.

repaired to create the natural cascade of the flexed digits. Because the lumbrical tendon braids to the lateral band of the toe extensor, the Stiles-Bunnell tendon transfers were repaired to the toe lumbrical tendon but not the lateral bands. The flexor digitorum sublimis was passed along the similar pathway of the lumbrical canal (volarly to the transverse metacarpal ligament) to reach the toe lumbrical tendon. To adjust the tension of the tendon transfer, the toe lumbrical tendon was first pulled to flex the metacarpophalangeal joint to 70 to 80 degrees. The flexor digitorum sublimis was pulled to test the excursion of the muscle. The midpoint of the flexor digitorum sublimis excursion was chosen as the proper tension of the tendon transfer. The lumbrical-to-flexor digitorum sublimis tendon repair was then performed using a Pulvertaft weave.

**Rehabilitation Protocol**

A dorsal forearm-based thermoplastic splint was fabricated to maintain an intrinsic-plus position for protection after surgery. The transferred toe was kept immobilized to minimize adrenergic response and vasoconstriction during the first postoperative week.<sup>6</sup> A controlled passive flexion

and extension range-of-motion rehabilitation protocol was recommended in the first month.<sup>7</sup> Resistance-free active motion and differential tendon-gliding exercises were initiated after 4 weeks. Motor retraining for the reconstructed intrinsic tendon was facilitated through flexor digitorum sublimis gliding exercises in conjunction with place-and-hold techniques. Occupation-related activities were designed for grasp power and pinch power strengthening after 8 weeks. Full use and return to work were permitted after 12 weeks.<sup>8</sup>

**RESULTS**

Seven second-toe transfers with Stiles-Bunnell transfer were performed in five metacarpal and metacarpal-like hands (Table 1). The follow-up was 12.5 to 25.4 months (median, 14.7 months). The overall extensor lag of seven proximal interphalangeal joints was  $19.9 \pm 9.9$  degrees. The active motion values of the proximal interphalangeal joints were  $61 \pm 9.5$  degrees and  $36 \pm 6.4$  degrees in the middle and ring fingers, respectively. The transferred toe proximal interphalangeal joints had minimal extensor lag with the metacarpophalangeal joint in flexion position. [See Video 1, Supplemental Digital Content 1, which shows a double

**Table 1. Results of Toes with Lumbrical-to-Flexor Digitorum Superficialis Transfer for Middle and Ring Finger Reconstruction**

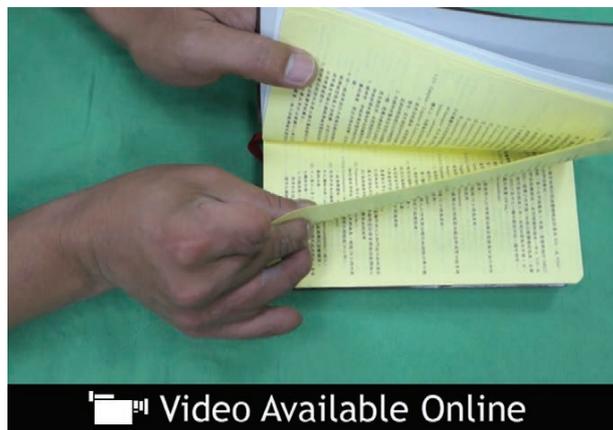
Case	Toe to Middle Finger (deg)			Toe to Ring Finger (deg)			Pinch Power (* /contralateral)
	PIPJ Angle			PIPJ Angle			
	Extension Lag	Range of Motion	TAM	Extension Lag	Range of Motion	TAM (deg)	
1	0	65	155	20	40	130	6.5/11.5
2	25	70	190	20	35	150	7.5/10
3	24	51	88	Native finger with limited AOM			5.5/amputated
4	Replanted finger			10	50	145	4
5	Amputated			25	30	125	4.5

PIPJ, proximal interphalangeal joint; TAM, total active motion; AOM, arc of motion.

\*Pinch power from the middle finger for cases 1, 2, and 3, and from the ring finger for cases 4 and 5, compared with the corresponding contralateral digit.



**Video 1.** Supplemental Digital Content 1 shows a double second-toe transfer (third and fourth digits) with intrinsic reconstruction demonstrating good flexion sweep and superior extension of the proximal interphalangeal joints with individual control of each joint in the reconstructed digit, <http://links.lww.com/PRS/C464>.



**Video 2.** Supplemental Digital Content 2 demonstrates a second-toe transfer with intrinsic reconstruction to the right middle finger position and the ability to accurately turn each leaf of a book, <http://links.lww.com/PRS/C465>.

second-toe transfer (third and fourth digits) with intrinsic reconstruction demonstrating good flexion sweep and superior extension of the proximal interphalangeal joints with individual control of each joint in the reconstructed digit, <http://links.lww.com/PRS/C464>.] The pinch power of the transferred toes was greater than 5.5 kg in middle fingers and greater than 4 kg in ring fingers. The patients were able to use the transferred toes for sophisticated daily activities, such as turning book pages. (See Video, Supplemental Digital Content 2, which demonstrates a second-toe transfer with intrinsic reconstruction to the right middle finger position and the ability to accurately turn each leaf of a book, <http://links.lww.com/PRS/C465>.)

## DISCUSSION

Although toe transfers have been recognized to improve hand functionality, claw deformity after second-toe transfer is still challenging for a microsurgeon. Foucher and Moss<sup>9</sup> reported 33 degrees of average motion and 34.5 degrees of extension lag in their series,<sup>9</sup> and Kotkansalo et al.<sup>10</sup> observed 28 degrees of motion and 58 degrees of extension lag of transferred toes in long-term outcomes. Even compared to our historical series,<sup>11</sup> the range of motion and the extension lag were improved in recent cases.

The intrinsic muscles not only contribute to normal digital sweep during flexion but also bridle meticulous finger motion. In addition, paralysis of the intrinsic musculature greatly reduces grip strength in the affected hand.<sup>12</sup> In complex claw hand reconstruction, the patients require a transfer that not only improves metacarpophalangeal joint posture but also augments extension. Stiles-Bunnell transfer attaches the donor tendons to the lateral bands and thus enhances the extension of the interphalangeal joints.

## CONCLUSIONS

In the cases we have performed, we noticed that the arc of motion for toes transferred to the ring finger position was smaller than for toes transferred to the middle finger position. One possible reason is that when reconstructing the natural

flexion cascade of the hand, the flexor digitorum profundus-to-flexor digitorum longus repair of the ring finger was tighter than that of the middle finger. Nonetheless, the Stiles-Bunnell tendon transfer not only improved the inherent clawing and extensor lag of the toe proximal interphalangeal joint, but also enhanced the functional outcome of the transferred toes.

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**Room A**

**Luncheon Symposium**  
Daewon Pharm

Seoul National Univ.

Kee Jeong Bae

**Room A**

## **Invited Speaker 2**

Orthop Surg. Kosin Univ. **Young Ho Kwon**

Plast Reconstr Surg. Gwangmyeong Sungae General Hosp. **Jin Soo Kim**

# The Sensation of Touch and The Real Function of the Hand

St. Vincent's Hospital (Australia)

**Anthony Berger**  
[APFSSH Visiting professor]

As hand surgeons we are constantly measuring various aspects of hand function, range of motion, strength, sensation etc. These measurements give us an estimate of impairment. We now measure patient disability through the use of various Patient Reported Outcome Measures (PROM). We do this to review the results of our treatments, to compare one method of treatment with another and to assess a level of functional loss in order to apportion a level of financial compensation following work and traffic injuries etc.

When looking at sensation loss or impairment we are limited to the very crude measurement of 2 point discrimination and at time Semmes Weinstein testing. Whilst this gives a measurable assessment perhaps of sensory loss it gives only a crude assessment of the experience of touch.

Touch is an intrinsically emotional experience. Whilst we may hold an object in our hands and experience the sensation of contact, temperature and pressure this is a totally different experience to holding the hands of a loved one. Whilst the physical and "measurable" sensation with these two actions may be the same, the emotional experience is vastly different. I believe that, whilst hand injuries may result in a measurable loss of sensation and a disability crudely assessed by various PROM's, the loss of the sensation of touch and it's emotional impact is for many patients a far greater loss than is currently assessed.

My presentation aims to raise the awareness of the experience of touch which goes much further than simple sensation.

# Mobilization of the radio-ulnar synostosis -recent advances -

Chairman Tominaga-Kusano Hospital Professor Emeritus, University of the Ryukyus

Fuminori Kanaya

## Background

Congenital proximal radio-ulnar synostosis is a rare congenital anomaly characterized by a fixed forearm rotation. It has the high tendency toward re-ankylosis after separation. In 1993, we devised a mobilization procedure consisted of a free vascularized fascio-fat graft (FVFG) to prevent re-ankylosis and a radius osteotomy to reduce the dislocated radius head (Kanaya's procedure). After confirming prevention of re-ankylosis with a FVFG, we started to use pedicle vascularized fascio-fat graft (PVFG) to simplify the procedure. The purpose of this study was to report the surgical outcomes of both procedures.

## Patients and Methods

We performed mobilization procedures for 104 forearms in 91 patients followed-up more than 2 years after surgery. The mobilization procedure composed of four steps: (1) Separation of the synostosis (the biceps tendon insertion was inevitably detached during separation), (2) radius osteotomy to reduce the dislocated radius head, (3) soft tissue reconstruction with anconeus interposition and reattachment of the detached biceps tendon to the dorsal cortex of the radius, and (4) vascularized fascio-fat graft interposed between the separated radius and ulna. All cases achieved >90 degrees of ROM during surgery. There were 26 forearms of 25 patients treated with FVFG and 78 forearms of 66 patients treated with PVFG.

The mean age at the surgery was 8.1 years (range, 5.1 to 13 years) in FVFG and 7.1 years (range, 4.0 to 14 years) in PVFG. Mean preoperative forearm ankylosis was 50.0 degrees of pronation (range neutral to 110 degrees pronation).

## Results

All patients reported improvements in performing some activities, such as catching a ball, accepting objects such as coins, holding a bowl of soup and performing gymnastics. Four re-ankyloses were observed only in PVFG group among 78 mobilizations. The mean range of active forearm rotation after mobilization was 86.5 degrees in FVFG, 71.1 degrees in PVFG excluding 4 re-ankyloses. PVFG group showed slightly less ROM than FVFG group but not significantly different.

The average surgery time of PVFG group was 3.9 hours that was significantly shorter than 9.8 hours of FVFG group.

## Discussion and conclusions

The mobilization procedure using vascularized fascio-fat graft prevented re-ankylosis after separation of the synostosis and provided some forearm rotation that improved a child's daily activities. Mobilization with a pedicle fascio-fat graft shortened the surgery time, however, post-op ROM was slightly less than that with a free vascularized fascio-fat graft.

**Room A**

# **Industrial Session**

Orthop Surg. The Catholic Univ. of Korea **Yang Guk Chung**  
Naeun Pil Hosp. **Jong Pil Kim**

# Advancement in Mini C-arm Technology: The Role of Fixed-Angle C-arm Tomosynthesis (FACT)

서울대학교 의과대학

## 이요한

### 서론

근골격계 영상은 근골격계 질환 진단과 수술 가이드의 역할을 수행하는 중요한 도구로, 특히 수부외과에서는 정밀한 영상 확보가 성공적인 수술 결과를 결정하는 핵심 요소 중 하나이다. 전통적인 2D X-ray 영상은 제한된 정보를 제공하며, 이로 인해 복잡한 골절 구조나 관절면 침범 여부를 정확히 판단하기가 어렵다. 기존의 C-arm 기반 CT 촬영(cone-beam computed tomography, CBCT)은 C-암을 환자 주위로 회전시켜 3D 이미지를 생성하지만, 비용이 높고 촬영 시간이 오래 걸리며 수술실 내 적용에 어려움이 있다. LG Electronics의 \*FT scan\*은 이러한 제약을 극복하기 위해 설계된 소형 C-암 장치로, Fixed-Angle C-arm Tomosynthesis (FACT) 기술을 적용하여 고정된 각도에서 3D 단층 촬영 이미지를 제공한다. 특히 FACT는 수술실에서의 빠른 촬영과 높은 해상도를 제공하여, 수부외과 수술의 정확성과 효율성을 높이는 데 기여한다.

### FACT의 원리와 기술적 특징

Angle C-arm Tomosynthesis (FACT)의 원리는 디텍터 내에서 다양한 각도로 다수의 2D X-ray 영상을 촬영하고 이를 재구성하여 tomosynthesis 영상을 생성하는 데 있다. 일반적으로 CBCT와 같은 회전식 C-arm 시스템은 수백 장의 이미지를 필요로 하지만, FACT는 고정된 각도에서 적은 수의 이미지로 3D 재구성을 수행한다. 이로 인해 촬영 시간과 방사선 노출을 크게 줄일 수 있다. 실제로 FT scan에서 촬영하는 FACT의 방사선 노출량은 약 0.20 mGy로, 이는 수부 X-ray 한 장 촬영 시의 방사선량에 해당하여 빈번한 촬영이 요구되는 수술 중에도 안전하게 활용 가능하다. 이 저선량 촬영 시스템은 특히 방사선 피폭에 민감한 환자와 의료진에게 적합하다.

또한, FT scan은 FACT 기술을 통해 고정된 각도에서도 다양한 방향의 영상을 확보하여, 기존의 2D X-ray나 투시 촬영(fluoroscopy)보다 더욱 세밀한 영상을 제공한다. 이로써 고정된 각도에서 얻어진 이미지를 재구성함으로써 고해상도의 단층 영상을 제공하여, CT 수준에 가까운 세밀한 관절 및 골절 상태 평가가 가능하다.

## 수부외과에서의 FT scan의 임상적 적용

FT scan의 FACT 기술은 손과 손목과 같은 부위의 수술에서 특히 유용하다. 손과 손목의 작은 관절 구조는 X-ray 한 장만으로는 충분한 정보를 제공하지 못해 수술 중 오차가 발생할 가능성이 높다. 예를 들어, 주상골 골절에서는 정렬과 고정이 중요한 요인으로 작용하지만, 기존 소형 C-암 장치는 제한된 각도에서만 영상을 제공해, 정확한 정렬을 평가하는 데 어려움이 많았다. FACT는 이러한 한계를 극복하여 수술 중 다양한 각도에서의 단층 촬영을 가능하게 하며, 이를 통해 최소 침습적(minimally invasive) 수술을 지지하고 수술 성공률을 높이는 데 기여한다.

또한, FT scan은 고해상도 영상으로 가이드 핀의 위치와 나사 관통 여부를 정확히 확인할 수 있어, 기존 투시 촬영에 비해 임상적 유용성이 높다. 최근 연구에서는 주상골 모델을 사용하여 FT scan의 FACT와 기존 투시 촬영의 정확성을 비교한 결과, FACT는 나사 및 핀의 위치를 더 정확하게 판단할 수 있었다. 특히, 관절면 관통 여부를 평가할 때 FACT는 기존 투시 촬영보다 높은 민감도와 특이도를 보여주어 수부외과 수술에서 정밀한 내고정과 합병증 예방에 중요한 역할을 수행할 수 있다.

## FACT의 임상적 장점

1. 수술 오류 감소: FACT는 수술 후 CT 촬영실로 환자를 이동하지 않고도 수술실 내에서 고품질 단층 촬영 이미지를 수술실에서 직접 획득할 수 있어, 환자 이동 중 발생할 수 있는 오류를 줄이고 수술 중 정확한 영상 평가를 가능하게 한다. 또한, 나사 고정 후 관절면 침범 여부를 즉각적으로 확인할 수 있어, 수술 후 합병증 예방에도 기여한다.
2. 정밀한 임플란트 위치 평가: FACT는 관절 및 골절 구조와 관련된 정밀한 평가가 가능하도록 설계되었다. 골절면, 나사나 금속판 등 내고정물의 위치를 정확히 평가할 수 있어 골절의 정복 및 고정 정도를 확인하고 인접 조직의 손상 위험을 줄일 수 있다. 특히 주상골 골절 모델 연구에서 FACT는 기존 투시 촬영 대비 더 높은 민감도와 특이도로 임플란트 위치를 판별할 수 있어, 수술 후 안정성과 예후를 향상시킨다[18†source].
3. 낮은 방사선 노출: FT scan의 FACT 기술은 촬영 횟수를 줄이면서도 3D 영상을 제공하여, 방사선 노출을 대폭 줄일 수 있다. 수부 X-ray 한 장에 해당하는 약 0.20 mGy의 방사선량은 빈번한 촬영이 필요한 수술 중에도 안전하게 사용 가능하여, 환자와 의료진 모두에게 저선량의 이점을 제공한다. 방사선 피폭에 민감한 소아 및 고위험 환자군에서 FACT의 저선량 특징은 더욱 유리하다.
4. 수술실 내 사용 편의성과 무균 유지: FACT는 고정 각도 설계와 비회전 방식 덕분에 수술실 내에서의 자유로운 이동성을 제공하며, 무균 환경을 유지하는 데 유리하다. 다양한 각도에서 촬영한 2D 영상을 재구성하여 CT와 유사한 3D 이미지를 생성함으로써, 수술 중 다양한 각도에서의 정확한 시각적 정보를 제공한다. 이러한 단층 촬영 기능은 촬영 과정을 간소화하고 수술 중 빠른 조정을 가능하게 하며, 수술 시간을 줄이고 이미지 확인이 원활하게 이루어질 수 있게 한다.

## 향후 연구 방향

FACT는 초기 연구 결과에서 근골격 수술의 영상 표준을 재정립할 가능성을 보여주었으며, 특히 CT 기능을 완전히 갖추지 못한 의료 시설에서도 사용이 기대된다. 향후 연구에서는 FT scan이 다양한 정형외과 수술, 특히 손목, 팔꿈치, 어깨 수술에 미치는 효과를 추가적으로 검증하는 것이 필요하다. 또한, 3D 재구성 소프트웨어의 개선을 통해 FACT의 영상 품질을 더욱 높여 수부외과 수술에 필수적인 영상 장비로 자리 잡을 가능성이 있다. 다양한 골절 모델과 복잡한 해부학적 구조에 대한 평가를 통해, FACT가 기존 영상 장비와 비교했을 때 수술 결과에 미치는 영향을 평가하는 연구도 이루어져야 한다.

## 결론

Fixed-Angle C-arm Tomosynthesis (FACT)를 적용한 LG Electronics의 FT scan은 기존 2D 기반 mini C-arm 및 CBCT 영상의 한계를 해결하는 솔루션으로, 정형외과 특히 수부외과 수술에서 그 유용성을 입증하고 있다. FACT 기술은 고정 각도에서 단층 촬영(fixed-angle tomography)을 가능하게 하여 수술 중 정밀성과 효율성을 높이며, 골절의 정복 정도, 고정 후 내고정물의 위치 판단 등 여부를 수술실 내에서 즉각적으로 평가할 수 있어 수술자의 편의와 정확성을 동시에 제공한다. 수술실에서 간편하고 안전하게 사용할 수 있는 FT scan은 향후 근골격계 영상 분야에서 중요한 도구로 자리매김할 것이다.



# Lecture Outline: DOF SC connect Allograft Nerve Product

Gangneung Asan Hospital

Shin Woo Choi

DOF Inc. has developed the SCconnect, an innovative product within regenerative healthcare aimed at improving quality of life. This nerve allograft solution utilizes advanced supercritical fluid technology, a process that combines high temperature and pressure to reach the supercritical point of CO<sub>2</sub>. At this point, CO<sub>2</sub> acts as both a gas and a liquid, which allows it to dissolve lipids and cellular material effectively. This method is non-toxic, eco-friendly, and widely used in industries requiring precise extraction, such as decaffeination.

In tissue engineering, effective grafts rely on three critical elements: cells, extracellular matrix (ECM), and growth factors. The decellularization process is essential in allografts to remove cells, which are the primary cause of immune rejection, while preserving ECM and growth factors that aid in tissue integration and healing.

DOF's SCconnect nerve graft undergoes a precise decellularization process using supercritical CO<sub>2</sub>. This process removes lipids and muscle tissue, thoroughly cleans the graft, and includes gamma sterilization, ensuring a clean and structurally sound graft with preserved ECM integrity.

When compared to traditional detergent-based methods, SCconnect's decellularization stands out. Traditional processes often require prolonged use of surfactants that can leave behind residues, heighten rejection risks, and damage ECM. SCconnect's supercritical CO<sub>2</sub> technology, however, achieves a faster decellularization process without these residues, allowing it to retain higher levels of ECM and laminin, essential components for effective nerve repair.

The structural integrity of SCconnect is noteworthy, with thickness and length preserved within  $\pm 10\%$  of the original structure. This stability ensures that the graft remains mechanically robust, even in thinner nerve graft configurations. The product's strength and elasticity are retained, which is particularly beneficial for surgical applications that demand reliable structural support.

Seoul Asan Hospital conducted a preclinical study on SCconnect's efficacy, focusing on functional and

histological outcomes. Functional assessments, including gait analysis, were conducted at four-week intervals, with muscle force and mass evaluations at sixteen weeks. Histological evaluations used toluidine blue staining to assess myelination and nerve regeneration at the distal end of the graft.

Clinically, SCconnect offers versatile applications and can be tailored to suit specific surgical needs with custom diameter and length options. It has broad applicability in reconstructive surgeries, including those for the hand, breast, face, and trauma cases. To ensure optimal quality, SCconnect grafts are stored at temperatures of  $-40^{\circ}\text{C}$  or lower.

In summary, DOF's SCconnect nerve allograft offers substantial advantages, including a detergent-free, safe decellularization process that retains ECM integrity. The product's efficacy is backed by preclinical studies, highlighting its suitability as a reliable nerve graft for clinical use in complex reconstructive surgeries.

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# I love it, open Cast !

Chungnam National Univ.

Soo Min Cha

## Introduction

Traditional hand fracture casts limit daily activities, cause discomfort, and complicate skin inspection. Opencast, the world's first open cast, was developed to solve these issues and improve recovery.

## Body

Introduced in 2018, Opencast revolutionizes cast technology with its open design, promoting air circulation and reducing issues like itching and odor. It allows patients to shower and enables direct skin monitoring by healthcare providers.

Opencast is customizable, making it suitable for a wide variety of patients, including athletes and those with complex hand injuries. Since its inclusion under selective insurance coverage in 2019, Opencast has become more accessible, with positive patient feedback for comfort and ease of use. Clinically, it proves as effective as traditional casts, successfully treating hand fractures, tendon repairs, and deformity corrections. Furthermore, several kinds of wrist surgeries requiring proper protection/immobilization are emerging as new indications based on the numerous experiences by hand surgeons.

## Conclusion

Opencast marks a significant improvement in hand/wrist fracture and disease management, providing better comfort and medical oversight. This presentation will explore its clinical strengths and its potential to become a new standard in hand/wrist trauma and disease regardless of surgery vs conservative treatment.

**Room A**

# **Free Paper 7**

## **Elbow**

**SM Christianity Hosp. In Hyeok Rhyou**  
**Orthop Surg. Korea Univ. In Cheul Choi**

# Technique for Arthroscopic Lateral Ulnar Collateral Ligament Reconstruction for Posterior Rotatory Instability of the Elbow

Asan Medical Center

Jia Guo

The Lateral Collateral Ligament (LCL) complex of the elbow is pivotal for maintaining the stability of the elbow joint. The open technique for reconstructing the lateral ulnar collateral ligament (LUCL) is a common procedure to treat elbow instability caused by LUCL deficiency. Nevertheless, as arthroscopy procedures in the elbow have advanced, we have developed a novel arthroscopic technique to reconstruct the LUCL with suture anchors and bone tunnel techniques.

## Introduction

Posterolateral rotatory instability (PLRI) of the elbow is the most common pattern of chronic instability in the elbow joint, which generally refers to insufficiency of the lateral ulnar collateral ligament (LUCL) complex. LUCL injury can be caused by multiple injury mechanisms, such as trauma, deformity or iatrogenic injury following lateral elbow surgery. (1, 2) Numerous open surgical techniques for LUCL has been described, which vary in graft source, graft configuration, and fixation modality. (3) Jones et al. first described the docking technique in 2012, and it is now the most widely used open approach for LUCL reconstruction.(4) In recent years, elbow arthroscopy has made significant progress because of advancements in technology and surgical skills. Recent studies on arthroscopic LCL repair have shown positive clinical and radiological results and high patient satisfaction after arthroscopic repair.(5) However, an arthroscopic-assisted technique for LUCL reconstruction has not yet been developed. We present a Technical Note for arthroscopic-assisted LUCL reconstruction for patients with PLRI. /video/

## Surgical Technique

### Patient Setup and Preparation

Under general anesthesia, the patient is placed in the lateral decubitus position on the operating table. A

preoperative assessment of the elbow instability was performed, including valgus stress and lateral pivot-shift tests. The arm is fixed to a padded support with the shoulder is abducted at 90° and the elbow is positioned at 90°, allowing the forearm to hang freely. A sterile tourniquet is placed and inflated to 250 mm Hg. The water pump pressure is 30 mm Hg.

## Portal Establishment and Arthroscopic Assessment

The bony and soft-tissue landmarks are determined and marked prior to the operation. The “Soft spot” (i.e. midlateral portal) is identified as the center of the triangle interval formed by the olecranon tip, lateral epicondyle, and radial head (Figure 1). A 20-mL normal saline solution is administered to distend the elbow joint for insufflation with the use of an 18-gauge needle inserted via the “Soft spot”. The proximal anteromedial portal is established at 2 cm proximal to the medial epicondyle and 1 to 2 cm anterior to the medial intermuscular septum for diagnostic arthroscopy of the anterior compartment (Figure 1). With a 4.5-mm, 30° arthroscope, an arthroscopic diagnosis involves the examination of elbow laxity and any concomitant pathologies or injuries, such as plica syndrome and lateral epicondylitis (Figure 2).(2, 6) The concomitant pathologies could be addressed after the establishment of the posterolateral working portal. The proximal posterolateral portal is established at 2-3 cm proximal to the tip of the olecranon on the lateral edge of the triceps tendon to visualize the posterolateral compartment. In PLRI, a “drive-through-sign” is observed. This typical sign indicates that the scope will be able to be fully advanced through the radiocapitellar joint into the anterior joint compartment allowing for a visible view of the anterior rim of radial head. In addition, the medial trochlear is visualized through the posterolateral viewing portal, which is described as the “medial trochlear sign” (Figure 3).(7)



Figure 1. Injection of 20 cc saline to the soft spot portal.

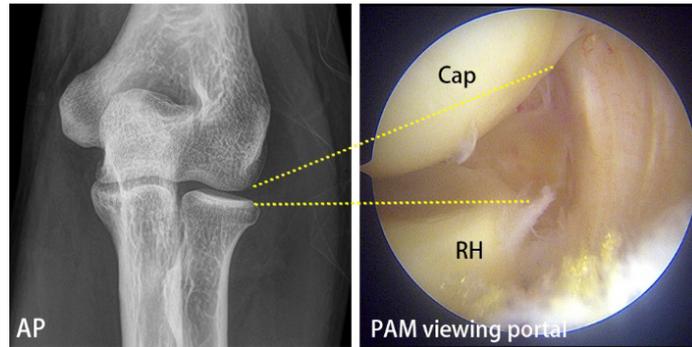


Fig 2

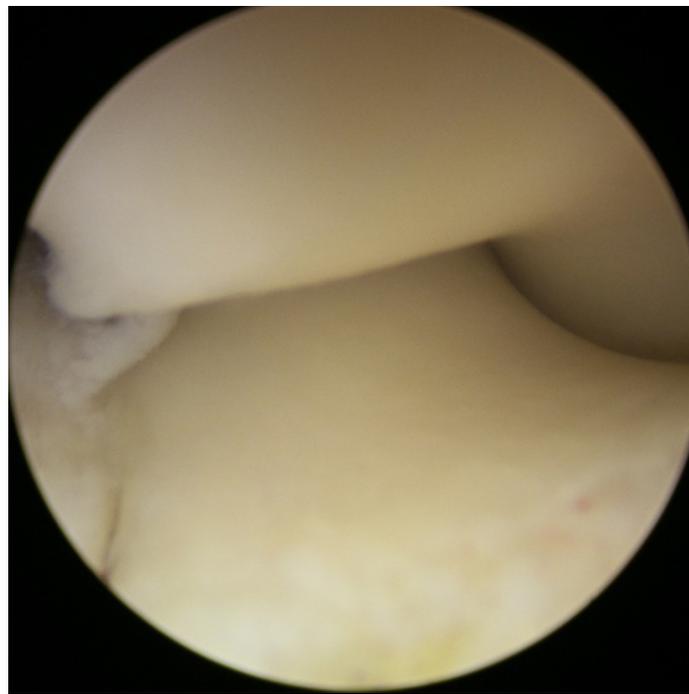


Fig 3

It is essential to conduct arthroscopic instability testing to confirm the diagnosis of LUCL deficiency to determine the necessity for LUCL reconstruction prior to the reconstruction procedure.(8)

### Graft Harvest and Preparation

An intraoperative diagnosis was performed to ensure that the ipsilateral palmaris longus tendon existed. A 1-cm incision was made over the distal wrist crease, and a tendon stripper was used to harvest the palmaris longus tendon with a length of 15-20 cm. An assisting surgeon prepared the graft using a whipstitch running suture with a 5-0 ETHIBOND suture at both free ends (Figure 4).



Fig 4

## Ulnar tunnel preparation

Based on the landmark for the ulnar tunnel, which is located at the supinator crest, distal from the proximal margin of the radial head (9), a 2-cm incision was made at the posterior ulna at the level of the radial neck (Fig 5). A double-strand LUCL reconstruction is conducted. The ulnar tunnel is created by drilling two 2.2-mm-diameter convergently with 1-1.5 cm osseous bridge (Fig 6). The distal bone tunnel is created firstly at the 15 mm distal from the proximal margin of the radial head (approximately at the level of the radial neck) and immediately proximal to the supinator crest, according to the previous study based on previous computer model studies. (10) The second bone tunnel is created proximally and posteriorly to the first one, with at least a 1-1.5 cm distance bony bridge reserved between the two holes. A cerclage wire or a looped stiff fiber wire is passed through the tunnel to assist graft shuttling.



Fig 5

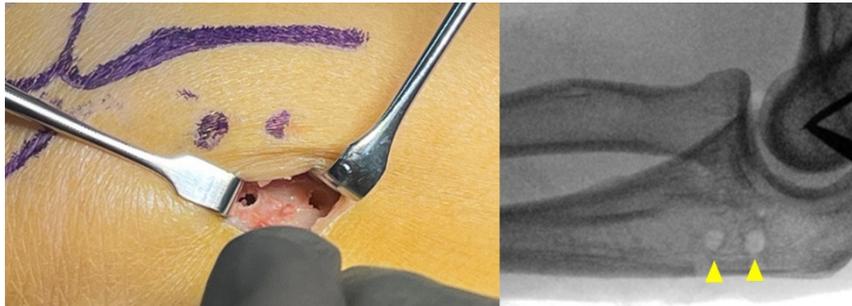


Fig 6

### Humeral tunnel preparation

After the ulnar tunnel has been created, preparation of the humeral tunnel commences with making an incision centered at the lateral epicondyle. The humeral attachment of the graft is the center of the capitellum to get an isometric reconstruction that ensures consistent stress over the whole range of the flexion-extension arc.(9) The isometric point on the capitellum for suture anchor insertion is confirmed under the intraoperative image intensifier (Fig 7). After removing soft tissue from the subchondral bone of the lateral epicondyle, a 3.0-mm knotless bioabsorbable suture anchor (Smith&Nephew) is inserted into the chosen isometric point on the lateral epicondyle. After inserting the guide into the predetermined isometric point, a 2.4-mm drill hole is created. Then, the suture anchor, with single-strand No. 2-0 FiberWire repair suture attached to the anchor, is placed through the guide into the drilled hole and impacted with a mallet. Double strands palmaris Longus graft was secured to the suture anchor with a sliding knot (Fig 8).

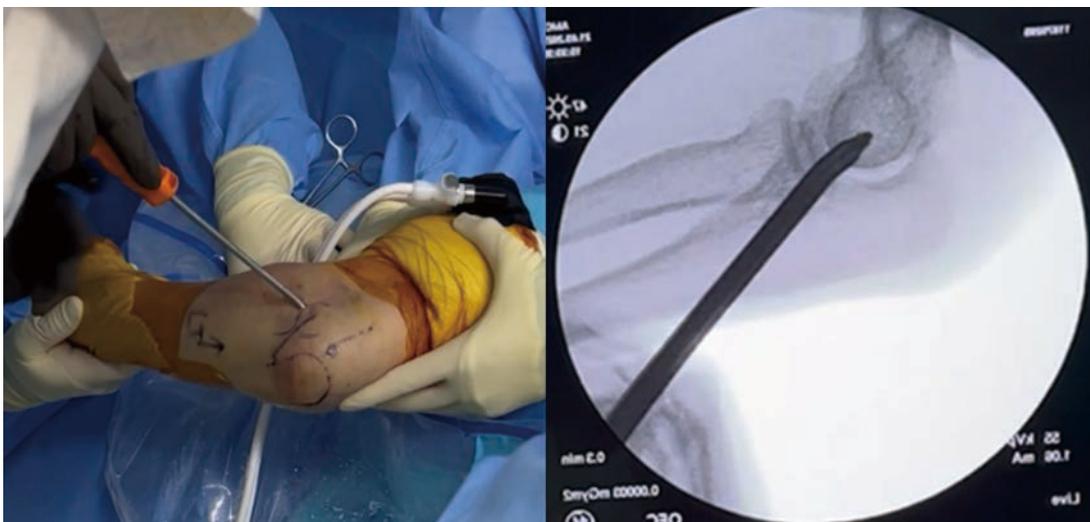


Fig 7

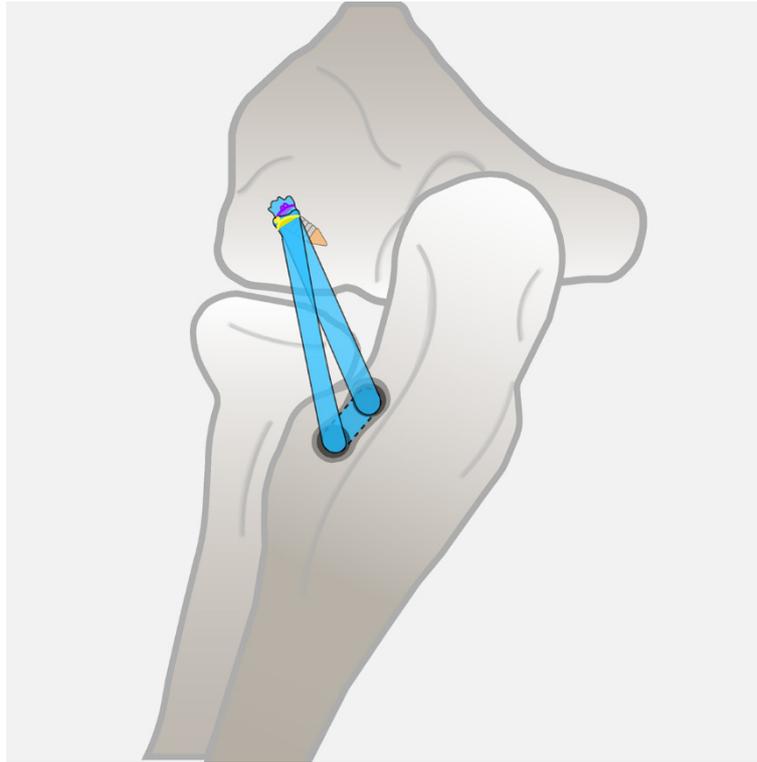


Fig 8

## Graft Passing and Fixation

A spinal needle loaded with PDS No.1 is passed through from the ulnar tunnel into the posterolateral compartment in advance to assist with subsequent graft shuttling with the shuttle relay technique. The two free limbs of the graft were shuttled through the soft sport portal (Fig 9).

Graft is shuttled through the ulnar with a tunnel shuttle relay technique under direct vision from the arthroscope through the posterolateral portal. At the same time, the surgeon checks the position of the graft under arthroscopy to make sure that the graft sits at the posterior side of the radial head (Fig 9). Following the graft passage, the two free end limbs were retrieved from the soft spot portal. One limb is passed to the predrilled ulnar tunnel. Graft is cycled, tensioned and fixed at elbow 90-degree flexion in neutral rotation (Fig 9). The two ends of the graft were sutured together using a 1-0 ETHIBOND (Ethibond Excel; Ethicon, US LLC) for augmentation. The arthroscope was reinserted to the posterolateral portal and drive-through sign and the medial trochlear sign disappeared after surgery. Then, the wound is closed in layers.

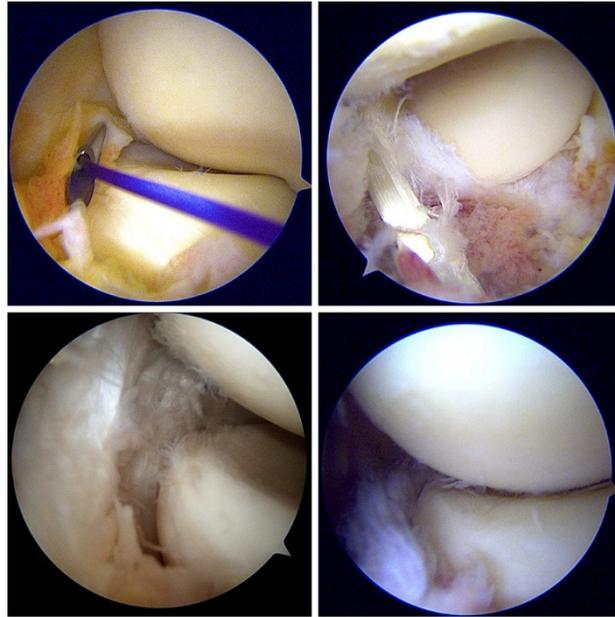


Fig 9

## Postoperative Rehabilitation

Postoperatively, the elbow was immobilized for 3 weeks with a long-arm splint, and then active-assisted elbow flexion exercises were performed. Elbow flexion from  $60^{\circ}$ ~ $120^{\circ}$  is allowed but extension should be limited at the first month. Activities including varus gravity motion should be avoided in the first 6 weeks. The range of motion (ROM) is gradually progressed aiming to achieve complete ROM within two months after the surgery.

## Discussion

Surgical reconstruction of the LUCL is a dependable method in individuals with LUCL insufficiency. Reconstruction of the LUCL remains the primary treatment strategy for chronic PLRI. An arthroscopic LUCL reconstruction is an adaptation to the previously well described open LUCL reconstruction by O'Driscoll et al.(11) A few advantages exist for an arthroscopic approach to LUCL reconstruction including reduced tissue resection (Table 1). There three summarized absolute advantages of the arthroscopic LUCL reconstruction based on capacity of arthroscopic technology to provide adequate visualization of the lateral ulnohumeral joint: (1) ensure the severity of the elbow instability which can further clarify the indications for LUCL reconstruction to avoid in case of unclear diagnosis; (2) the ability to detect any associated lesions such as the scar tissue, loose bodies, heterotopic ossification, lateral epicondylitis; (3) able to visualize the width of the lateral ulnohumeral joint space immediately and directly to verify the efficient tension of passed graft.(7, 12) Arthroscopic LUCL reconstruction uses a posterolateral viewing portal which replaces posterolateral approach in the open manner and this can present the anconeus muscle which is a important dynamic lateral stabilizer of the elbow joint.

Furthermore, minimizing surgical dissection is crucial to avoid affecting the proprioception of the elbow joint.(13)

The most common 2 concerns from surgeons about this technique are determination of tunnel location and proper graft tension (Table 2). The bone tunnel location will mostly dictate the survivorship of the joint which serve as a critical step in this technique. The graft tensioning should be performed to avoid over-tension as it can limit the ROM exercise the early postoperative period.

In conclusion, the arthroscopic LUCL reconstruction using palmaris longus autograft is an option to the traditional open LUCL reconstruction in treating PLRI. It is with less insult and dissection to the soft tissue at the lateral side of the elbow while providing excellent tools to diagnose any concomitant intra-articular pathologies. However, the demanding technique necessitates long learning curve and experience to work at the posterolateral compartment.

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## Figures and video legends

- Figure 1. Injection of 20 cc saline to the soft spot portal.
- Figure 2. Arthroscopic assessment of posterolateral rotatory instability and elbow joint laxity. The viewing portal is through the proximal anteromedial portal. Widening joint space can be observed, consistent with preoperative stress radiography results. (CAP, capitellum; RH, radial head.)
- Figure 3. The medial trochlear can be seen through the posterolateral viewing portal in cases of elbow with posterolateral rotatory instability, known as the "medial trochlear sign".
- Figure 4. The ipsilateral palmaris longus tendon was harvested as graft and prepared using a whipstitch running suture with a 5-0 ETHIBOND suture at both free ends.
- Figure 5. An incision of 2 cm was made on the posterior ulna at the radial neck level in order to create the ulnar tunnel.
- Figure 6. Two 2.2-mm-diameter convergent ulnar tunnels were made with a 1-1.5-cm osseous bridge reserved. On the intraoperative image intensifier, tunnels and bony bridges are visible (marked by yellow triangles).
- Figure 7. The intraoperative image intensifier is used to validate the isometric point on the capitellum for suture anchor insertion during the humeral tunnel preparation.
- Figure 8. An illustration demonstrates the technique of fixing the double-stranded palmaris longus graft to the suture anchor with a sliding knot.
- Figure 9. The process of graft Passing and fixation, the joint space is reduced after tensioning the graft.

Tables (each on separate page)

Table 1. Advantages and Disadvantages of Arthroscopic LUCL reconstruction

Advantages	Disadvantages
<ol style="list-style-type: none"> <li>1. obtain adequate visualization of the anterolateral and posterolateral compartments.</li> <li>2. able to conduct thoroughly arthroscopic assessment, to determine the level of elbow instability and concomitant pathologies.</li> <li>3. Accurate determination on the humeral attachment site to obtain an isometric LUCL reconstruction by using the intraoperative image intensifier</li> <li>4. Less soft tissue dissection because of arthroscopic manner</li> <li>5. No irritation from suture knot compared to non-reconstruction technique.</li> <li>6. Stronger constructs compare to non-reconstruction technique</li> <li>7. No insult to anconeus muscle as the part of lateral stabilizer of the elbow</li> <li>8. Used in patients with inadequate tissue for repair.</li> </ol>	<ol style="list-style-type: none"> <li>1. Donor site morbidities compared to non-reconstruction technique such as imbrication.</li> <li>2. Over tension of the graft can render ROM exercise at early post operative period</li> <li>3. Technical demanding because of the necessity of experience in posterolateral compartment work.</li> <li>4. Determination of the ulnar and humeral footprint necessitate the use of image intensifier.</li> </ol>

Table 2. Pearls and Pitfalls

<ol style="list-style-type: none"> <li>1. Determination of both humeral and ulnar footprint should be performed under image intensifier to ensure optimal placement.</li> <li>2. The graft should be place at the posterior side of the radial head.</li> <li>3. The elimination of medial trochlear sign is the key of a sufficient lateral collateral ligament complex reconstruction as the ulno-humeral joint is tightened.</li> </ol>
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# Plate osteosynthesis for treatment of segmental diaphyseal forearm fractures

Orthop Surg. Wonkwang Univ.

Hyun Tak Kang, Hong Je Kang

## Background

Segmental fractures often result from high-energy or indirect trauma that causes bending or torsional forces with axial loading. We evaluated surgical outcomes of the Plate osteosynthesis for treatment of segmental diaphyseal forearm fractures in adults.

## Methods

From 2014 to 2023, We retrospectively analyzed 218 cases of adult diaphyseal forearm fractures. Of these, 20 patients who underwent plate osteosynthesis for segmental diaphyseal fractures were included. The mean age was 56.6 years, and there were 13 males and 7 females. Clinical outcomes were measured using the range of motion and Grace and Eversmann criteria, and radiological outcomes were assessed using the time to bone union.

## Results

The average range of rotational motion was 75 degrees of supination and 78 degrees of pronation. The Grace and Eversmann evaluation criteria showed excellent in 14 cases, good in 3 cases and acceptable in 3 cases. The average bone union time was 16.7 weeks. There was no major complication such as infection or nonunion.

## Conclusion

Plate osteosynthesis for the treatment of adult forearm diaphyseal segmental fractures has achieved good clinical and radiological results.

**Keywords:** Diaphyseal; Forearm; Fracture; Segmental.

# Articular Impaction of Olecranon Fracture Associated with Poor Postoperative Clinical Outcome

Orthop Surg. Ewha Womans Univ.

Ji-Sup Kim

## Background

Articular impactions in fractures usually have poor clinical outcomes. This study investigated the degree of articular impaction in olecranon fractures using the circle drawing method, analyzed the radiographic and clinical outcomes, and determined whether articular impaction affects the outcomes and the effect of variables on the outcomes.

## Methods

We reviewed the records for a cohort of consecutive patients who had undergone operative treatment for an olecranon fracture, were followed for at least 2 years, and had available radiographs and elbow computed tomography (CT) scans. Patients were stratified into an articular impaction group and a non-impaction group based on preoperative CT scans. Independent t-test or chi-square analysis were performed to compare demographic features, radiologic parameters, and radiologic and clinical outcomes between the groups. Subgroup regression analyses were performed to evaluate which variables affect the clinical outcomes.

## Results

Of 124 patients with olecranon fractures, 43 (34.67%) demonstrated articular impaction on CT; simple radiographs identified articular impaction in only 28 patients (22.58%). The impaction group was more likely to have sustained high-energy trauma and had worse postoperative clinical outcomes than the non-impaction group. In the subgroup analysis, unsatisfactory impaction reduction quality was associated with poor clinical outcomes.

## Conclusions

Olecranon fractures should be evaluated using CT because simple radiographs cannot accurately identify articular impaction. Articular impaction in olecranon fractures adversely affects postoperative outcomes, and precise restoration of the impaction is essential for improved clinical outcomes.

# Clinical results of treatment of comminuted olecranon fracture with free articular fragments using the embedded subchondral K-wire fixation along with plate fixation

Orthop Surg. Yeson Hosp.

Kyoung-Tae Min, Jin Sung Park

## Hypothesis

Comminuted olecranon fractures are inherently unstable, intra-articular fractures, requiring surgical treatment. Open reduction and internal fixation using plate and screws are usually recommended, as tension band wiring can compress the articular surface, causing shortening of the olecranon, articular incongruity, and subluxation of the elbow joint. In severely comminuted fracture with multiple free fragments, the articular fragments are small and unstable, making it difficult to achieve sufficient reduction using only plate and screws. The loss of reduction may even occur. The purpose of this study is to introduce the clinical and radiological results of embedded subchondral K-wire fixation along with plate fixation for free articular fragments in comminuted olecranon fractures.

## Methods

From July 2013 to December 2022, the patients who were followed up for at least one year after the embedded subchondral K-wire fixation combined with plate fixation for comminuted olecranon fracture were retrospectively analyzed. The radiologic evaluations include bony union, the number of embedded subchondral K-wires between intraarticular fragments, quality of joint reduction, and delayed reduction loss. To evaluate clinical outcomes, range of motion of the elbow joints, Mayo elbow performance score (MEPS), and complications were evaluated at the final follow-up.

## Results

Fourteen patients enrolled in this study, 8 males and 6 females (6 right, 8 left). The average age of the patients was 42.3 years (range, 17~71) and the average follow-up period was 20.1 months (range, 12~54.7). The union

was achieved in all cases. At the final follow-up, the mean range of elbow motion was 138.2 degrees(range, 110~150) of flexion, and 6.4 degrees(range, 0~15) of flexion contracture. The average Mayo elbow performance score at the last follow-up was 95.4 points(range, 80~100). There were 2 cases of mild post-traumatic arthritis at final follow up. There was one case of heterotopic ossification, in which a re-fracture occurred due to slip down 2 weeks after plate fixation, and revision surgery was performed.

### Summary Point

The embedded subchondral K-wire fixation along with plate fixation in highly comminuted olecranon fracture resulted in excellent clinical outcomes. This technique might serve as a reliable and good surgical option in similar cases for the restoration of articular congruency and elbow function.

Keyword: comminuted olecranon fracture, plate fixation, embedded subchondral fixation

Table 1. Patient Demographics and Operative Details

Parameter	Details
Total Patients	14
Gender	8 males, 6 females (6 right, 8 left)
Average Age (years)	42.3 (range 17-71)
Average Follow-up Period (months)	20.1 (range 12-54.7)
Union Achieved	100% (14 cases)

Table 2. Pain and Functional Outcomes

Parameter	Details
Elbow Motion (Flexion)	138.2 degrees (range 110-150)
Flexion Contracture	6.4 degrees (range 0-15)
Mayo Elbow Performance Score (MEPS)	95.4 points (range 80-100)
Post-Traumatic Arthritis	2 cases of mild arthritis
Heterotopic Ossification	1 case, re-fracture occurred, revision surgery performed

# Open fracture of medial condyle of distal humerus with exposed ulnar nerve after motorbike TA

Orthop Surg. Dong-A Univ.

Sung Yoon Jung

A 29-year-old male patient was admitted to the emergency room after a motorcycle TA. At that time, he was complaining of pain in both upper extremities, and there was an open wound around the left elbow joint with exposure of the ulnar nerve.(Fig 1) Lt. The patient complained of a 50% decrease in sensation in the 4th and 5th fingers, and abduction/adduction power was grade 2.

The following is a clinical photo and X-ray at the time of injury.



Fig 1. Clinical photo at the initial visit at ER

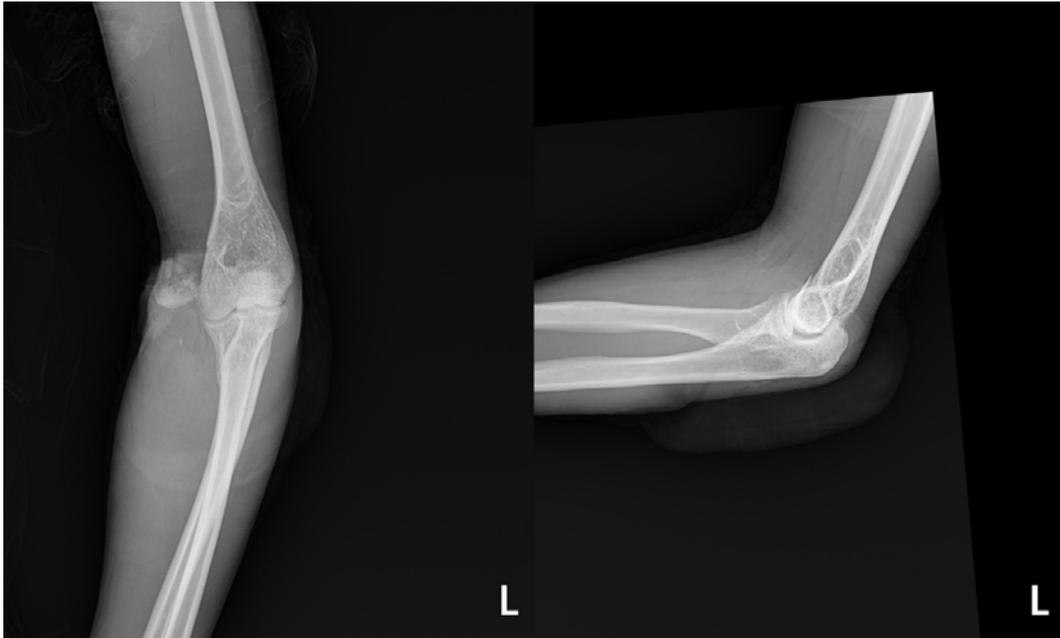


Fig 2. Initial left elbow X-ray at the time of injury

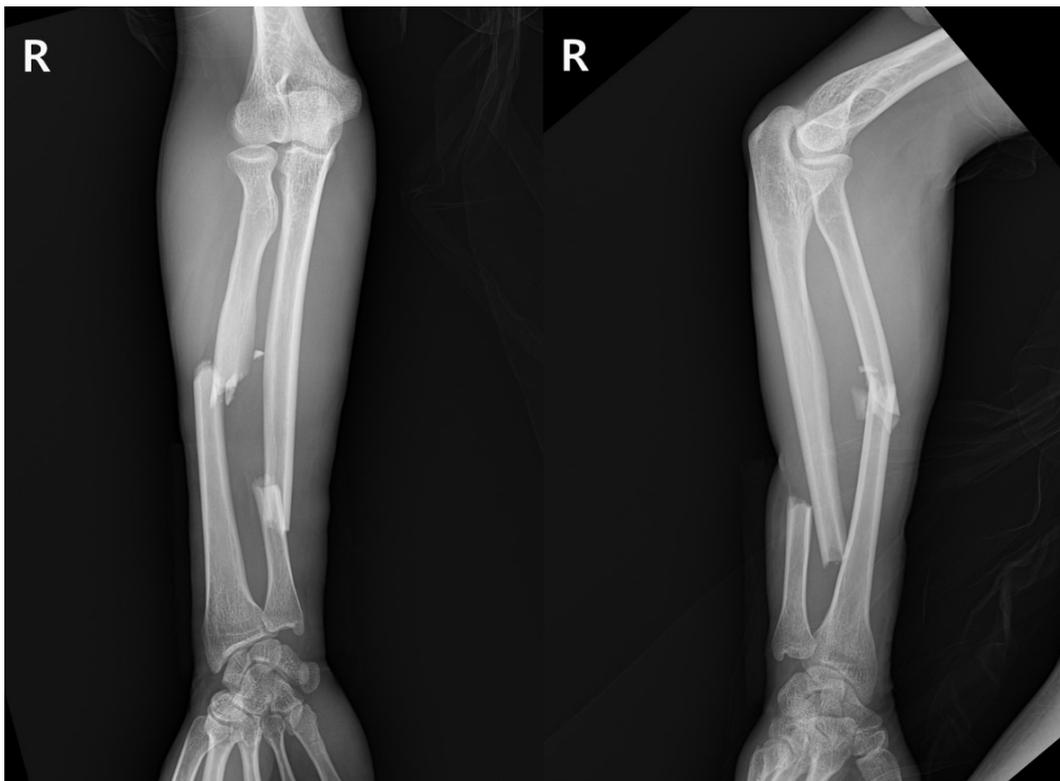


Fig 3. Initial right forearm X-ray at the time of injury

On the x-ray at the initial visit at ER, there were comminuted fracture of medial condyle of left elbow and both bone shaft fracture at right forearm.(Fig 2, 3)

## 〈Operation plan〉

- Fx. both bone, forearm, Rt.
  1. Radius : dual plate (2.0 mini-plate + 3.5 LC-LCP)
  2. Ulna : dual plate (2.0 mini-plate + 2.4 foot plate)
  
- Open fx. med. condyle, distal humerus, elbow, Lt. c ulnar n. injury
  1. Ulnar n. : release and ant. transposition
  2. Med. condyle
    - 1) temporary k-wire fixation and VAC apply or wound open
    - 2) headless screw fixation + PRN VAC apply or wound closure
    - 3) ORIF using distal humerus plate + secondary operation(bone graft)
    - 4) ORIF using distal humeral plate + auto-iliac bone graft

A large amount of dirt and foreign substances were found in the operation field and were washed using a continuous irrigation pump. ORIF using distal humeral plate with iliac bone graft was performed with the idea of first inducing bone union and then considering next step. The postoperative x-rays are as follows.(Fig 4,5)

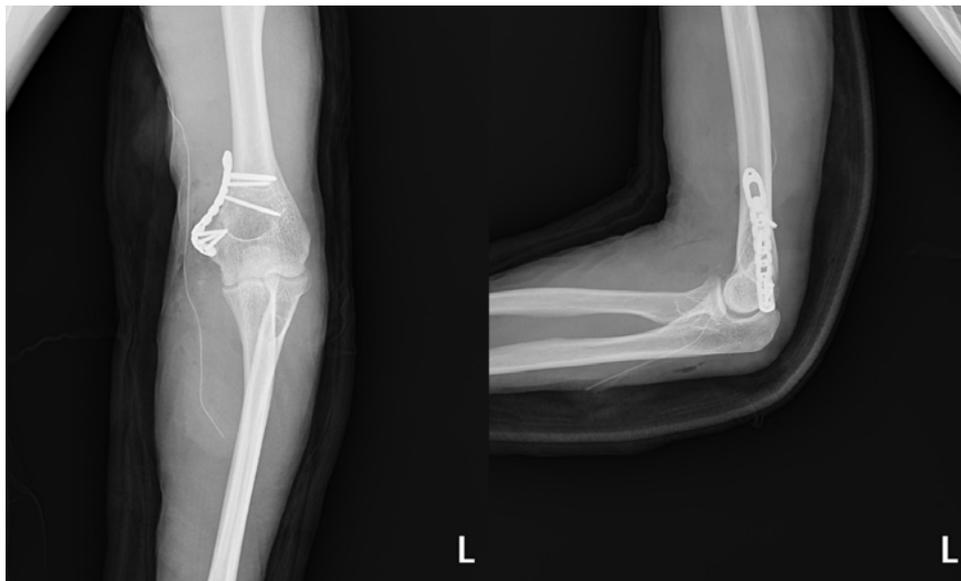


Fig 4. Postoperative x-ray of left elbow



Fig 5. Postoperative x-ray of right forearm

**<Questions>**

- Exposed ulnar nerve and open fracture with bone defect
  1. primary ORIF or delayed internal fixation
  2. Bone graft or delayed bone graft
  3. Wound closure or VAC apply or delayed suture

# The challenge of trans-ulnar basal coronoid fracture-dislocations : A surgical strategy based on the pattern of coronoid fracture

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Hyoung-Seok Jung<sup>1</sup>, Hyun-Cheul Nam<sup>1</sup>, Min Su Chu<sup>2</sup>, Jae-Sung Lee<sup>2</sup>

## Background

The rarity and complexity of trans-ulnar basal coronoid fracture-dislocations pose significant challenges in treatment. This study aimed to categorize these fractures based on coronoid fracture patterns and propose tailored surgical approaches for each type. Additionally, we evaluated the functional and radiological outcomes among the patients managed using our treatment algorithm.

## Methods

A total of 19 patients who underwent open reduction and internal fixation for trans-ulnar basal coronoid fracture-dislocations between March 2018 and October 2022 were enrolled in this study. These patients were classified based on the coronoid fracture patterns associated with olecranon fractures: type 1 involved anteromedial facet (AMF) fractures, type 2 encompassed coronoid base and body fractures, and type 3 involved a combination of types 1 and 2. We made a midline longitudinal dorsal incision to facilitate the provisional fixation of the olecranon fragment to the distal metaphysis using a locking plate. Subsequently, we employed the over-the-top (type 1) and Taylor-Scham approaches (type 3) for direct coronoid process fixation with buttress plating. Type 2 fractures were approached via medial fascial exposure from the posterior ulnar cortex or through the olecranon fractures, and subsequently fixed with miniplates and screws. Bony union and joint articulation were assessed via plain radiographs, and functional outcomes were evaluated using range of motion and the Mayo Elbow Performance Score.

## Results

Among the 19 patients, 3 had type 1 fractures, 14 had type 2 fractures, and 2 had type 3 fractures. All fractures

exhibited solid osseous union without subluxation or dislocation. The average flexion and extension arc was  $119.47^\circ \pm 20.88^\circ$ , with a mean flexion of  $127.37^\circ \pm 13.37^\circ$  and an average flexion contracture of  $7.89^\circ \pm 10.04^\circ$ . The average Mayo Elbow Performance Score was  $82.63 \pm 12.51$  points. Qualitatively, patient outcomes were excellent in 5 patients, good in 9, and fair in 5.

### Conclusion

Most of our patients presented with easily approachable coronoid base and body fractures. However, in AMF fractures of the coronoid process, a direct medial approach is required for buttress plating. We believe our study helps provide useful guidelines for making appropriate decisions in trans-ulnar basal coronoid fracture-dislocations.

**Room A**

**Free Paper 9**  
Basic Research & Miscellaneous I

Orthop Surg. Ulsan Univ. **Jae Kwang Kim**  
Orthop Surg. Konkuk Univ. **Seoung Joon Lee**

# Comparison of Clinical Outcomes Between Ultrasound-Guided Needling with platelet-rich plasma Injection and Arthroscopic Debridement for Refractory Lateral Epicondylitis

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## Background

Lateral epicondylitis that does not improve after more than one year of conservative treatment may be considered for surgical treatment. We aimed to analyze the clinical outcomes in patients with refractory lateral epicondylitis by comparing two groups: those treated with ultrasound-guided needling and platelet-rich plasma (PRP) injection (needling group), and those treated with arthroscopic debridement (surgery group).

## Methods

Between 2022 and 2023, patients who underwent surgery or needling for refractory lateral epicondylitis were evaluated. We performed surgical treatment in cases of conservative treatment failure lasting over a year. Only patients who underwent arthroscopic debridement were included in the surgical treatment group. We excluded patients if they had undergone needling before surgery, had other diseases such as osteoarthritis, or had not been followed up for over a year. The surgery group included 20 patients, consisting of 13 men, with an average age of 54 years (range 33-69). For patients who did not want surgical treatment, we performed needling therapy. The procedure involved multiple punctures with an 18-gauge needle under ultrasound guidance, followed by PRP injection. The needling group included 13 patients, with 4 men, and an average age of 53 years (range 46-69). We compared the following outcomes between the surgery group and the needling group: pain visual analogue scale (pVAS) scores, post-operative Quick Disabilities of the Arm, Shoulder, and Hand scores, and the degree of pain reduction reported by patients.

## Results

There were no differences in demographic data and preoperative pVAS between the surgery group and the

needling group before the treatment. The post-treatment clinical outcomes were as follows: pVAS scores were 3.4 in the needling group and 1.5 in the surgery group (p-value: 0.009); QuickDASH scores were 15.2 and 6.1 (p-value: 0.040); and the degree of pain reduction was 55% and 80% (p-value: 0.030). In the needling group, 6 patients (46%) had symptoms remaining at 50% or more after the procedure, and 3 of these patients subsequently underwent surgical treatment. In the surgery group, 2 patients (10%) had symptoms remaining at 50% or more after the surgery, with no patients requiring reoperation.

### Conclusion

Needling with PRP injection shows some effectiveness in treating refractory lateral epicondylitis; however, its failure rate is higher compared to surgical treatment.

# The characteristics and costs of traumatic extremity amputation versus replantation at a single center in the Republic of Korea: a retrospective observational study

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Chan Ik Park<sup>5</sup>, Kyoungwon Park<sup>6</sup>, Sang Hyun Lee<sup>6</sup>

## Purpose

This study investigated the epidemiology and treatment outcomes of patients with traumatic limb amputation who visited a regional trauma center.

## Methods

From November 2015 to December 2021, patients with traumatic limb amputation who visited the Regional Trauma Center at Pusan University Hospital were retrospectively studied. The injury mechanism, number of operations for accompanying injuries, hospitalization period, injury severity score, insurance classification, and medical costs were investigated using medical records. We analyzed medical costs according to the injury site and treatment method.

## Results

We enrolled 57 patients who visited the hospital for traumatic limb amputation. The median patient age was 55 years, and there were 48 males and nine females. Seventeen patients underwent replantation, and 40 patients underwent amputation. Replantations were performed in 43.7% of cases of upper extremity injuries and in 12.0% of cases of lower extremity injuries. Six operations were performed per patient for replantation and three for amputation ( $p=0.027$ ). In an analysis of the total medical costs submitted to the national health insurance system, replantation surgery was over twice as expensive as amputation surgery for the upper extremities ( $p=0.029$ ). However, no significant cost difference was observed for lower limb amputations.

## Conclusion

As a treatment for limb amputation patients, replantation requires a higher number of operations and a longer hospital stay than amputation. There was no difference in patients' contributions to medical costs between replantation and amputation, but from the standpoint of national health insurance coverage, upper extremity injuries cost more when treated by replantation than by amputation. Keywords: Traumatic amputation, Replantation, Surgical amputation, Health care costs

# Reduction methods and treatments of Isolated volar dislocation of distal radioulnar joint: a case series

MS Reconstruction Hosp.

Hyo-Kon Kim

## Purpose

volar dislocation of the distal radius-ulna joint without concomitant fracture of the radius or ulna is a very rare compared to the dorsal dislocation. Therefore, we want to find out about rapid diagnosis, adequate anatomical reduction methods and treatments.

## Materials and Methods

In the anteroposterior view of three cases, we found overlap of distal radius and ulna. In the lateral view, distal ulna is displaced anteriorly compared with the radiocarpal bone. We got confirmation volar dislocation and impaction of ulna head in the axial view of CT. Under BPB anesthesia, an assistant applies pressure on the interosseous membrane of the forearm and then the operator pushes posteriorly on the ulna head and pronates the forearm. After postreduction stability testing, percutaneous K-wire can be used to temporarily transfix the DRUJ. In one case of chronic volar dislocation, closed reduction was unsuccessful because of ulna shaft fracture. after open reduction and plate fixation for ulna fracture, joint reduction was achieved by chronic scar tissue removal, release of pronator muscle and interosseous membrane.

## Results

No dislocation and DRUJ instability occurred at persistent outpatient follow-up after removal of pin in all three cases. there were ulna nerve palsy and ulna shaft fracture due to aggressive closed reduction in chronic case. But after three months, ulnar palsy improved, and union of fracture was confirmed. After six months, there was no significant difference in ROM of wrist and forearm compared to the other side in all three cases.

## Conclusion

A CT of wrist should be ordered if there is any suspicion of volar dislocation. When impaction of ulna head was observed on CT, the closed reduction was first attempted by compression of ulna head toward volar aspect for release of impaction. a second attempt was performed with an assistant applying pressure on forearm using both palms. Ant then the operator pushes dorsally on the ulnar head and pronates the forearm. However, reduction can be failed by spasm of the pronator quadratus or IOM, interposition of the torn TFCC and chronic scar tissue. Because excessive closed reduction can cause ulnar nerve palsy or ulna fracture. Promptly an open reduction was necessary in failed closed reduction.

# Which reconstructive technique is most appropriate for scapholunate dissociation? Preliminary cadaveric biomechanical evaluation

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Il-Jung Park<sup>1</sup>, Ho Youn Park<sup>1</sup>, Soo-Hwan Kang<sup>1</sup>, Joo-Yup Lee<sup>1</sup>, Dai-Soon Kwak

## Introduction

There are many techniques for the treatment of chronic scapholunate dissociation (SLD). The original SwiveLock (O-SW) technique is simple and reasonable, but it is hardly effective in restoring the "secondary stabilizer" of the scapholunate articulation. Therefore, the modified SwiveLock (M-SW) technique is implemented to simultaneously reconstruct the DIC ligament, but reconstructing only the dorsal ligament may be a weakness. The anatomical front and back (ANAFAB) technique, a recently introduced method, provides strong anterior and posterior stability, but the surgical procedure is too complicated. The purpose of this study was to perform biomechanical comparisons of different reconstructive techniques for SLD using a controlled laboratory cadaveric model.

## Methods

Six fresh-frozen upper-extremity cadaveric specimens were prepared. The scapholunate distance, scaphoid rotation, and lunate rotation of the specimens were measured during continuous flexion-extension and ulnar-radial deviation movements. The data were collected using a wrist simulator with a linear guide rail system (tendon load/motion-controlled system) and a motion capture system. Results were compared in five conditions: (1) intact, (2) SLD, (3) O-SW, (4) M-SW, and (5) ANAFAB. Paired t-test was employed to compare the biomechanical characteristics of intact wrists to those of SLD wrists, and to those of wrists after each of the three reconstruction methods.

## Results

After SLD, all four parameters worsened. After the three different reconstructions, all four parameters improved

in almost every wrist position. ANAFAB was an effective solution in reducing the widening in scapholunate distance. On the other hand, in terms of the scapholunate angle, M-SW showed results closest to those of the intact wrist.

### Conclusions

ANAFAB most effectively improved distraction intensity, and M-SW most effectively improved rotational strength for the treatment of SLD. Considering the technical complexity of other techniques, M-SW may be a more efficient technique to reduce operating time and minimize complications.

# Three-Dimensional Computed Tomographic Evaluation of the Ulnocarpal Joint Under Stress Loading

The Catholic Univ. of Korea

Ho Youn Park, Dai-Soon Kwak, Il-Jung Park, Jin-Woo Lee, Seung Hyo Kim, Joo-Yup Lee

We investigated which wrist stress position would result in the most significant reduction in the ulnocarpal distance (UCD) using three-dimensional computed tomographic (3DCT) images. 3DCT scans of 10 normal individuals and 19 patients of ulnar impaction syndrome were taken in neutral, radial/ulnar deviation (RD/UD), weight-bearing pronation/supination (WBP/WBS) wrist positions, and the shortest ulnolunate distance (ULD) and ulnotriquetral distance (UTD) were evaluated separately for UCD in each position. Both ULD and UTD were the shortest in the WBS position in all participants, and ULD was significantly decreased compared to neutral position in the UIS group. The change in UTD did not show significant differences between the normal group and UIS group. This study demonstrated that supination may be more vulnerable than pronation to ulnar impaction syndrome.

**Keywords:** Ulnocarpal distance; ulnolunate distance; ulnotriquetral distance; stress loading; 3DCT; ulnar impaction syndrome.

**Type of study:** Level IV, case series

# Comparison of the hepatotoxicity of low-molecular-weight versus unfractionated heparin for anticoagulation therapy after digital replantation

Plast Reconstr Surg. Korea University Ansan Hosp.

Han-Jin Bae, Tae-Yul Lee

## Purpose

Unfractionated heparin (UFH) is more commonly used as an anticoagulant after digital replantation than low-molecular-weight heparin (LMWH). We compared the success and complication rates of these two anticoagulants, since only a few studies have made this comparison directly.

Methods: Forty-four patients who underwent digital replantation for complete or incomplete digital amputation in the past 7 years at a single institution were included. The patients were divided into LMWH and UFH groups according to the anticoagulant administered. The success rates for each group were obtained, and the postoperative serum aspartate aminotransferase (AST) and alanine transaminase (ALT) levels were analyzed to compare the complication rates.

Results: All patients, except one, had successful recovery of circulation after replantation, and the success rate did not show a statistically significant difference between the two groups. The statistical analysis showed that the proportion of patients with abnormal serum AST or ALT levels in the LMWH group was significantly lower than that in the UFH group.

Conclusion: Although there was no significant difference in the success rate between the two groups, the risk of hepatotoxicity was significantly lower in the LMWH group than in the UFH group. Considering the advantages of LMWH, its extensive use is highly recommended for anticoagulation therapy in patients after digital replantation.

**Table 2.** Comparison of the success rate between groups

Variable	Total (n = 44)	LMWH group (n = 10)	UFH group (n = 34)	p-value
Success or failure				> 0.999
Success	43 (97.7)	10 (100)	33 (97.1)	
Failure	1 (2.3)	0 (0)	1 (2.9) <sup>a)</sup>	

Values are presented as number (%).

LMWH, low-molecular-weight heparin; UFH, unfractionated heparin.

<sup>a)</sup>Microvascular insufficiency.

**Table 3.** Differences in liver function test results between groups

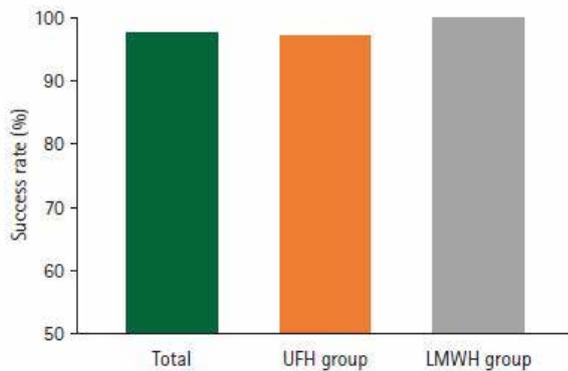
Variable	Total (n = 44)	LMWH group (n = 10)	UFH group (n = 34)	p-value
AST				0.031*
Normal	26 (59.1)	9 (90.0)	17 (50.0)	
Abnormal <sup>a)</sup>	18 (40.9)	1 (10.0)	17 (50.0)	
ALT				0.027*
Normal	25 (56.8)	9 (90.0)	16 (47.1)	
Abnormal <sup>a)</sup>	19 (43.2)	1 (10.0)	18 (52.9)	

Values are presented as number (%).

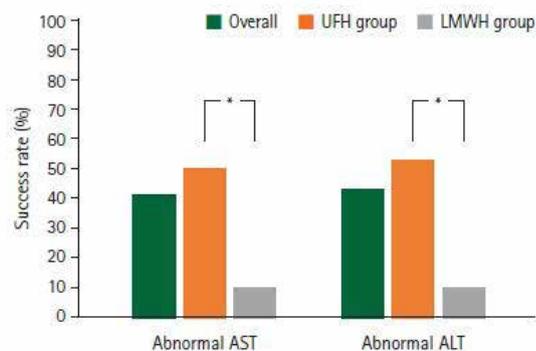
LMWH, low-molecular-weight heparin; UFH, unfractionated heparin; AST, aspartate aminotransferase; ALT, alanine transaminase.

<sup>a)</sup>Peak AST or ALT levels > 3 × upper normal limit (40 U/L for AST and 41 U/L for ALT).

\*p < 0.05, statistically significant.



**Fig. 3.** The success rates showed no difference between the two groups. LMWH, low-molecular-weight heparin; UFH, unfractionated heparin.



**Fig. 4.** The complication rates showed significant differences between the two groups in both aspartate aminotransferase (AST) and alanine transaminase (ALT) levels. LMWH, low-molecular-weight heparin; UFH, unfractionated heparin. \*p < 0.05, statistically significant.

# The Effect of Age and Gender on Range of Motion of Digits

Orthop Surg. Yeson Hosp.

Joonha Lee

## Purpose

We usually follow the guidelines of the American Medical Association (AMA) when determining treatment goals and assessing disabilities. However, these guidelines do not take into account differences in age and gender, and no research has been conducted on the normal range of motion (ROM) according to these differences. I aim to measure the ROM of digits in normal people and establish a new guideline.

## Methods

When measuring ROM in this hospital, we measure all 10 digits in addition to the injured digit. I studied the data of the healthy hand of patients who measured ROM from September 2022 to September 2024. Patients with a history of contralateral hand injury or surgery were excluded, and a total of 200 patients were included. The data were classified by gender and age group, and the ROM was compared and analyzed.

Results: In the age group of 60 years and older and male, ROM was significantly decreased. The decrease was prominent in extension of the metacarpophalangeal joint and flexion of proximal and distal interphalangeal joints.

## Conclusion

The age- and gender-specific ROM data from this study may be useful in setting treatment goals and assessing disability.

**Key Terms:** Range of Motion, Fingers, Thumb, Age Factors, Sex

Digit	Joint	Motion	Age group				Gender	
			< 40	40 ~ 50	50~60	≥ 60	Male	Female
Thumb	MCP	Extension	7.63 (13.39)	9.39 (9.74)	8.86 (12.36)	<b>0.70 (12.34)<sup>a</sup></b>	4.94 (13.01)	<b>9.05 (10.89)<sup>*</sup></b>
		Flexion	59.47 (11.43)	57.73 (9.45)	58.60 (11.01)	<b>53.45 (10.54)<sup>c</sup></b>	56.08 (10.66)	59.40 (11.54)
	IP	Extension	13.55 (12.08)	18.48 (12.08)	13.42 (9.57)	14.44 (11.42)	15.38 (11.15)	11.90 (8.69)
		Flexion	70.13 (7.84)	67.12 (8.10)	<b>64.30 (8.15)<sup>c</sup></b>	<b>59.58 (9.25)<sup>a</sup></b>	63.79 (9.33)	65.71 (9.28)
Index finger	MCP	Extension	20.79 (8.21)	16.97 (7.90)	<b>15.26 (5.38)<sup>c</sup></b>	<b>11.39 (6.49)<sup>a</sup></b>	14.46 (7.06)	<b>17.98 (6.99)<sup>*</sup></b>
		Flexion	86.84 (5.63)	86.52 (5.66)	83.51 (6.61)	<b>80.69 (7.84)<sup>b</sup></b>	83.39 (7.34)	84.52 (6.61)
	PIP	Extension	0.66 (3.32)	1.52 (5.08)	-0.44 (3.03)	0.14 (3.02)	0.03 (3.32)	1.31 (4.14)
		Flexion	101.05 (4.95)	101.36 (3.60)	97.89 (5.97)	<b>94.65 (9.76)<sup>b</sup></b>	97.15 (8.13)	<b>100.71 (4.50)<sup>*</sup></b>
	DIP	Extension	0.00 (2.85)	0.45 (2.61)	-0.35 (4.99)	-1.04 (3.55)	-0.41 (3.61)	-0.36 (4.47)
		Flexion	71.32 (7.60)	69.55 (5.64)	67.81 (8.50)	<b>60.63 (10.21)<sup>a</sup></b>	65.00 (9.92)	<b>70.60 (6.94)<sup>*</sup></b>
Long finger	MCP	Extension	20.53 (5.79)	16.97 (7.90)	<b>14.82 (6.12)<sup>c</sup></b>	<b>10.97 (6.90)<sup>a</sup></b>	14.15 (7.47)	<b>17.62 (7.01)<sup>*</sup></b>
		Flexion	89.87 (3.94)	85.91 (14.97)	86.14 (5.18)	<b>83.75 (6.43)<sup>c</sup></b>	85.57 (8.67)	87.38 (5.44)
	PIP	Extension	0.13 (4.86)	1.36 (3.81)	-0.61 (4.23)	-0.90 (3.88)	-0.60 (4.24)	<b>1.07 (3.91)<sup>*</sup></b>
		Flexion	97.50 (16.39)	101.67 (4.08)	98.42 (5.01)	<b>94.93 (12.00)<sup>d</sup></b>	96.55 (11.78)	<b>101.19 (4.10)<sup>*</sup></b>
	DIP	Extension	0.79 (4.11)	0.61 (2.42)	-0.44 (4.36)	-1.39 (4.30)	-0.32 (4.06)	-0.60 (4.31)
		Flexion	72.76 (17.46)	74.24 (5.02)	70.96 (7.35)	<b>65.14 (9.19)<sup>a</sup></b>	68.67 (11.59)	<b>73.81 (6.61)<sup>*</sup></b>
Ring finger	MCP	Extension	20.53 (5.79)	16.97 (7.90)	<b>15.00 (5.51)<sup>c</sup></b>	<b>11.25 (6.43)<sup>a</sup></b>	14.34 (7.05)	<b>17.62 (7.01)<sup>*</sup></b>
		Flexion	89.34 (4.96)	86.67 (5.10)	85.70 (6.84)	<b>83.75 (6.96)<sup>c</sup></b>	85.66 (6.49)	86.55 (6.94)
	PIP	Extension	0.26 (2.84)	1.82 (4.65)	-0.18 (3.66)	-0.07 (3.20)	0.19 (3.70)	0.60 (3.16)
		Flexion	100.79 (4.43)	101.82 (4.30)	99.21 (4.31)	<b>95.42 (9.60)<sup>a</sup></b>	97.85 (7.68)	<b>101.31 (3.50)<sup>*</sup></b>
	DIP	Extension	0.92 (2.81)	0.15 (3.18)	0.18 (4.01)	<b>-0.33 (4.04)<sup>c</sup></b>	-0.44 (4.08)	0.12 (3.90)
		Flexion	73.95 (6.49)	71.52 (4.59)	69.39 (8.30)	<b>83.85 (9.07)<sup>a</sup></b>	67.34 (9.25)	71.67 (6.31)
Little finger	MCP	Extension	20.92 (6.56)	16.82 (7.99)	<b>15.18 (5.26)<sup>c</sup></b>	<b>11.32 (6.97)<sup>a</sup></b>	14.53 (7.44)	<b>17.50 (7.09)<sup>*</sup></b>
		Flexion	86.97 (6.53)	83.94 (9.25)	85.44 (8.62)	83.26 (7.37)	84.46 (8.07)	85.60 (7.75)
	PIP	Extension	0.13 (1.83)	0.76 (4.70)	-1.32 (5.05)	-2.01 (5.97)	-1.27 (5.35)	0.24 (3.30)
		Flexion	96.32 (7.23)	98.48 (5.79)	95.35 (7.00)	<b>92.57 (12.25)<sup>d</sup></b>	94.78 (9.94)	96.07 (6.49)
	DIP	Extension	0.53 (2.26)	-1.82 (6.94)	-0.88 (4.92)	<b>-2.29 (5.43)<sup>c</sup></b>	-1.27 (5.32)	-1.31 (4.82)
		Flexion	75.66 (6.39)	74.09 (4.75)	71.58 (7.27)	<b>64.65 (10.43)<sup>a</sup></b>	69.37 (9.59)	<b>73.69 (6.63)<sup>*</sup></b>

(Table) The mean and standard deviation of the joint ROM. a: statistically significant difference with < 40, 40 ~ 50, and 50 ~ 60, b: statistically significant difference with < 40 and 40 ~ 50, c: statistically significant difference with < 40, d: statistically significant difference with 40 ~ 50, \*: statistically significant difference with male

**Room B**

# **Free Paper 1**

## **Hand I**

Plast Reconstr Surg. Keimyung Univ. **Dae Gu Son**  
Orthop Surg. Hanyang Univ. **Joo Hak Kim**

# Novel figure-of-eight reconstruction with free tendon graft for unreparable collateral ligament of the thumb metacarpophalangeal joint

Kyung Hee Univ. Hosp., <sup>1</sup>Yeson Hosp., <sup>2</sup>Kyung Hee Univ. Hosp. at Gangdong

Jong Hun Baek, Jae Hoon Lee<sup>1</sup>, Ki Hyeok Ku<sup>2</sup>

## Objectives

This study aimed to report surgical technique and clinical outcomes for a novel figure-of-eight collateral ligament reconstruction technique using palmaris longus autograft for chronic irreparable collateral ligament injury of the thumb metacarpophalangeal joint.

## Material and methods

The Jobe elbow collateral ligament reconstruction method was adapted for thumb metacarpophalangeal joint collateral ligament reconstruction. Sixteen reconstructions (7 ulnar collateral ligament, 9 radial collateral ligament) using palmaris longus autograft were reviewed retrospectively. Surgery was performed at a mean 12 months post-injury. All 16 patients were followed up for more than 1 year. Metacarpophalangeal joint radial and ulnar deviation, metacarpophalangeal and interphalangeal joint range of motion, key pinch and grip strength, Glickel functional grade and QuickDASH score were evaluated.

## Results

Preoperative radial or ulnar deviation improved from 19.38 to 5.38 postoperatively. Metacarpophalangeal range of motion improved from 31.58 to 46.68, and interphalangeal range of motion from 48.48 to 65.68. Preoperative key pinch and grip strength were respectively 49% and 81% of contralateral values and improved to 82% and 87%. On Glickel grade, 9 cases were excellent and 7 good.

## Conclusion

The novel Jobe-like figure-of-eight reconstruction technique using palmaris longus graft was useful for

reconstructing irreparable thumb metacarpophalangeal joint instability without an incision on the opposite side or an additional implant.

**Level of evidence:** Therapeutic study, level IV.

# Wrist and Hand Tuberculosis (Case Series)

Soonchunhyang Univ.

Ki Jin Jung

## Background

Wrist and hand tuberculosis is a rare disease, which is easy to be misdiagnosed, leading to delayed treatment and poor prognosis. In this study, the clinical manifestations, diagnosis, treatment, and prognosis of 13 cases of wrist tuberculosis were analyzed retrospectively.

## Methods

A retrospective study was conducted, investigating tuberculosis of the wrist, diagnosed in 13 patients from January 2013 to December 2023. Puncture biopsy confirmed the diagnosis. The study includes 6 males and 7 females, and 8 left and 10 right wrists. The average age was 55 years and ranged from 15 to 81 years. The disease course was 1 to 22 months, with an average of 13 months. The DASH score, the range of motion (ROM), grip strength, and imaging examinations were used to evaluate the postoperative recovery of the patients.

## Results

Thirteen patients were followed up for 13 to 36 months. DASH scores were improved after treatment. The range of motion (ROM) of the wrist and grip strength improved significantly when compared to those at admission.

## Conclusion

For patients with wrist tuberculosis, early diagnosis, preoperative and postoperative medical therapy, thorough focus removal, and appropriate fixation of the affected limb can help restore the function of the affected wrist, reduce the recurrence rate, and improve the quality of life.

# Improving Surgical Decision Making: A Reliable Method for Assessing Volar Subluxation in Bony Mallet Finger

Orthop Surg. Chungnam National Univ.

Seung Hoo Lee

## Purpose

This study aims to propose and validate a new qualitative method for assessing volar subluxation in bony mallet finger, focusing on the limitations of existing methods and improving surgical decision-making.

## Methods

We retrospectively analyzed 117 cases of bony mallet finger. A total of four evaluators, including three hand surgeons and one radiologist, reviewed the radiographs and assessed volar subluxation using subjective evaluation, the concentric circle method, and the malalignment method (conventional method). The concentric circle method was developed to address the limitations of existing methods by defining volar subluxation as the disruption of a single circular patterns formed by the distal interphalangeal joint.

## Results

Volar subluxation was confirmed in 55 cases (48.2 %) based on evaluators consensus. The concentric circle method demonstrated a higher average accuracy (92.3%) compared to subjective assessment and malalignment method, with higher sensitivity, specificity, and excellent intra- and interobserver reliability.

## Conclusion

The concentric circle method offers a more reliable and accurate assessment of volar subluxation in bony mallet finger compared to subjective and malalignment methods. Its clearer and more objective definition of volar subluxation has the potential to enhance surgical decision-making.

**Key words:** Volar subluxation; Bony mallet finger; Concentric circle method; Radiographic assessment; Surgical decision-making

# Surgical management of delayed presentation of mallet finger fracture by Two-extension block technique with dorsal counter force technique

Orthop Surg. Chungnam National Univ.

Seung Hoo Lee

## Purpose

This study assessed the efficacy of combining the “two-extension block technique” and the “dorsal counterforce technique” for treating delayed bony mallet fractures (4 weeks or more), previously introduced to prevent fracture fragment rotation in axial and sagittal planes in acute cases.

Method: A total of 29 delayed bony mallet fractures were treated using percutaneous curettage followed by the two-extension block technique, incorporating the dorsal counterforce technique for cases of inadequate reduction. If we failed to achieved satisfactory reduction, we converted to open procedure. Outcomes were evaluated over 6 months after surgery, focusing on healing time, range of motion, complications, and Crawford functional outcomes.

## Results

Out of 29 delayed bony mallet fractures, 13 patients were treated by percutaneous curettage and two-extension block technique, and 15 patients required additional dorsal counterforce technique. One case required conversion to open procedure due to failure of restoration of congruent joint surface, and exclude from the outcome assessment. All of the 28 fractures which were treated by our suggested method had healed within 8 weeks, and 24 patients (85.7%) within 6 weeks. According to the Crawford’s evaluation system, the outcomes were excellent in 17 patients, good in 7 patients, fair in 3 patients and poor in 1 patient.

Conclusion: Two-extension block pinning with dorsal counterforce technique could be a feasible option for delayed bony mallet fractures, achieving congruent joint surface and satisfactory outcomes in the majority of cases.

## Clinical relevance

This study introduces an efficient surgical method for the closed treatment of delayed bony mallet fractures.

Level of evidence: IV

**Key words:** Chronic bony mallet; Chronic mallet fracture; Two extension block; Extension block; Dorsal counterforce technique

# Ligament Reconstruction Tendon Interposition Arthroplasty in the Trapeziometacarpal Joint Osteoarthritis of the Thumb

Orthop Surg. Soo Hospital, Presbyterian Medical Center<sup>1</sup>

Byung Ho Lee, Han A Lee, Jun Mo Lee, Byeong Heon Choi<sup>1</sup>, Kyung Tae Kim<sup>1</sup>

**Background** The purpose of this clinical study was to identify the effectiveness of Eaton and Littler's ligament reconstruction tendon interposition arthroplasty in restoring a pain-free, stable, and functional thumb. Pain, grip strength, radiologic findings and deep anterior oblique ligament state on MRI were assessed pre and postoperatively to obtain excellent clinical outcomes.

**Methods** Among 24 cases in 23 patients(19 women, 4 men) from September 2019 to August 2024, the average age was 66.1 years(range 51-90). 1 case(4%) was bilateral and the left thumb was involved in 16 cases(66.7%) and the right in 8 cases(33.3%). All cases had pain and decreased tip and lateral grip strength using the thumb and second finger. Radiologic findings showed stage I in 4 cases(16.7%), stage II in 11 cases(45.8%), stage III in 8 cases(33.3%) and stage IV in 1 case(4.2%) by Eaton and Glickel classification and deep anterior oblique ligaments were damaged in 24 cases on MRI. Ligament reconstruction tendon interposition in the trapeziometacarpal joint of the thumb was performed with a strip of flexor carpi radialis tendon.

**Results** Average 2.7-year follow-up, pain in the trapeziometacarpal joint of the thumb was subsided and tip and lateral grip strength using the thumb and second finger increased in 24 cases. On radiology osteoarthritis in the trapeziometacarpal joint of the thumb was improved. On the final MRI, damaged deep anterior oblique ligaments were not visible because of the deviation of its course after reconstructive ligament reconstruction procedures. No complication was found except temporary sensory hypesthesia of the radial nerve at dorsum of the first web space in 3 cases(12.5%). Excellent final outcomes in 23 cases(96%) and good 1 case(4%) were achieved.

**Conclusions** Eaton and Littler's ligament reconstruction tendon interposition arthroplasty was one of the best surgeries in trapeziometacarpal osteoarthritis of the thumb.

# Static External Fixator and Concomittant K-wire Fixation for Pilon Type Fracture of the Proximal Interphalangeal Joint of the Finger

Orthop Surg. Eulji Univ.

Seong Ju Choi

## Hypothesis

Fracture-dislocation and pilon injuries of the proximal interphalangeal joints (PIPJ) continue to pose significant management challenges. In this study, we report clinical and radiographic outcomes of a pilon type fracture-dislocation of the proximal interphalangeal joint of the finger using static external fixator and concomittant K-wire fixations.

## Methods

Static external fixator and K-wire fixations were applied for 6 pilon type PIPJ fractures. The joints involved were 3rd PIPJ in 1 patient, 4th PIPJ in 3 patients, and 5th PIPJ in 2 patients. The mean age of the patients was 41.7 (range, 27 ~ 52) and mean follow-up duration was 7.7 months (range, 4 - 12 months). All patients were clinically and radiologically assessed on an outpatient basis after being discharged.

## Results

At the final follow-up, the mean range of motion of PIP joints in flexion was 99.5° (flexion range, 85°-110°), the mean extension lag was 5.0° (extension range, 0°-15°), and the mean visual analogue scale score was 0.7. On anteriorposterior and lateral radiographs, congruity of the joint was satisfactory and distal interphalangeal joint stiffness was found in one cases.

## Summary

We attained satisfactory clinical outcomes on the recovery of joint movement and joint congruity after treating PIP joint fracture-dislocation injury with multiple K-wire fixation using static external fixator.

**Key Terms:** Proximal interphalangeal joint, fracture-dislocation, pilon injury, external fixator

## Changes of force generation by two types of finger striking methods

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Kun Hwang<sup>1, 2</sup>, Hun Kim<sup>3</sup>

Acute sagittal injury in boxer's knuckle causes subluxation of the extensor tendon. We analyzed anatomical measurements for each hand part related to posture and measured the force generated when striking the fingers. In 120 healthy adults (55 men, 65 women), palm area, finger length, finger length, finger circumference, and wrist circumference were measured. Using a digital force gauge, force generated by striking with finger flexion (FFF) performed by middle finger was measured. Forces generated by striking with finger extension (FEF) by the index and ring finger were also measured. The force exerted by the hand and fingers was measured using a grip force meter. SPSS was used to identify relationships between measured values by sex and age.

The FFF of the middle finger was  $12.9 \pm 7.0\text{N}$ , and the FEFs of the index and ring fingers were  $6.8 \pm 2.5\text{N}$  and  $5.8 \pm 2.3\text{N}$ , respectively. The grip force was  $343.3 \pm 134.7\text{N}$  in the four fingers excluding the thumb,  $108.4 \pm 41.6\text{N}$  in the index finger,  $110.5 \pm 45.4\text{N}$  in the middle finger, and  $83.6 \pm 36.5\text{N}$  in the ring finger. FFF of the middle finger was significantly greater in men ( $17.9 \pm 6.6\text{N}$ ) than in women ( $8.6 \pm 3.9\text{N}$ ) ( $p < .001$ ). FEF of the index finger and ring finger were significantly greater in men ( $8.5 \pm 2.0\text{N}$  and  $7.1 \pm 2.2\text{N}$ , respectively) than in women ( $5.3 \pm 1.7\text{N}$  and  $4.7 \pm .8\text{N}$ ) ( $p < .001$ ). Cross-analysis results showed differences by sex and age. Circumferences of the index finger was greater than ring finger.

The results of this study will help to understand the relationship between the forces generated in the process of finger flicking. Supported by grant from ROK Ministry of National Defense (ROK-MND-2023-KMMRP-020).

**Room B**

# **International Session 1**

## **Brachial Plexus**

Orthop Surg. Korea Univ. **Jong Woong Park**  
Raon Plastic Surgery **Seongeon Kim**

# Nerve Transfers For Upper Type Brachial Plexus Injuries

University of the Philippines, Manila

Emmanuel Estrella

Upper type brachial plexus injuries can be as high as 45-50% in some large case series. The primary goals of reconstruction include the restoration of shoulder and elbow function. Nerve transfers in upper and extended upper-type brachial plexus injuries result in significant improvements in DASH scores, in muscle strength recovery of  $\geq$ M4 elbow flexion and shoulder function, especially those with C5-6 only injuries. Improvement can still be expected in patients with longer follow-up. Additional nerve transfers can also improve function for extended upper type brachial plexus injuries involving paralysis of the elbow extension and wrist extension. The double nerve transfers for both shoulder and elbow nerve reconstruction tend to result in greater muscle strength and range of motion compared to single nerve transfers, especially in shoulder external rotation. Additional nerve grafting, if available, can also help improve function in these types of patients, especially in external rotation and elbow extension. The effect of surgical intervention within 6 months tend to have a significant effect on the recovery of shoulder function compared to elbow flexion. In upper type injuries of the brachial plexus of more than 12 months, nerve transfers may still have a role in the restoration of shoulder and elbow function.

# Contralateral C7 Transfer for Brachial Plexus Birth Injury Reconstruction: A Matched Cohort Study

Shriners Children's Philadelphia (US)

Eugene Park, Tim Irwin, Benjamin K. Gundlach, Scott H. Kozin, Dan A. Zlotolow

## Introduction:

Contralateral C7 (CC7) nerve transfer for the management of brachial plexus birth injury (BPBI) remains a controversial treatment option. In the setting of global injuries with three or more root avulsions, there remain few other options to provide healthy axons into the injured extremity. The aim of this study is to compare the results of global BPBI treated with CC7 to patients treated with only nerve grafting and non-CC7 nerve transfers.

## Methods

A retrospective review of the Shriner's Hospital for Children - Philadelphia patient database was performed between the years 2010 - 2019. Patients who underwent CC7 with a minimum of two years follow up were included. An equal number of patients with global injuries treated with available root grafting and local nerve transfers were selected as a comparison group. Matching for patient demographics or exact injury was not performed. Pre-operative and follow up AMS scores were collected.

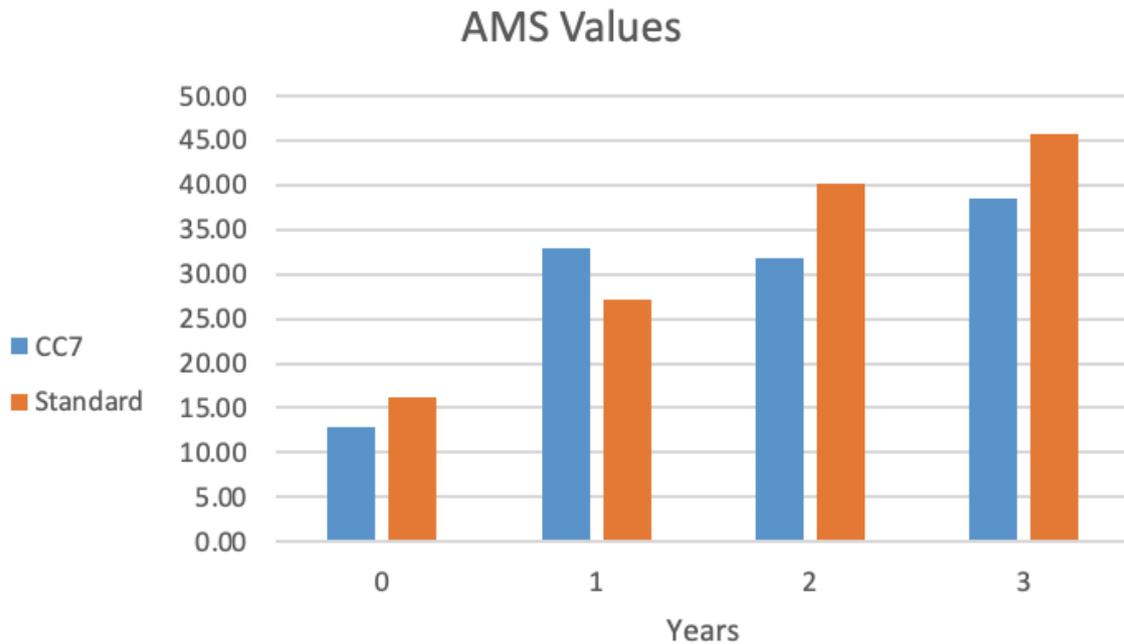
## Results

Six patients underwent CC7 at a mean age of 5.2 months. Mean follow up from surgery was 40 months. The recipient of the CC7 was the lower trunk in two patients, C7/C8 in three patients, and C7 in one patient. Six patients who were managed with only available root grafting, and intercostal and/or spinal accessory nerve transfer were chosen as comparison. At 3 years post-surgery, mean total AMS was 38.50 in the CC7 groups vs 45.67 in the comparison group; thumb flexion was 4.75 in the CC7 group, compared to 2.00 in the comparison group; and finger flexion was 3.50 in the CC7 group vs 3.25 in the comparison group. There were no long-lasting deficits in the donor extremity. A single patient sustained partial laceration to the posterior division of

lower trunk, which was repaired, with fully recovery by 6 months.

## Conclusion

CC7 transfer can provide functional lower trunk recovery in BPBI patients with two or fewer available roots, as evidenced by multiple patients in our cohort developing an AMS of 7 in both finger and thumb flexion.



Graph 1: Total AMS values over time in both CC7 (blue) and Standard (orange) treated patients

AMS	Finger Flexion			AMS	Thumb Flexion		
	0-2	3-5	6-7		0-2	3-5	6-7
CC7	2	0	4	CC7	2	2	2
Standard	4	1	1	Standard	4	1	1

Table 1: Distribution of AMS values for finger flexion and thumb flexion at patient's last documented follow up.

# Functional Hand Reconstruction in Pan-Brachial Plexus Injury

Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital  
Mahidol University, Bangkok, Thailand

**Yuwarat Monteerarat**

Restoring finger flexion in patients with total arm type brachial plexus injury (BPI) presents a significant challenge due to the extensive nerve damage affecting the upper limb. This presentation aims to showcase the various surgical options available for restoring finger flexion and share clinical outcomes based on Siriraj Hospital's experience.

The presentation will then highlight three specific strategies for the direct restoration of finger flexion:

1. Nerve transfer combined with hemicontralateral C7 to median nerve transfer, a technique pioneered by Professor Panupan Songcharoen at Siriraj Hospital. This technique uses the C7 nerve from the contralateral side to restore median nerve function, leading to the reinnervation of the flexor muscles in the hand.
2. Staged procedure with primary reconstruction of elbow flexion and shoulder stabilization, followed by secondary reconstruction with wrist and 1st carpometacarpal (CMC) fusion, and tensor fascia lata transfer for restoring finger flexion. This approach aims to reanimate elbow flexion and finger movement, with wrist fusion providing a stable base for improved hand function.
3. For cases where nerve transfer is not feasible due to delayed presentation or extensive nerve injury, we will also discuss the option of Double Free Functional Muscle Transfer (FFMT). This procedure uses one or two-stage gracilis muscle transfers to restore both elbow flexion and hand function, providing a reliable solution for reanimating hand movements in severely affected patients.

Throughout the presentation, we will show case examples from Siriraj Hospital's experience with each of these approaches, illustrating the outcomes and challenges associated with each technique. The presentation will conclude with an overview of our current protocol, which combines these strategies to provide individualized treatment based on the patient's specific condition and timing of presentation.

# Spinal Accessory to Suprascapular Nerve Transfer: Anterior vs Dorsal approach

Orthop Surg. Ulsan Univ.

Jae Kwang Kim

Spinal accessory to suprascapular nerve transfer is the most commonly used method for restoration of the function of the supraspinatus and infraspinatus muscles. Spinal accessory to suprascapular nerve transfer has been traditionally performed from the anterior approach [1-3]. This supraclavicular approach enables revision of the proximal parts of the brachial plexus. However, it does not allow exploration of more distal lesions, especially in the region of the scapular notch. Transfers performed proximally to the injury may cause failure of the reinnervation of supraspinatus muscle. The posterior approach was firstly described by Colbert et al. in 2006 [4]. The advantage of this technique is that as the neurotization is more distal reinnervation times are shorter [4]. The only study comparing both approaches showed better external rotation achieved by the posterior neurotization technique [5]. However, the differences between the two approaches in dual nerve transfers remain unclear. The aim of this presentation was to perform a review on both methods of suprascapular nerve reconstruction in order to determine the most suitable technique for restoration of shoulder abduction.

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**Room B**

## **International Session 2**

Orthop Surg. Seoul Hyun Hosp. **Hyun Dae Shin**  
Gwangmyeong Sungae General Hosp. **Dong Chul Lee**

# Paediatric Hand Injuries

Yong Loo Lin School of Medicine, National University Hospital (Singapore)

**Alphonsus Chong**

This presentation explores the presentation and management of hand injuries in children, emphasizing their distinct characteristics compared to adults. The most common injuries include hands wounds and fractures. There are unique features of pediatric hand anatomy, such as the presence growth plate locations of the bones and their variations, which influence assessment and treatment strategies. Common causes of injury are identified, alongside a review of frequent misdiagnoses. I will focus on specific fractures, including fingertip injuries, Seymour fractures, and proximal phalanx base and neck fractures, detailing their diagnosis and management. The importance of early intervention is stressed, as well as the potential for conservative treatment in certain cases of displaced fractures. The care of children with hand injuries requires a careful assessment approach and an understanding of the role of growth and remodeling in recovery outcomes for young patients.

# DIC/ DRC/ SL Ligament Reconstruction in Chronic Static SL Dissociation

FHKCOS, FRCSEd(Orth), FHKAM (Orth Surg), MRCS, MBChB

Clara Wong Wing-yee

## Introduction

Scapholunate stability is maintained not only by the intrinsic scapholunate ligament but also by key dorsal extrinsic ligaments, namely the dorsal intercarpal ligament (DIC) and the dorsal radiocarpal ligament (DRC). In acute scapholunate dissociation, the mechanism of injury usually not only damage the intrinsic but also the extrinsic ligaments. In cases of chronic scapholunate instability, the mechanical load from the thumb through the scapho-trapezium-trapezoid joint onto the scaphoid, and from the ulnar hand through the carpometacarpal joint onto the lunotriquetral complex, results in the scaphoid adopting a flexion and pronation position, while the lunate and triquetrum adopt an extension and pronation position. Over time, the DIC and DRC ligaments become attenuated. Therefore, in chronic static and reducible scapholunate dissociation, reconstructing not only the scapholunate ligament but also the DIC and DRC ligaments is both logical and beneficial. This study presents the radiological and functional outcomes of patients who underwent DIC/DRC/SL ligament reconstruction using autologous tendon grafts.

## Method

This retrospective study was conducted from May 2021 to August 2023. Seven patients with chronic static reducible scapholunate dissociation were treated with DIC/DRC/SL ligament reconstruction. All of them were male and sportsman. Patients were followed for a minimum of one year. Radiological assessments (scapholunate angle, radiolunate angle, radioscaploid angle, and scapholunate interval) and clinical and functional performance (visual analog scale, DASH, Mayo wrist score) were recorded.

## Results

All patients demonstrated significant improvements in radiological and clinical functional performance post-operatively. One patient experienced K-wire migration, infected and another Kwire later breakage after early sports participation, necessitating a second operation for removal and reinsertion. Although the scapholunate interval was widened, it showed improvement compared to the pre-operative status.

## Conclusion

DIC/DRC/SL ligament reconstruction is a biologically and biomechanically sound, straightforward, and effective technique for addressing chronic static reducible scapholunate dissociation, yielding favorable outcomes.

# Complications of wrist arthroscopy

Godrej Memorial Hospital (India)

Pankaj Ahire

Apart from complications related to any surgical procedure like infection, or those related any arthroscopic procedure (equipment failure), wrist arthroscopy has possibility of peculiar complication owing to the uniqueness of the region.

Various studies have quoted complication rates from 2% to 6%.

The commonest complications listed in these studies are:

1. Equipment failure
2. Injuries due to traction devices
3. Iatrogenic cartilage injury
4. Injury to sensory nerves around the wrist
5. Extensor tendon injury
6. Failure to achieve the intended goal of surgery

I present an unusual complication of damage to dorsal extrinsic ligaments of the wrist, which necessitated an attempt at reconstruction and eventually lead to a salvage surgery in a 22 year old male.

I hypothesise that this injury happened due to uncontrolled traction during the arthroscopy procedure for an unrelated pathology.

# The Spastic Elbow: Evaluation and Management

Mayo Clinic, Rochester, MN

Peter Charles Rhee

## Background

An injury to the upper motor neuron (UMN) can result in a constellation of symptoms including impaired regulation or loss of voluntary movement, easy fatigability, altered muscle tone, exaggerated deep tendon reflexes or a velocity-dependent hyperexcitability of muscle activation otherwise known as spasticity. Deformities of the upper limb can occur from spasticity that creates muscle imbalance across a joint which could lead to muscle and pericapsular joint contractures.

## Lecture Content

The spastic elbow most commonly results in a flexed elbow posture primarily from the spastic and/or contracted biceps, brachialis, and brachioradialis that overpower the weak or paralyzed triceps. Evaluation of the spastic elbow should focus on the ability of the patient to meaningfully and intentionally activate the elbow flexors and extensors, determine if the deformity is primarily due to spasticity (increased muscle tone without limitation in passive range of motion) versus muscle contracture (full arc of physiologic range of motion is not possible), recognizing that both spasticity and muscle contracture can co-exist. Surgical techniques to correct the spastic flexed elbow deformities is based upon the presence or absence of volitional motor control and spasticity versus contracture. In general, spastic deformities are effectively corrected with peripheral-nerve based procedures, such as hyperselective and partial selective motor neurectomies, which are intended to alter the overactive reflex arc that results in spasticity. Otherwise, muscle contractures require muscle lengthening procedures, such as muscle origin release, fractional lengthening, or Z-lengthenings. Some severe elbow flexion contractures may require soft tissue rearrangement over the antecubital fossa and/or ulnohumeral joint releases.

## Discussion and Conclusion

Spastic elbow deformities can markedly affect patient's quality of life and function. The goal of correcting the spastic elbow deformity is to identify the predominant driver of the deformity, spasticity versus contracture, and if the patient has preserved volitional control of the muscle. Lastly, the surgical technique should be selected to optimize the achievement of the patient's goals.

**Room B**

# **KSSH 'W Grand Lecture'**

W Hosp. **Sang Hyun Woo**  
Yeson Hosp. **Goo Hyun Baek**

# Surgery for Volkmann Ischaemic Contracture (VIC)

Ganga Hospital (India)

Raja Sabapathy

VIC is a spectrum with very minor contracture of a couple of fingers to total loss of muscles, nerves and soft tissues that occurs as a sequelae of missed or inappropriately treated acute compartment syndrome.

VIC affects all tissues in variable proportion. The sequence of surgery and the type of procedure are chosen according to the level of involvement. If the fingers are insensate, early decompression is advised, when the opportunity is taken to debride all dead muscles and release the scar tissues. Neurolysis yields good results in children and most adults with recovery of intrinsics when the nerves are decompressed early. Even in situations of total loss of flexor compartment and loss of nerves useful function can be achieved by nerve grafting and free functioning Gracilis muscle transfer. FFMT has revolutionized the outcome in severe VIC. When FFMT is performed in patients with no recovery of intrinsics, a separate procedure is needed for claw correction to maximize the outcome of the FFMT. By a combination of procedures, it is now possible to obtain a useful hand even in the most severely affected VIC hand.

The decision making, and technical determinants to get a good outcome will be elucidated in the W Grand Lecture

# Searching for Changes: 35 + year's Career at Chang Gung Memorial Hospital

Wan Fang Hospital, Taipei Medical University (Taiwan)

David Chwei-Chin Chuang

I have been a qualified plastic surgeon for more than 40 years since 1983. From a rookie to a world recognized expert (I was elected as the president of WSRM, World Society for Reconstructive Microsurgeon, in 2015) it took me 30 years.

I briefly classify the plastic surgeons into two groups: group A surgeons without ambition: they always follow the routine process, have a rather easier life, and inertia for changes; and group B surgeons: they continuously search for potential changes, have adventure and ambition, and great contribution. The end results are that the group A doctors are progressively knocked out and disappear in his Society and market, but the group B doctors are continuously searching for changes and tend to continue grow in the Society and markets. The group B doctors achieve numerous honors and awards and great business. In the lecture, many evidences of people and materials are shown to evidence my thought. If you stay without changes, you will lose your market and disappearance. However, if you are continuously searching for changes, you will survive in your markets and get numerous benefits.

The so called potential changes are from device promotion and naïve promotion from my point of views. The device promotion includes traditional microscopy, supermicroscopy and their microinstruments, fat injection gum, CAD/CAM virtual surgery, robotic surgery et cetera. Navie promotion includes anatomy refinement, technique refinement, experience refinement, animal research refinement et cetera. In this talk, I will show many evidences from materials and people including me.

Finally, I use words from Michelangelo Buonarroti, "Change is no trifle and only changes can make perfection", and I modified it as "Trifles make perfection and perfection is no trifle" for my conclusion.

**Room B**

# Travelling Fellowship

Orthop Surg. Hallym Univ. **Bong Cheol Kwon**  
Plast Reconstr Surg. Inha Univ. **Sae Hwi Ki**

# Trans-Osseous One-Tunnel Technique in Arthroscopic TFCC Repair: Pearls and Pitfalls

<sup>1</sup>National Health Insurance Service Ilsan Hospital, <sup>2</sup>Korea University

Jun-Ku Lee<sup>1</sup>, Jong Woong Park<sup>2</sup>

## Introduction

The triangular fibrocartilage complex (TFCC) is a combination of anatomical structures that stabilize the distal radioulnar joint (DRUJ) and transmit load across the wrist. When patients experience traumatic TFCC tears that fail conservative treatment, leading to ulnar-sided wrist pain and DRUJ instability, surgical intervention becomes necessary.

Arthroscopic-assisted techniques have become more popular due to their less invasive nature and reduced soft tissue damage. However, many variations of the procedure have been introduced, and no single technique has been universally accepted as the gold standard.

Recently, there has been an increased emphasis on repairing the proximal component of the TFCC, particularly the foveal attachment. The introduction of TFCC bone tunnel guides has facilitated proximal component foveal reattachment by allowing sutures to pass through a bone tunnel in the distal ulna. This presentation introduces a technique for trans-osseous TFCC repair using a relatively large, single bone tunnel.

## Surgical Procedure

- **Diagnosis:** Confirmation of the foveal tear is achieved using MRI, radiographs, and arthroscopic examination.
- **Surgical Approach:** A small joint arthroscope is used for visualization through the 3-4 viewing portal, with 4-5 or 6R as working portals. A single transosseous tunnel is created in the ulnar bone, approximately 1.0~1.5cm distal to the ulnar styloid process.
- **Bone Tunnel:** The tunnel is progressively widened to 3.5 or 4.0 mm in diameter.
- **Suturing:** High-tensile sutures (non-absorbable) are passed through the bone tunnel and TFCC to repair the tear. A cruciform suture configuration is used for enhanced stability, and the sutures are anchored securely to

the bone.

- Postoperative Care: Patients are immobilized with 2-week sugar-tong splint followed by an additional 4 weeks short arm cast (JW Park) or Munter-type brace for six weeks (JK Lee). After 6 weeks, range-of-motion exercises are initiated, and strength training begins at three months post-surgery. Full return to activity is expected after six months.

## Pearls

1. Large-Diameter Tunnel: Stepwise widening of the bone tunnel (up to 4 mm) facilitates easier and various suture placement and allows for a wider knot, increasing the strength of the repair.
2. Multiple Sutures: An average of two sutures can be passed through the bone tunnel. The cruciform configuration with two foveal sutures enhances stability by evenly distributing tension, reducing the risk of re-tear. The configurations of suture can be modified according to the site and shape of TFCC tear.
3. No DRUJ Portal Required: The procedure can be completed without the need for a separate DRUJ portal for debridement and refreshment of foot-print of foveal insertion.
4. Enhanced Healing: Drilling the transosseous tunnel stimulates cancellous bone bleeding, which aids in the healing of the TFCC-bone interface, especially in chronic cases.
5. Avoiding Ulnar Styloid Injury: Stepwise drilling and careful tunnel placement minimize stress on the ulnar styloid, reducing the risk of fractures or other complications.

## Pitfalls

1. Tunnel Placement: Improper tunnel placement—too close to the ulnar styloid or in a thin section of bone—can result in fractures or unstable fixation.
2. Narrow Tunnels: Creating a tunnel that is too narrow limits the ability to achieve adequate fixation, potentially leading to poor tension on the TFCC or tearing of the repaired tissue.
3. Limited Indications for Ulnar Impaction: This technique is not recommended for patients with significant ulnar impaction syndrome unless it is combined with ulnar shortening osteotomy.

# Clinical Outcomes of Arthroscopic All-inside Knotless Fovea Repair Treating Atzei Class II and III Triangular Fibrocartilage Complex Tear

Department of Orthopedic Surgery, MacKay Memorial Hospital, Taipei, Taiwan

Min-Yao Chuang

## Introduction

Foveal attachment of the triangular fibrocartilagenous complex (TFCC) is essential for distal radioulnar joint stability. Controversy still exists as to which is the best treatment in case of foveal lesions. Actual arthroscopic techniques either require mini open steps or are complex and expensive. A simplified all inside knotless repair is introduced to provide a strong bony fixation in the fovea. This study is to evaluate the clinical outcomes in patients of TFCC tear, Atzei class II and III, underwent all-inside arthroscopic fovea repair with one knotless anchor.

## Materials and Methods

From March 2019 to March 2023, 55 patients presenting with Atzei calss II and III lesions of the TFCC were operated on with this technique. Clinical evaluations were based on a compared measurement of the grip strength, pain on a visual analogic scale (VAS), ranges of motion, and distal radioulnar joint (DRUJ) stability. Functional scores including Mayo modified wrist score (MMWS) and Quick disability arm, shoulder and hand (DASH) were also evaluated.

## Results

On postoperative evaluation, pain was reduced by 4.5 points and grip strength averaged 84% of the unaffected side. Range of motion averaged 92% on the unaffected side. Average values of MMWS and Quick Dash were 83.4 and 17.8. There were no major complications, except two patients had complex regional pain syndrome. The anchor dislodge was noted in one patient six months postoperative. Recoverable neuropraxia of the dorsal sensory branch of the ulnar nerve were noted in three patients.

## Discussion

This simplified arthroscopic technique uses a single suture anchor placed in the ulnar fovea to achieve strong bony fixation. Repairs performed with this technique can reduce irritations of soft tissues and the results achieved seem to be similar to those obtained with conventional open or arthroscopic techniques, although further investigation with an increased number of patients and follow-up are required.

## Conclusion

Arthroscopic all-inside knotless fovea repair could be an alternative treatment in Atzei class II and III lesions of the TFCC. This minimal-invasive fashion can provide benefits regarding healing potentials and cosmetics.

# The Stabilizing Effect of the Distal Interosseous Membrane on the Distal Radioulnar Joint in an Ulnar Shortening Procedure : A Biomechanical Study

Investigation performed at the Mayo Clinic, Rochester, Minnesota

Sayuri Arimitsu, Hisao Moritomo, Takashi Kitamura,  
Lawrence J. Berglund, Kristin D. Zhao, Kai-Nan An, and Marco Rizzo

## Background

The importance of the stabilizing effect of the distal interosseous membrane on the distal radioulnar joint, especially in patients with a distal oblique bundle, has been described. In clinical settings of ulnar shortening procedure, we sometimes encounter difficulties in achieving the desired amount of shortening due to increased tension when approximating the ulnar bone ends following osteotomy. We hypothesized that the increased tension of the distal interosseous membrane with ulnar shortening improve DRUJ stability. The purpose of this study was to evaluate the stability of the distal radioulnar joint after an ulnar shortening osteotomy and to quantify longitudinal resistance to ulnar shortening when the osteotomy was proximal or distal to the ulnar attachment of the distal interosseous membrane. These relationships were characterized for forearms with or without a distal oblique bundle.

## Methods

Ten fresh-frozen cadavers were used. A transverse osteotomy and ulnar shortening was performed proximal (proximal shortening) and distal (distal shortening) to the ulnar attachment of the distal interosseous membrane. Distal radioulnar joint laxity was evaluated as the volar and dorsal displacements of the radius relative to the fixed ulna with 20 N of applied force. Testing was performed under controlled 1-mm increments of ulnar shortening up to 4 mm, with the forearm in neutral alignment, 60 of pronation, and 60 of supination. Resistance to ulnar shortening was quantified as the slope of the load-displacement curve obtained by displacing the distal ulnar segment proximally.

## Results

In proximal shortening, significantly greater stability of the distal radioulnar joint was obtained with even 1 mm of shortening compared with the control, whereas distal shortening demonstrated significant improvement in stability of the distal radioulnar joint only after shortening of 4 mm in all rotational positions. Significantly greater stability of the distal radioulnar joint was achieved with proximal shortening than with distal shortening and in specimens with a distal oblique bundle than in those without a distal oblique bundle. The longitudinal resistance to ulnar shortening was significantly greater in proximal shortening than in distal shortening. The stiffness in proximal shortening was not affected by the presence of a distal oblique bundle in the distal interosseous membrane.

## Conclusions

Ulnar shortening with the osteotomy carried out proximal to the attachment of the distal interosseous membrane had a more favorable effect on stability of the distal radioulnar joint compared with distal osteotomy, especially in the presence of a distal oblique bundle.

## Clinical Relevance

When ulnar shortening osteotomy is performed, there is a stabilizing effect on the distal radioulnar joint because of increased tensioning of the distal interosseous membrane. To improve distal radioulnar joint stability, it is important to preserve the ulnar attachment of the distal interosseous membrane, which requires that the osteotomy should be located 70 mm proximal to the ulnar styloid.

# Arthroscopic Management of Synovial Chondromatosis of the Elbow

Department of Orthopaedics and Traumatology, North District Hospital, Hong Kong SAR

Slocum, Amanda Mun Yee, Lui Tun Hing

## Introduction

Synovial osteochondromatosis is a rare benign proliferative disease of the synovial membrane, typically resulting in formation of multiple loose bodies and progressive joint damage. Patients may complain of pain, stiffness, locking or neurological symptoms. We reviewed the clinical presentation and imaging findings of patients diagnosed with synovial osteochondromatosis of the elbow, as well as the results from arthroscopic management of those patients who failed conservative management.

## Methods

Between 2009 and 2023, 10 patients diagnosed with synovial osteochondromatosis of the elbow were retrospectively reviewed. 6 were male and 4 were female. The mean age at diagnosis was 57.2 years' old. 1 patient had bilateral elbow involvement. All patients presented with reduced range of elbow motion. 8 patients complained of elbow pain and 5 patients had locking symptoms. 2 patients complained of neurological symptoms. Imaging findings revealed 8 elbows with predominant anterior compartment involvement, 1 elbow with predominant posterior compartment involvement and 2 elbows with similar involvement of both compartments. All elbows had mild to moderate osteoarthritic changes on imaging. Eventually, 5 patients underwent arthroscopic synovectomy and removal of loose bodies.

## Results

The mean follow-up was 36.2 months. All patients who underwent surgery achieved complete pain relief, resolution of locking symptoms and slight improvement in the range of elbow motion (mean improvement in elbow extension = 12°, elbow flexion = 8°). One patient who had numbness at the middle and ring finger before the

operation reported complete symptom relief after the operation. All patients were satisfied with the procedure. No recurrence was noted upon latest follow-up. There were no complications reported.

### **Conclusion**

Arthroscopic management of synovial osteochondromatosis of the elbow is a safe and effective method in providing symptomatic relief.

**Room B**

# **Free Paper 8**

## **Neuropathy**

Plast Reconstr Surg. Chonnam National Univ. **Jae Ha Hwang**  
Orthop Surg. Yeungnam Univ. **Sam Guk Park**

# Comparative Outcomes of Revision Carpal Tunnel Release with External Neurolysis Versus Primary Carpal Tunnel Release: A Propensity-Matched Study

National Health Insurance Service Ilsan Hospital

Jun-Ku Lee

## Background

Carpal tunnel syndrome (CTS) is a common neuropathy of the upper limb, with carpal tunnel release (CTR) being a widely performed surgical intervention when conservative treatments fail. However, up to 20% of patients experience persistent or recurrent symptoms, and up to 12% may require revision surgery. This study aims to evaluate the outcomes of revision CTR with external neurolysis compared to primary CTR using propensity score matching.

## Methods

This retrospective single-center cohort study included patients who underwent primary and revision CTR between March 2021 and February 2024. A total of 38 patients were analyzed, with 19 patients undergoing revision CTR (Group 1) and 19 patients undergoing primary CTR (Group 2). Propensity score matching was used to ensure comparability between the groups based on age, weight, height, body mass index (BMI), comorbidities, and the operated arm. Clinical outcomes were assessed using the Visual Analog Scale (VAS) for pain and the Boston Carpal Tunnel Questionnaire (BCTQ) for symptom severity and functional status. Results: Patients in Group 1 initially presented with significantly higher VAS scores compared to Group 2 (8.1 vs. 6.5,  $p = 0.001$ ). However, after an average follow-up of 13.9 months, the BCTQ scores for symptom severity scale (SSS) and functional status scale (FSS) in Group 1 were comparable to those in Group 2 (SSS: 17.4 vs. 17.4,  $p = 0.393$ ; FSS: 14.9 vs. 14.9,  $p = 0.101$ ). No significant differences in CTS severity grades were observed between the groups preoperatively. One patient in Group 1 experienced symptom recurrence 18 months postoperatively, but no other complications were reported.

## Conclusions

This study highlights that revision carpal tunnel release with external neurolysis can effectively manage persistent or recurrent carpal tunnel syndrome, though patients may require a longer recovery period to achieve outcomes similar to those undergoing primary CTR.

# A Clinical Application Study on Ultrasonographic Cross Sectional Area of Median Nerve at the Wrist in Patients with Carpal Tunnel Syndrome

Orthop Surg. Korea Univ.

Ma. Loren Josephine Lantin, Yeongyoon Koh, Minsu An, In Cheul Choi, Jong Woong Park

## Purpose

This study aims to evaluate the usefulness of the ultrasonographic cross-sectional area of the median nerve at the wrist (CSA-W) by examining the correlation between CSA-W measurements and electrophysiologic severity in patients who underwent endoscopic carpal tunnel release (ECTR) for carpal tunnel syndrome (CTS). Additionally, it investigates whether changes in CSA-W after surgery can predict symptom improvement in CTS patients.

## Methods

From January 2021 to March 2023, 135 patients (192 wrists) underwent ECTR. Preoperative ultrasonography and electrophysiological studies were performed on both wrists. Electrophysiologic severity was categorized into non-severe and severe groups, and CSA-W of the median nerve in each group was compared and analyzed. For 22 patients who followed-up, changes in CSA-W of the median nerve were analyzed pre operatively and 3 months postoperatively to assess the predictive value of CSA-W changes for symptom improvement.

## Results

The CSA-W of the median nerve did not show a statistically significant difference when compared across electrophysiologic severity groups as a whole. However, a significant difference was observed between the non-severe ( $14.07 \pm 3.17 \text{ mm}^2$ ) and severe groups ( $17.90 \pm 5.06 \text{ mm}^2$ ). The difference in electrophysiologic severity between wrists correlated with the difference in CSA-W measurements. No significant change in CSA-W was observed in follow-up ultrasounds at 3 months post-surgery.

## Conclusion

While CSA-W of the median nerve is not directly correlated with the electrophysiologic severity of CTS, it may serve as a useful parameter in assessing the severity of the condition. However, changes in CSA-W after surgery do not predict the improvement of symptoms in CTS patients.

**Key words.** carpal tunnel syndrome, ultrasound, median nerve cross sectional area, electrophysiologic test

# Simultaneous tendon transfer and nerve transfer to treat radial nerve palsy

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Yu-Huan Hsueh

## Background

Radial nerve injuries cause significant disability, and it is not an uncommon injury, especially in patient with distal third humerus fracture. Tendon transfer has been used to restore the hand and wrist extension function with many modified procedures. Recently, more surgeons are using nerve transfer to treat the radial nerve injury with a comparable outcome. To obtain an optimal outcome, we performed the tendon transfer and nerve transfer simultaneously.

## Methods

We retrospectively reviewed 8 patients with radial nerve palsy in our institute. Clinical outcomes were recorded post-operatively. Post-operative MRC grade and ROM were collected.

We performed multiple nerve transfer with one branch of PT to ECRB branch and FDS branch to PIN. In addition, we performed multiple tendon transfer simultaneously with PT to ECRB, FCR to EDC, PL to EPL.

## Results

There were four men and four women with age between 23 and 45 year-old. The mean post-operative follow-up period was 26 months (range, 20-48 months). All patients obtained more than M4 hand and wrist extension recovery with excellent outcome. In addition, all patients can extend the wrist and digits simultaneously.

## Conclusions

The current study demonstrated that simultaneous tendon transfer and nerve transfer is an alternative treatment option to treat the radial nerve palsy with good outcome.

## Discussion

Radial nerve palsy is one of common peripheral nerve injury in trauma patients. Most of patients with radial nerve palsy can be treated conservatively. However, patient without spontaneous recovery may need surgical reconstruction. Tendon transfer to treat radial nerve palsy has been used for years, and there were many modifications had been introduced subsequently. Nerve transfer is another treatment option to treat radial nerve palsy. Although nerve transfer takes longer recovery time than tendon transfer, the more precise finger function could be obtained by nerve transfer. In our study, we performed the tendon transfer and nerve transfer at the same time. Patient could regain reasonable extension function recovery at early post-operative period. At late post-operative period, patient could further enhance their hand and wrist function that is contributed by nerve transfer.

# Combined compression neuropathy of carpal tunnel syndrome and anterior interosseous nerve syndrome : a clinical approach

DongGuk University Ilsan Hospital

Su Rak Eo, Jung Soo Yoon, Soo A Lim

Carpal tunnel syndrome (CTS) is a common acquired compressive neuropathy of the median nerve affecting 0.1-10% of general population (up to 70% of patients have bilateral CTS). The incidence of CTS in cervical radiculopathy was recently reported to be 9.98%, which explains “double crush syndrome”. Besides, combined compression neuropathy, other than the double crush syndrome can co-occur at the same upper extremity. It is usually caused by space occupying lesion or might occur by aberrant nerve connections such as Martin-Gruber and Riche-Cannieu anastomosis. Patients who underwent concomitant carpal tunnel release (CTR) and cubital tunnel release (CubTR) have benefited from simultaneous decompression.

Compression of the anterior interosseous nerve (AIN), also known as Kiloh-Nevin's syndrome is a compressive neuropathy at the forearm which results in motor deficits of the AIN nerve. Due to the weakness of thumb, index and middle finger flexion, the patients reveal the inability to make OK sign with the normal median nerve sensory exam. It is commonly caused by transient neuritis (Parsonage-Turner syndrome, PTS) and various anatomical sites of compression of the AIN. With its rare occurrence of less than 1% of median nerve neuropathies, treatment involves a prolonged nonoperative course, and rarely, surgical decompression is indicated when the space occupying lesion is clearly identified or nonoperative treatment fails after 12 months.

Authors report a 55-year-old woman who showed the combined CTS and signs of anterior interosseous nerve (AIN) compression on her left hand. She was diagnosed typically for CTS with electromyography(EMG)/nerve conduction velocity(NCV) studies. In addition, she had clumsy finger movements and couldn't make an “O” sign. Otherwise, she had no special clue for the transient neuritis causing AIN syndrome (PTS). With the patient's consent, we performed only the carpal tunnel release at first with minimal skin incision technique and she began to recover the symptoms just after the first day of the surgery. At postoperative 6 months, she had

recovered to make an “O” sign with improved fine finger motions. She visited our clinic again recently over the 10-year period with the combined CTS and CubTS on her other side, right hand. We recommended the CTR at first and would’ve been waiting for the result again.

Authors would like to discuss the concomitant double compression neuropathy and possibility of the abnormal nerve connections causing the symptoms.

# Risk factors influencing revision surgery of idiopathic cubital tunnel syndrome: A nationwide population-based cohort study

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## Purpose

This study aimed to investigate the risk factors influencing primary and revision surgery in patients with idiopathic cubital tunnel syndrome (CuTS) using a nationwide, population-based database.

## Methods

We formed the CuTS cohort from 2009 to 2021 health screening participants provided by National Health Insurance Service (NHIS) in the Republic of Korea. The cohort consisted of patients with CuTS aged over 20 years, who were registered with following codes: (1) ICD-10 based diagnostic code (G56.2) and (2) NHIS based codes of CuTS related surgery. A total of 7,810 patients newly diagnosed with idiopathic CuTS who underwent at least one surgical procedure were included, of which 308 patients required two or more surgeries. The factors provided by the national health screening data and comorbidities based on ICD-10 code were investigated.

## Results

Cox proportional hazards regression analysis identified several significant risk factors for undergoing CuTS surgery, including current smoking (hazard ratio [HR] 1.144), heavy alcohol consumption (HR 1.077), obesity (HR 1.310), metabolic syndrome (HR 1.168), rheumatologic disease (HR 1.423), diabetes (HR 1.147), upper arm arthrosis (HR 2.617), and coexisting carpal tunnel syndrome (HR 1.848). In contrast, risk factors for revision surgery included current smoking (HR 1.491) and rheumatologic disease (HR 2.325). Notably, obesity, diabetes, metabolic syndrome, upper arm arthrosis, and carpal tunnel syndrome were not associated with an increased risk of revision surgery.

## Conclusions

The incidence of revision surgery following CuTS surgery was low (3.9%) during the study period. Smoking and rheumatologic disease were identified as significant predictors of revision surgery, while other comorbidities such as obesity, diabetes, metabolic syndrome, upper arm arthrosis, and carpal tunnel syndrome did not increase the likelihood of requiring revision surgery.

# Predictive and Cut-off Values of Compound Muscle Action Potential Amplitude in Intrinsic Recovery After Cubital Tunnel Syndrome Surgery

Orthop Sug. Yonsei Univ. Severance Hosp.

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Won-Taek Oh, Il-Hyun Koh, Yun-Rak Choi

## Background

This study aimed to evaluate the predictive and cut-off values of preoperative compound muscle action potential (CMAP) amplitude for surgical outcomes in idiopathic cubital tunnel syndrome.

## Methods

A retrospective study was conducted on patients who underwent ulnar nerve transposition between January 2011 and July 2022 with a minimum of 24 months of follow-up. The primary outcome was the Medical Research Council (MRC) muscle strength of the abductor digiti minimi, and poor intrinsic function was defined as an MRC grade of 2 or lower at the final follow-up or a grade lower than the baseline. Secondary outcomes included the key pinch strength ratio, grip strength ratio, and patient-reported outcomes. Statistical analyses were performed to identify factors associated with postoperative outcomes, and a receiver operating characteristic (ROC) curve was used to determine the cut-off value of preoperative CMAP amplitude for predicting poor intrinsic function.

## Results

Of the 79 patients, 11 (14%) exhibited poor intrinsic function, which was independently associated with CMAP amplitude. The ROC curve analysis revealed a CMAP cut-off value of 6.15 mV (area under the curve 0.83, sensitivity 100%, specificity 71%). Additionally, among patients with a CMAP amplitude less than 6.15 mV in the subgroup analysis, age was the only factor significantly higher in the poor intrinsic function group compared with the good intrinsic function group.

## Conclusion

Low preoperative CMAP amplitude was independently associated with poor postoperative intrinsic function in idiopathic cubital tunnel syndrome, with a cut-off value of 6.15 mV

# Objective comparison of muscle power, sensory in cubital tunnel syndrome patients between In situ decompression and anterior ulna nerve transposition

Orthop Sug. Soonchunhyang Univ. Bucheon Hosp.

Byung Sung Kim, Joo Young Cha

## Introduction

Cubital tunnel syndrome is the second most common peripheral nerve condition with a high prevalence. Various surgical techniques have been proposed, yet there is no consensus on the optimal treatment. According to meta-analyses, different surgical methods yield similar outcomes, but assessing clinical symptom improvement before and after surgery often relies on subjective evaluations, such as questionnaires. This study aims to compare these objective measurements between patients undergoing in situ decompression and those undergoing anterior ulnar nerve transposition, to determine if there are significant differences in outcomes between the two surgical techniques.

## Materials & Methods

We included 189 patients diagnosed with cubital tunnel syndrome based on physical examination, clinical symptoms, and electromyography (EMG). Additional ultrasound (USG) and MRI were performed when necessary for differential diagnosis. Patients underwent surgery if pain, strength, and sensation did not improve despite ongoing medical treatment. Group 1 consisted of patients who underwent in situ decompression, while Group 2 included those who underwent anterior ulnar nerve transposition. Prior to surgery, patients completed questionnaires to assess subjective symptoms using scores such as DASH and VAS. During preoperative outpatient visits, the surgeon measured the maximum pinch strength of both hands using a hydraulic pinch gauge and conducted two-point discrimination tests. These assessments were repeated by the same surgeon during outpatient follow-ups one year after surgery. To account for individual variations in muscle strength, we measured the percentage decrease in strength relative to the healthy side rather than comparing absolute values.

For accurate comparison, patients with bilateral cubital tunnel syndrome or other peripheral nerve diseases af-

fecting the healthy side were excluded. We tried to include only idiopathic cubital tunnel syndrome, as excluding cases with elbow joint deformities resulting from trauma, elbow osteoarthritis, rheumatoid arthritis, or other conditions. Patients with concurrent Guyon's canal syndrome, carpal tunnel syndrome, or cervical disc herniation causing radiculopathy were also excluded. As muscle strength and sensation were measured directly by the surgeon, there were no missing data for these variables. However, clinical scores such as DASH and VAS could be incomplete due to patients missing follow-up appointments, providing incomplete responses, refusing to complete the questionnaires, or forgetting to fill them out. Cases with incomplete data were excluded to ensure data integrity, which led to a reduction in the number of cases with clinical scores compared to direct measurements.

## Surgical procedure

In all patients, in situ decompression was performed via a 4 cm incision centered over the ulnar nerve. If flexion instability was detected during intraoperative elbow flexion and extension, the incision was extended to facilitate transmuscular transposition.

## Result

Normality tests indicated that the data did not follow a normal distribution, so non-parametric methods were used for analysis. All data were presented as medians, with the 25th and 75th percentiles (Q1 and Q3) reported. For comparisons between the two groups, Pearson's chi-square test (or Fisher's exact test for small samples) was used for qualitative variables, and the Wilcoxon rank-sum test was used for quantitative variables.

A total of 189 patients underwent surgery, and 67 patients were included after applying the exclusion criteria. There were no significant demographic differences between the groups in terms of gender or age.

The average operation time was 25 minutes for Group 1 and 37 minutes for Group 2.

No significant differences were observed between the groups in preoperative pinch strength and two-point discrimination. However, Group 1 showed significant improvement in muscle strength and sensation postoperatively. There were no significant differences in DASH scores pre- and postoperatively, although VAS scores were higher in Group 1 before surgery, with no differences observed afterward. However, clinical scores such as DASH and VAS may be less reliable due to missing values, compared to the objective assessments of muscle strength and sensation.

Within-group comparisons before and after surgery showed improvements in DASH, VAS, pinch strength, and two-point discrimination in Group 1. In Group 2, only pinch strength and two-point discrimination improved significantly, while DASH and VAS scores did not show significant changes.

## Conclusion

There were no demographic effects based on age or gender. The in situ decompression group showed significant improvements in pinch strength and sensation compared to the transposition group.

**Key Words:** Ulnar nerve, cubital tunnel syndrome, in situ decompression, transposition

**Room C**

# **Free Paper 2**

## **Wrist I**

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# Radiographic and Clinical Results after Ulnar Shortening Osteotomy alone or Ulnar Shortening Osteotomy with TFCC Foveal Repair in the patients with Ulnar Impaction Syndrome combined with TFCC foveal tear

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## Purpose

This study aims to compare the radiographic and clinical outcomes of ulnar shortening osteotomy (USO) alone versus USO combined with arthroscopic transosseous triangular fibrocartilage complex (TFCC) foveal repair in patients with ulnar impaction syndrome (UIS) combined with TFCC foveal tears.

## Materials and Methods

This retrospective study included 18 patients diagnosed with UIS, presenting with chondral lesions of the lunate on preoperative plain radiographs, along with concurrent TFCC foveal tears. The patients were divided into two groups: Group 1 (n = 9) underwent USO alone, while Group 2 (n = 9) underwent USO combined with arthroscopic transosseous TFCC foveal repair. Radiographic and clinical outcomes, including changes in the size of the chondral lesions, visual analogue scale (VAS) scores, Mayo Wrist scores, and patient rated wrist evaluation (PRWE) evaluated preoperatively, immediately postoperatively, and at 6-month, 1-year, and 2-year follow-ups.

## Results

Both groups demonstrated significant radiographic and clinical improvements after surgery. In the radiographic results, preoperative chondral lesion size of the lunate was 12.6mm<sup>2</sup> in Group 1 and 9.9mm<sup>2</sup> in Group 2. At postoperative 6 months, 1year, and 2years, it was 6.4mm<sup>2</sup>, 4.9 mm<sup>2</sup>, 4.5 mm<sup>2</sup> in Group 1 and 2.8 mm<sup>2</sup>, 2.1 mm<sup>2</sup>, 1.9 mm<sup>2</sup> in Group 2. Group 2 showed more rapid improvement in the size of chondral lesion of lunate.

In the clinical results, preoperative VAS, MAYO wrist score, and PRWE in each group was 4.3, 60.0, 45.8 in Group 1 and 4.6, 55.0, 44.8 in Group 2. At postoperative 2years they were improved as 1.1, 93.3, 11.1 in Group 1 and 1.0, 90.0, 10.4 in Group 2. In the clinical results, there was no significant difference between the groups.

### **Conclusion**

In patients with ulnar impaction syndrome (UIS) combined with TFCC foveal tears, both USO alone and USO combined with arthroscopic transosseous TFCC foveal repair resulted significant radiographic and clinical improvements. USO combined with arthroscopic transosseous TFCC foveal repair showed faster recovery in the size of lunate chondral lesion, however the radiologic results did not exactly correlate with clinical improvement.

**Key words** Ulnar Impaction Syndrome, Ulnar Shortening Osteotomy, TFCC foveal Repair, Chondral Lesions

# The Results of Arthroscopic Wrist Synovectomy in CPPD Synovitis

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Jeong Keun Kim, Jae Woo Shim, Min Jong Park

## Introduction

Calcium pyrophosphate deposition (CPPD) disease is arthritis caused by calcium pyrophosphate crystals. The basic treatment of CPPD disease is conservative treatment such as medication or injection. But in cases where there is no response, surgical treatment may be necessary. The purpose of this study is to evaluate the effect of arthroscopic synovectomy in patients who had CPPD synovitis of the wrist despite long periods of conservative treatment.

## Methods

We performed arthroscopic synovectomy on 21 wrists in 21 patients with CPPD disease. The mean period of conservative treatment was 25.4 months (range, 6 to 84 month). Inclusion criteria were patients who had intra-articular calcification, no previous surgical procedures in the wrist, and the painful inflammatory symptoms such as warmth, erythema, swelling in the wrist persisting for more than 6 months despite conservative treatment. Exclusion criteria were patients who had additional procedure such as ulnar shortening osteotomy. A mean follow-up was 92.9 months (range, 20 to 98 month). We evaluated pain and patient satisfaction using a visual analog scale, wrist ROM (extension and flexion), and overall function using the quick DASH score preoperatively and postoperatively. We checked the plain radiographs of the wrist to assess chondrocalcinosis.

## Results

The mean visual analog scale score for wrist pain decreased from 6.6 (range 3~9) to 0.8 (range 0~3) ( $P < 0.001$ ), and the mean quick DASH score decreased from 52.3 (range 13.6~75) to 6.9 (range 2.3~13.6) ( $P < 0.001$ ). The mean VAS score of patient satisfaction of surgery was 8.5 (range, 5~10). Mean preoperative ROM was 62.3°

(range, 30~90°) for wrist extension and 58.1° (range, 20~90°) for wrist flexion. Postoperatively, the mean ROM was 69.5° (range, 40~90°) for wrist extension and 65.9° (range, 30~90°) for wrist flexion. Based on final radiographs, there was no evidence of recurrent chondrocalcinosis.

### Conclusion

Arthroscopic synovectomy might be considered as a good surgical treatment option for patients with CPPD wrist synovitis because of minimal invasive procedure. It is technically feasible by using arthroscopy to access the multiple sites of intra-articular calcification. Arthroscopic synovectomy of the wrist provides pain relief, and functional improvement in patients with CPPD wrist synovitis which has not responded to conservative treatment.

# The usefulness of dry wrist arthroscopy in treatment of distal radius fracture : Case Series

H Plus Yangji Hosp.

Youn-Tae Roh

## Introduction

The development of wrist arthroscopy has made it possible to more accurately and less invasively restore articular congruency in the treatment of distal radius fracture. However, there is a risk of compartment syndrome due to fluid extravasation, so a dry wrist arthroscopy technique has been developed. The purpose of this study was to investigate the treatment results and complications of patients treated with dry wrist arthroscopy in the treatment of distal radial fractures to confirm its usefulness.

## Materials and Methods

Among patients with distal radial fractures treated from January 2020 to July 2022, a total of 41 patients (27 females and 14 males) who underwent operative treatment using the dry wrist arthroscopy technique and retrospectively analyzed. Arthroscopy was performed when intra-articular stepping or gap greater than 2 mm, bony fragments in the joint, and accompanying ligament injury were confirmed on preoperative radiographs. Cannulated screw fixation was performed for B1 type fractures, and volar locking plate fixation was performed for all other fracture types. After reduction by intrafocal pinning or joystick method under image intensifier, temporary fixation was performed with K wire. In the case of using a volar plate, after applying the plate, the proximal screw was fixed with one or two screws, and the distal was fixed with K wire, and arthroscopy was performed to confirm the condition of the joint space. Arthroscopic findings, radiographic examinations, and patient charts were retrospectively analyzed. Operation time, fracture union, and complications were investigated. Pain visual analogue scale and the shortened disabilities of arm, shoulder and hand questionnaire (QuickDASH) were measured as clinical outcomes.

## Results

The average age was 56.1 years, and the average follow-up period was 25.3 months (13~38 months). Fracture union was achieved in all cases, and the average pain visual analogue scale score was 0.7 points and the average QuickDASH score was 2.77 points, showing good results. The average operative time was 77 minutes. Although reduction was performed before arthroscopy, additional reduction was performed because articular surface gap or depression was found in 11 cases at the time of surgery. Accompanying triangular fibrocartilage complex injury was confirmed in 8 cases, and chondral injury of the lunate was confirmed in 1 case. Acute scapholunate dissociation was confirmed in 2 cases. In 4 cases, bony or chondral loose bodies were identified and removed. Since there was no soft tissue swelling after arthroscopy, there was no difficulty in performing an additional open procedure to treat the accompanying metacarpal fracture or carpal fracture. There were no additional complications, and soft tissue problems such as compartment syndrome did not occur because water was not used.

## Conclusion

In the treatment of distal radius fractures, dry wrist arthroscopy is a viable option for good treatment results. In distal radial fractures with intra-articular fractures, good results can be expected as intra-articular problems can be identified and resolved, and it is considered to be very useful because there is no possibility of soft tissue problems that can occur due to the use of water.

In addition to distal radius fractures, the author uses a dry arthroscopy for dorsal wrist ganglion surgery and bone grafting during arthroscopic scaphoid nonunion surgery.

**Keyword:** wrist arthroscopy, distal radius fracture, dry wrist arthroscopy

# Ideal Positioning of the C-guide for Creating an Optimal Bone Tunnel in Arthroscopic One-bone Tunnel Transosseous TFCC foveal repair

Orthop Sug. Korea Univ. Anam Hosp.

Jae Jun Nam, Youngwoon Ko, In Cheul Choi, Jong Woong Park

**Purpose:** This study aims to determine the ideal positioning of the C-guide for creating an optimal bone tunnel at the anatomical triangular fibrocartilage complex (TFCC) foveal insertion site during arthroscopic one-bone tunnel transosseous TFCC foveal repair.

## Materials and Methods

A total of 40 patients who underwent arthroscopic one-bone tunnel transosseous suture repair for Palmer 1B foveal TFCC tears (with or without superficial fiber tears: Atzei class 2 [n = 20] or class 3 [n = 20]) were selected. Immediate post-operative plain radiograms were used to measure the starting point of the bone tunnel and the angle relative to the longiyudinal axis of the ulnar shaft. Based on these measurements, the ideal intraarticular positioning of the C-guide tip over the TFCC was estimated on coronal and axial slices from preoperative MRI scans.

## Results

The mean starting point of the C-guide was 9.9 mm (range: 7.2-12.2 mm) proximal to the tip of the ulnar styloid process. This point corresponded to the "inflection point" of the lateral border of the ulnar styloid process, where the lateral convex curvature transitions to concave (Figure 1). The angle of the bone tunnel relative to the ulnar shaft averaged 33.7 degrees (range: 30.2-41.4 degrees), targeting the anatomical center of the foveal insertion site (Figure 1). Based on this angle and starting point, the end point of the C-guide over the TFCC on MRI was approximately 3.6mm (range: 2.9-4.1 mm) radial to the medial border of the ulnar styloid process (Figure 2). Arthroscopically, the C-guide tip could be placed at the center of the upper third of an imaginary line dividing a triangle formed by connecting the dorsal and volar corners of the radius and the ulnar styloid process (Figure 3).

## Conclusion

The ideal starting point for the bone tunnel is the "inflection point" on the lateral ulnar styloid process, where the convex curvature transitions to concave. The appropriate C-guide angle is approximately 33.7 degrees, and under arthroscopy, the C-guide tip could be placed at the center of the upper third of an imaginary line dividing a triangle formed by connecting the dorsal and volar corners of the radius and the ulnar styloid process.

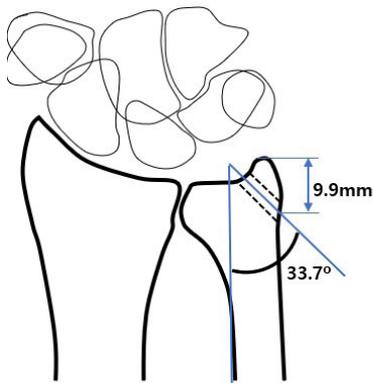


Fig. 1

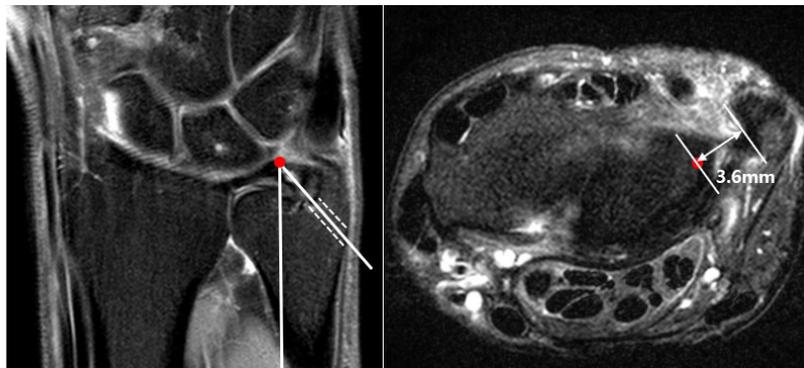


Fig. 2

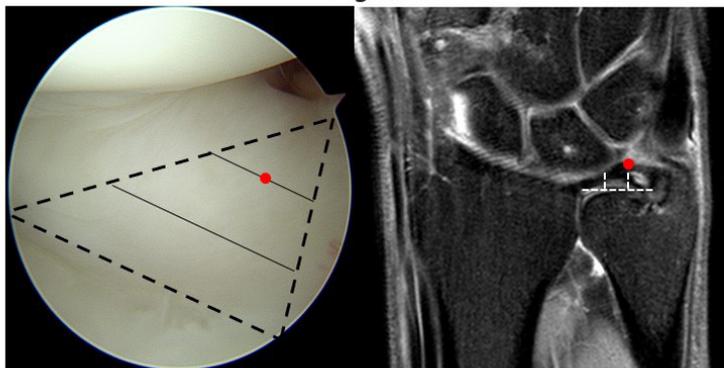


Fig. 3

# Diagnostic challenge of hidden, isolated foveal tear (Atzei class 3) of Triangular Fibro-Cartilage Complex (TFCC)

MS Reconstruction Hosp.

Jin Sik Park

Injuries to the Triangular Fibro-Cartilage Complex (TFCC) can lead to ulnar-sided wrist pain and instability of the distal radioulnar joint (DRUJ). Historically, the Palmer classification (1989) has been widely used to categorize TFCC injuries based on their location. However, anatomical studies by Nakamura et al. (1996) revealed the significance of the distal radioulnar ligament's (DRUL) proximal component, originating from the ulna fovea. Subsequent biomechanical studies emphasized the importance of the proximal part of the DRUL. In response, Atzei and Ruchetti (2011) refined Palmer's classification of type 1B tears, introducing a subclassification that highlights the involvement of the proximal DRUL.

In this refined classification, class 2 and 3 injuries—where the proximal part of the DRUL is damaged—are clinically associated with DRUJ instability. Atzei and Ruchetti argued that the hook test is the most reliable arthroscopic test for distinguishing between these subclasses and that direct visualization of the DRUJ through arthroscopy is unnecessary.

However, Crowe and Kakar (2023) challenged this view, suggesting that isolated foveal tears can exist as part of a spectrum, including partial tears. They posited that clinical DRUJ stability may vary based on the extent of the tear. Furthermore, they asserted that only DRUJ arthroscopy can definitively confirm these hidden lesions. This presentation aims to support their claims by reporting four cases, detailing the clinical presentation, diagnostic process, and treatment approach, accompanied by imaging data, to highlight the diagnostic challenges in identifying isolated foveal tears.

# Impingement of torn TFCC in the sagittal plane and its relation with DRUJ instability

Orthop Sug. Seoul National Univ.

Yohan Lee

## Purpose

Image analysis of triangular fibrocartilage complex (TFCC) tears have been mainly conducted in the coronal plane and there has been little research in the sagittal plane. In this study, we defined the characteristic findings (referred to as “Root sign”) found in sagittal Magnetic resonance image (MRI) of patients with TFCC tears and analyzed the relationship between root sign and distal radioulnar joint (DRUJ) stability.

## Methods

We retrospectively analyzed patients who underwent arthroscopic TFCC repair from 2016 January to 2023 March. In preoperative sagittal MRI image, a Root sign positive was defined as a case in which the TFCC showed a characteristic shape as if it was sandwiched between the ulna and the carpal bone. To quantitatively analyze the sagittal images, the thickest and thinnest thickness of the TFCC, and the slope were measured. Before surgery, Ballottement test was performed on both sides to determine DRUJ instability.

## Results

Among 29 patients, 18 patients showed Root sign positive (Group 1) and 11 were not (Group 2). Relatively less DRUJ instability was confirmed in the Root sign (+) group, and more DRUJ instability was confirmed in the Root sign (-) group. (18.2% (2/11) vs 88.9% (16/18);  $p < 0.001$ ). The slope was significantly steeper ( $38.2 \pm 6.8$  vs  $17.1 \pm 9.4$ ;  $p < 0.0001$ ) in the Root sign (+) group.

## Conclusion

If a torn TFCC impinges between the ulna and carpal bone, it can make ulnar subluxation irreducible, and this

can be confirmed as a root sign on MRI.

**Key Terms:** Triangular fibrocartilage complex, sagittal image, magnetic resonance image, DRUJ instability

# Arthroscopic Transosseous Foveal Repair of the Triangular Fibrocartilage Complex Tears Associated with Symptomatic Ulnar Styloid Non-union

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Jae Hoon Lee<sup>1</sup>, Jung Suk Lee<sup>1</sup>, Jong Hun Back<sup>2</sup>, Ki Hyuk Koo<sup>2</sup>

## Purpose

Symptomatic ulnar styloid non-union can be treated by excision of the ulnar styloid fragment. For combined triangular fibrocartilage complex (TFCC) tears with distal radioulnar joint (DRUJ) instability, several repair techniques such as arthroscopic repair, open repair or ligament reconstruction using a tendon graft have been introduced. This study reports the technique and outcomes of arthroscopic transosseous foveal repair of the TFCC with excision of the ulnar styloid fragment in patients with symptomatic ulnar styloid non-union and DRUJ instability.

## Methods

Consecutive patients with symptomatic ulnar styloid non-union with TFCC tears and DRUJ instability who underwent excision of the ulnar styloid fragment and arthroscopic transosseous foveal repair of the TFCC from Jan 2017 to Oct 2023 were retrospectively reviewed. A 2 cm longitudinal incision was made in the ulnar styloid area, and the ulnar styloid was resected. Afterwards, a transosseous tunnel was created with a 1.4 mm K-wire, and 2/0 ethibond or PDS was passed through it and sutured using the outside-in method. The outcomes were evaluated in terms of DRUJ stability and the Quick Disabilities of the Arm, Shoulder and Hand (DASH) scores.

## Results

In total, 17 patients with a mean age of 25 were enrolled in the study. All patients demonstrated DRUJ stability at a mean follow-up duration of 15 months. The mean Quick DASH score significantly improved from 28.9 to 2.95 ( $p < 0.05$ ).

## Conclusions

This study demonstrates that concurrent arthroscopic TFCC repair and open excision of the ulnar styloid fragment is an effective method to surgically treat patients with symptomatic ulnar styloid non-union with TFCC tear and DRUJ instability.

**Room C**

# **Free Paper 4**

## **Wrist II**

Orthop Sug. Yonsei Wonju Univ. **Jin Rok Oh**  
Plast Reconstr Sug. DongGuk Univ. **Su Rak Eo**

# Physical performance level is associated with patient-reported outcomes after operation for distal radius fracture in female patients

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Byung Hun Oh, Kalantan Rawdhah Kamil, Jae Kwang Kim and Young Ho Shin

## Purpose

This study aimed to evaluate the influence of physical performance level on patient-reported outcomes after operation for distal radius fracture (DRF).

## Materials and methods

We retrospectively reviewed 157 women with DRF who underwent operation and completed the evaluation of Short Physical Performance Battery (SPPB) within 1 month after trauma between January 2019 and August 2022. Patient-reported outcomes were assessed at postoperative 1 year using the Disabilities of the Arm, Shoulder, and Hand (DASH) and the Patient-Rated Wrist Evaluation (PRWE) questionnaires. Multivariate linear regression analysis was conducted using patient characteristics, fracture type, treatment-related factors, and SPPB results to evaluate the associated factors with the patient-reported outcomes.

## Results

In a multivariate linear regression model, dominant hand involvement (B 7.329; 95% confidence interval [CI] 2.901–11.757;  $p = 0.001$ ) and lower SPPB scores (B -2.145; 95% CI -3.194--1.096;  $p < 0.001$ ) were significantly associated with higher DASH scores. Furthermore, dominant hand involvement (B 5.718; 95% CI 1.126–10.731;  $p = 0.015$ ) and lower SPPB scores (B -2.007; 95% CI -3.095--0.920;  $p < 0.001$ ) were significantly associated with higher PRWE scores.

**Conclusions:** Physical performance level, which was evaluated using SPPB was significantly associated with poor clinical outcomes of DRF after operation. Physicians should implement a systematic approach to enhance

physical performance along with appropriate fracture treatment to improve clinical outcomes following operation for DRF.

**Kew word:** Physical performance, Radius fractures: Sarcopenia

# Comparison of Clinical Results for Treatment of Distal Radius Fracture Using Volar Locking Plate

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Jae-Hwi Nho<sup>1</sup>, Ki Jin Jung<sup>1</sup>, Soo Min Cha<sup>2</sup>, Byung-sung Kim<sup>1</sup>

## Introduction

The distal radius fractures are commonly treated using volar locking plates, which provide stable fixation and facilitate early mobilization. However, complications such as tendon rupture, reduction loss, and foreign body sensation often lead to patient dissatisfaction and requests for hardware removal. This study compares the clinical outcomes of the TDM Newcolle plate, known for its thin and strong design, with the Acumed volar locking plate in the treatment of distal radius fractures.

## Methods

A retrospective analysis was conducted on 250 patients who underwent surgery for distal radius fractures. Of these, 125 patients were treated with the TDM Newcolle plate, and 125 patients received the Acumed plate. Key outcomes measured included the rate of bone union within 12 weeks, incidence of tendon rupture, reduction loss, patient-reported symptoms such as foreign body sensation, and clinical assessments using the DASH (Disabilities of the Arm, Shoulder, and Hand) score and wrist ROM(range of motion). After one year, the rate of patients requesting plate removal due to discomfort or foreign body sensation was also assessed.

## Results

All patients in both groups achieved bone union within 12 weeks, with no significant differences in DASH scores or ROM between the two groups. Notably, no cases of tendon rupture or reduction loss were observed in patients treated with the TDM Newcolle plate, while these complications were reported in the Acumed group. Patients treated with the TDM plate reported less frequent complaints of foreign body sensation. After one year, the desire for plate removal due to discomfort was significantly lower in the TDM group (15%) compared to the

Acumed group (52%), demonstrating a statistically significant difference ( $p < 0.05$ ).

### Conclusion

The TDM Newcolle plate offers a thin and strong alternative to traditional volar locking plates for distal radius fractures, with excellent clinical outcomes and a significantly lower rate of hardware removal requests. These findings suggest that the TDM plate reduces the incidence of complications such as foreign body sensation and patient dissatisfaction, providing a favorable option for the surgical management of distal radius fractures. Further studies are warranted to validate these findings and explore long-term outcomes.

# Analyzing Treatment Outcomes in Scaphoid Nonunion: A Comparative Study of Humpback Deformity versus Dorsal Translation

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Chi-Hoon Oh<sup>1</sup>, Segi Kim<sup>2</sup>, Cheungsoo Ha<sup>3</sup>, Soo-Hong Han<sup>2</sup>

## Purpose

The aim of this study was to evaluate the patient-reported outcomes (PROs) following open reduction and internal fixation (ORIF) for distal radius fracture (DRF) in men and the factors influencing these outcomes.

## Materials and methods

We retrospectively reviewed the medical records and radiographs of 109 men who underwent ORIF for DRF between September 2016 and January 2021, and a minimum 2-year follow-up. The PROs were assessed using the Disabilities of the Arm, Shoulder, and Hand (DASH), and Patient-Rated Wrist Evaluation (PRWE) questionnaires. Multivariable linear regression analyses were performed to evaluate the associations between baseline patient characteristics, fracture type, treatment-related factors, and PROs after ORIF for DRF.

## Results

Older age (B 0.201; 95% confidence interval [CI] 0.042–0.361) and workers' compensation (B 13.348; 95% CI 4.530–22.165) were significantly associated with higher DASH scores at 1-year postoperatively. Only workers' compensation (B 5.417; 95% CI 2.646–24.122) was significantly associated with higher PRWE scores at 1-year postoperatively, whereas older age [B 0.194; 95% CI 0.050–0.338] and AO Foundation/Orthopedic Trauma Association (AO/OTA) type C fracture (B 6.229; 95% CI 0.250–12.208) were significantly associated with higher DASH scores at 2 years postoperatively. In addition, older age (B 0.163; 95% CI 0.002–0.324) and AO/OTA type C fracture (B 8.329; 95% CI 1.627–15.030) were significantly associated with higher PRWE scores at 2 years postoperatively.

## Conclusions

Workers' compensation was significantly associated with worse PROs after ORIF for DRF in men up to 1 year postoperatively. Older age and the initial fracture severity were significantly associated with worse PROs at 2 years postoperatively.

**Keywords:** Compensation, distal radius fracture, men, worker

# Does the operator's experience affect the occurrence of complications after distal radius fracture volar locking plate fixation? A comparative study of the first four years and thereafter

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## Background

The management of distal radius fractures (DRFs) has evolved with the introduction of volar locking plate (VLP) fixation, which offers stable fixation and better outcomes. However, the impact of surgeon experience on complication rates in VLP fixation remains to be determined, especially for less-experienced surgeons. This study compared the complication rates during the initial four years and subsequent two years of a hand surgeon's practice of VLP fixation for DRFs.

## Methods

Data from two hospitals Between March 2016 and December 2022 were retrospectively analyzed. A single surgeon performed all VLP fixation surgeries, with the first four years representing the less experienced phase (Group 1) and the following two years indicating the experienced phase (Group 2). Patient characteristics, operation-related factors, and post-operative complications including tendon injuries, nerve-related complications, fixation and instrument-related issues, osteosynthesis-related problems, and infections were compared between the two groups. In addition, compared with a large multicenter study results (1955 cases of surgically operated DRF) was conducted.

## Results

In total, 319 patients (321 wrists) were included. The average age was 63.3 years, 26.3% male and 73.7% female

patients. The operation time was  $53.7 \pm 14.5$  minutes in Group 2 and  $74.4 \pm 26.5$  minutes in Group 1, which was statistically significantly shorter ( $p < 0.001$ ). The incidence of complications was evaluated and the overall complications were compared in a large-scale multicenter study. Complication rates between the two groups were not significantly different, except for the higher implant removal rates in Group 1. A comparison with a previous multicenter study revealed higher carpal tunnel syndrome (CTS) rates and reduction losses in this study. However, the overall complication rate is low.

## Conclusion

VLP fixation for DRFs can be performed by less experienced surgeons, with relatively low complication rates. However, care should be taken to address the risk of loss of reduction and hardware-related issues, especially in complex fractures and elderly patients. The importance of training and ongoing education for mastering the technique should be considered, even in favorable fixation systems.

**Keywords:** Distal radius fracture, Volar plating, Learning curve, Complication

**Level of evidence:** Therapeutic level III, retrospective comparison study

# Analyzing the role of surgical management of initial fractures of the distal radius in refracture among elderly Ko-reans - A nationwide population-based cohort study -

Orthop Sug. Chungnam National Univ.

Soo Min Cha

**Background:** We hypothesized that surgical treatment for acute distal radius fractures (DRFs) plays a major role in minimizing malunion; thus, we sought to estimate the overall incidence of refracture in the distal radius in elderly populations using a real-world nationwide cohort through the National Health Information Database of Korea.

## Methods

A total of 201,146 participants from 49.4 million Korean people met the inclusion criteria. The inclusion criteria were as follows: (1) female; (2) older than 65 years at the time of index injury (first episode of DRF); (3) diagnosed between 2010 and 2015; and at least 2 years of follow-up since the index fracture.

## Results

Among the total enrolled patients 201,146 11.3% experienced refracture within the follow-up period. Among the 178,549 patients who did not experience refracture, 119,871 (59.6%) patients were treated conservatively (Scenario 1). Alternatively, 58,678 patients (29.1%) received surgical treatment and did not experience refracture. Surgical options were K-wire (19,823, 9.8%), plate without removal (12,601, 6.2%), and external fixator (1,253, 0.6%), for them (Scenario 2). Among the 58,678 patients, 25,001 patients (Scenario 3) underwent subsequent surgery for implant removal (plate) under anesthesia. Refractures were identified in 22,597 patients (11.3%), 4.1% were treated conservatively again at refracture (Scenario 4), and 2.9% of the patients were treated surgically for refractures with a history of recovery from the first fracture via a conservative approach (Scenario 5). Additionally, corrective surgeries for second fractures were identified in 1,046 patients (0.5%) (Scenario 6), in which the initial fracture was managed conservatively. Within the current cohort, refracture after surgical

treatment for the first event occurred in 7,386 patients (3.7%; Scenarios 7, 8, and 9).

## Conclusions

The refracture rate within this retrospective DRF cohort was revealed to be as common as the overall DRF rate in old patients. Considering the lack of knowledge regarding refractures until now, surgical treatment at initial fracture appears to minimize the risk of typical malunion, thus providing an easier approach to treating refractures. However, further studies with the aim of rationalizing surgical treatment for DRF should be conducted with respect to refractures at the radius malunion.

**Keywords:** refracture, radius, malunion, corrective surgery

# Outcome of Sauve-Kapanji procedures for advanced distal radioulnar joint arthritis/instability in patients with rheumatoid arthritis

Orthop Sug. The Catholic Univ. of Korea

Yang-Guk Chung

## Introduction

Sauve-Kapanji procedure is an established treatment option for distal radioulnar joint arthritis/instability. Patients with rheumatoid arthritis are prone to be prevalent for advanced DRUJ arthritis/instability with functional derangement.

## Materials

We performed Sauve-Kapanji procedures for 47 patients with RA who were suffered from advanced DRUJ arthritis/instability since 2006 January and followed up more than 1 year in 45 ones. For arthrodesis at DRUJ, autogenous iliac cancellous bones were grafted in all patients and I/F with Acutrak screws and K-wires in most of the patients. Ulnar stumps were stabilized using distal based half-slip of ECU tendons. Extensor tendon reconstructions were combined in 28 patients. The mean age was 48.2 (23-78) years old. We evaluated pain, bone union time, extensor function, range of pronation/supination, stability of ulnar stump, complications, any secondary procedures and subjective satisfaction for surgery. The mean follow-up period was 69.8 (15-192) months.

## Results

Among 45 patients, 5 ones complained mild main at DRUJ and 3 patients moderate pain. Solid bone union was achieved in all patient at 9.02 (6-12) weeks after surgery. All but one patient with extensor reconstruction showed full finger extension. All patients showed full pronation and only one patient had limitation of supination. Ulnar stumps were stable in thirty-one patients, and two patient revealed moderate instability and twelve ones mild instability. The main secondary procedure was K-wire removal (in 3 patients) and the

main complication was suture material irritation (in 3 patients). Most of the patients (42 out of 45) rated the procedure satisfactory.

### **Conclusion**

The Sauve-Kapanji procedures were reliable salvage ones for advanced RA with DRUJ arthritis/instability with/without extensor tendon ruptures.

# The Results of vascularized bone graft in stage IIIB or more advanced Kienböck disease

Orthop Sug. Samsung Medical Center, Sungkyunkwan Univ.

Jeong Keun Kim, Jae Woo Shim, Min Jong Park

## Introduction

Kienböck's disease is known as avascular necrosis of the lunate, but its natural course or optimal treatment in various stages has not been identified clearly. Traditionally, stage II and stage IIIA are treated with surgery aimed at revascularization, while stage IIIB and more advanced are managed with salvage surgery. However, there are no fixed principles. This study aimed to compare the outcomes before and after vascularized bone graft in patients with stage IIIB.

## Methods

Patients were included if the Stahl index on the wrist lateral X-ray was reduced by more than 30% compared to the unaffected side and if sagittal CT or MRI images showed a gap of 2 mm or more between major fragments. 14 patients included in the study underwent 4+5 extensor compartmental vascularized strut bone graft, with one patient also receiving an additional shortening procedure. A mean duration of radiological follow-up was 20 months (range 3 to 47 months) and symptomatic follow-up (via telephone survey) was 63 months (range 26.3 to 136 months).

## Results

The mean visual analog scale score for wrist pain decreased from 5.6 (range 4~7) to 1.1 (range 0~3), and the mean quick DASH score decreased from 43.3 (range 20.5~75.5) to 10.2 (range 2.3~27.3). The mean preoperative ROM arc was 102.8° (extension 52.1°, flexion 50.7°). Postoperatively, the mean ROM arc was 110.7° (extension 60°, flexion 49.3°). The Stahl' index decreased from 0.296 to 0.231 ( $P < 0.001$ ), and carpal height ratio decreased from 0.460 to 0.451 ( $P < 0.005$ ).

## Conclusion

After performing vascularized bone grafting, a decrease in carpal height was observed on plain radiographs. However, the patients reported a significant improvement in pain and range of motion. Vascularized bone graft in stage IIIB cases provides satisfactory clinical results with preservation of the joints.

**Room C**

# **Symposium 2: Show me the way**

## TFC foveal tear in UIS

Orthop Surg. Sungkyunkwan Univ. **Min Jong Park**  
Orthop Sug. Soonchunhyang Univ. **Byung Sung Kim**

# Arthroscopic wafer procedure with TFCC repair

이화의대

김지섭

삼각섬유연골복합체(TFCC)는 articular central disc, meniscus homolog, palmar and dorsal radioulnar ligaments, ulnocarpal ligaments, and extensor carpi ulnaris subsheath로 구성된다. TFCC는 척골수근 관절(ulnocarpal joint)을 통한 하중의 전달, 손목과 팔의 원활한 운동, 그리고 원위요척골관절(DRUJ)의 안정성에 중요한 역할을 한다. TFCC의 외상성 파열은 지속적인 척골 측 손목 통증을 유발할 수 있으며, 원위요척골 관절의 불안정성과 관련된다.

TFCC 파열은 처음에 Palmer가 해부학적 위치를 기준으로 분류하였다. (Table 1).

**Table 1**  
Palmer Classification of Acute Traumatic TFCC Tears

Type	Description
1A	Central disc perforation
1B	Peripheral ulnar-sided TFCC tear with or without ulnar styloid fracture
1C	Ulnocarpal ligament disruption
1D	Radial TFCC tear with or without sigmoid notch fracture

Radioulnar ligament 의 foveal insertion의 손상을 동반한 1B 파열은 DRUJ 불안정을 초래할 수 있는 파열이다. Atzei와 Luchetti는 1B 파열을 5개 그룹으로 세분화하여 원위부(styloid insertion)와 근위부(foveal insertion) 파열을 구분하고, 각각의 봉합 방법을 구분할 수 있게 하였다. 이 두 가지 분류가 일상적으로 사용되고 있지만, 일부의 TFCC 파열의 패턴은 이러한 분류법 중 어느 하나로도 분류할 수 없는 경우가 있다.

Combined tear는 degenerative 손상인 central disc tear 와 외상성 손상인 foveal tear가 동반된 경우이며, 이는 원위요골관절 혹은 척골 겹상돌기 골절력이 있는 경우에서 흔하게 발행하는 것으로 알려져 있다. 따라서 ulnar impaction sign으로

central tear 가 의심되는 환자에서, 원위 요척골 관절의 불안정성에 대한 검사(ballotment test, intraoperative hook test) 가 필수적이다.

Central disc tear는 일반적으로 퇴행성 병변이며, 척골-수근 충돌과 관련된 병리로 여겨진다. 치료로는 파열 부위의 변연절제술을 시행한다. 척골 충돌 증후군에서 두 가지 주요 수술 옵션은 척골 단축 절골술(ulnar shortening osteotomy)과 개방적 또는 관절경적 웨이퍼 술식(wafer procedure)으로, 척골 수근 관절의 하중을 감소시키기 위한 방법이다. 두 가지 수술 기법 모두 척골 충돌 증후군 치료에 효과적이지만, 관절경적 웨이퍼 술식이 수술 후 합병증이 적고 재수술율이 낮은 것으로 보고되고 있다. 관절경적 웨이퍼 술식은 파열된 TFCC 중심부를 변연절제한 후 ulnar head cartilage를 radiofrequency ablation을 이용하여 제거한 후, burr를 이용하여 bone resection을 시행한다. 이때 전완부를 회외전, 회내전 시키면서 충분히 제거하여야 하지만 원위 요척골 관절은 손상되지 않도록 주의한다. 드물게 젊은 환자의 경우, TFCC 중심부 파열이 없는 경우에서 sub-ligament approach를 통하여 TFCC 손상을 가하지 않고 ulnar head resection 이 가능하다.

DRUJ stability 회복을 위한 foveal repair는 관절경적으로 시행이 가능하다. 척골 양성이 심한 경우 fovea 부위의 시야가 제한될 수 있어, 먼저 wafer procedure를 통해 시야를 확보하는 것이 추천된다. Trans-osseous technique, suture anchor 등을 이용한 다양한 술식이 사용될 수 있다.

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### Initial conservative treatment

- Treatment based on a symptom (not on X-ray)
  - Activity modification: unloading
  - Immobilization
  - NSAIDs
- Idiopathic UIS: 60% improvement, 25% underwent USO
  - Prognostic factors associated with failure of conservative management
    - Female, longer symptom duration, initial high pain NRS score on ulnar provocation test
    - Signal enhancement of carpal or distal ulna on MRI

*(Roh et al., 2018)*

### Case.

- 50/F, Lt wrist pain for 2 months (remote 1 year)
- Housekeeper
  - ulnar fovea sign +
  - pain at the extremes of pronation and supination (+)
  - ulnocarpal stress test +
  - DRUI - stable
- Symptom improved after conservative treatment
  - NSAIDs, reduced activity, physical therapy

(VAS pain score 5 -> 1-2, no painful LOM)

> Observation

### Arthroscopic management during USO or wafer procedure

- Degenerative TFCC lesions
  - Simple arthroscopic debridement
  - Poor results associated with PUV *(Nishizuka et al., 1996; Westkaemper et al., 1998; Osterman, 1990; Van Sanden and De Smet, 2001; Verheil et al., 2012)*
  - TFCC debridement alone shows little benefit on the clinical course of recalcitrant ulnar wrist pain
  - Consider interventions that can modify the course of the disease, such as USO *(Nishizuka et al., 1996; Nishizuka et al., 2013; Kim Bs and Song IS, 2011)*

### Ulnar shortening osteotomy (USO)

- Originally described by Milch in 1941
  - Resecting the exact amount of ulnar shaft that corresponds to the ulnar positive variance
  - Osteosynthesis by plate fixation and postoperative immobilization
- Unload the ulnocarpal joint
- Tightening of the TFCC, distal interosseous membrane (secondary stabilizer of the DRUI)

(Left) positive ulnar variance, (right) after ulnar shortening osteotomy *(Matthew and Cole, 2005)*

→ Satisfactory outcome: 68-96% *(Bae et al., 2003; Kim and Song, 2011; Vandenberg et al., 2012; Roh et al., 2011)*

### Treatment Algorithm for TFCC Lesion

Fig. 1  
Treatment algorithm for ulnar wrist pain (TFCC, triangular fibrocartilage complex; USO, ulnar shortening osteotomy; DRUI, distal radioulnar joint).  
Nishizuka et al. BJJ, 2013

### Case 1. USO

- 60/F, Right wrist pain for 1 year, housekeeper
- ulna fovea sign +
- pain on supination/pronation +/-
- ulnocarpal stress test +
- DRUI instability -

Initial x-ray, PUV 2mm  
PD FSE COR FAT (outside MR)

**Case 1. USO**



**Case 1. USO**

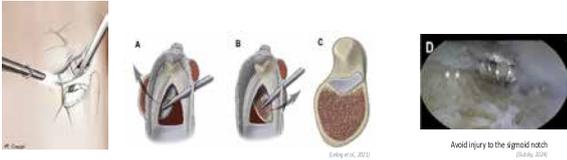


	Pre-op	Last follow-up
VAS pain score	6	0
DASH score	54.2	0
Mayo wrist score	70	95

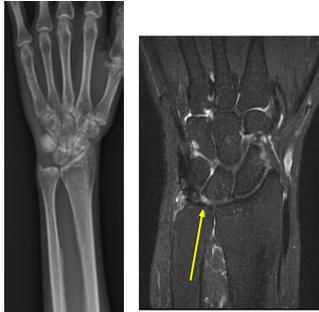
Immediate post-op      After hardware removal (POD 2Y2M)

**Wafer procedure**

- Feldon et al., 1992 : firstly described open procedure
  - To unload the ulnocarpal joint and impaction by a resection arthroplasty
  - Maximum limit can be achieved without negative effects to the DRUI : 2-3mm
  - Excision of 3 mm of subchondral bone – 50% | force transmitted across the ulnar head (further bone resection – little to decrease the force)
- Pros: less invasive, without the need for postoperative immobilization and bone healing, no hardware-related complications, treatment of accompanying lesions (LT ligament, TFCC, tip of hamate, synovitis)
- Cons: **not suited for > 4mm shortening is required**, no tensioning effect of ligament complex, not treat a potential associated stylocarpal impaction, not treat a dorsally subluxated ulna



**Case 2. Arthroscopic wafer procedure**



68/F, Lt wrist pain for 2 years, farmer

- ✓ ulna fovea sign -
- ✓ pain on sup/pro -/ -
- ✓ ulnocarpal stress test - clicking +
- ✓ DRUI instability -

**Case 2. Arthroscopic wafer procedure**



**Case 2. Arthroscopic wafer procedure**



	Pre-op	Last follow-up
VAS pain score	5	1
DASH score	48.3	9.2
Mayo wrist score	55	85

POD 2 years      POD 9 years

### Ulnar shortening osteotomy versus wafer procedure

**Arthroscopic Wafer Procedure Versus Ulnar Shortening Osteotomy as a Surgical Treatment for Idiopathic Ulnar Impaction Syndrome**  
 Won Suk Oh, M.D., Bo-Young Kang, M.D., Ph.D., Sang-Min Choo, M.D., Ph.D., B-Hyun Koh, M.D., Ph.D., Han-Mo-Su An, M.D., and Han-Rak Choi, M.D., Ph.D.  
 J Bone Joint Surg Am. 2018;100(12):1015-1021. doi:10.1097/BTS.0000000000000518

AWP (n=32) versus USO (n=30), RCT, mean follow-up periods 22 months

- Similar clinical outcomes
- Lower incidence of hardware irritation, earlier return to work (57.7 versus 117 days), fewer secondary procedures in AWP group

Outcome Measure	AWP Group	USO Group	P Value	
VASIS	Preoperative	91.0 ± 9.73	92.7 ± 7.94	.88
	Postoperative	93.9 ± 9.1	93.4 ± 9.18	.88
	P value	<.001	<.001	
USGRS	Preoperative	48.7 ± 12.2	49.3 ± 10.9	.22
	Postoperative	86 ± 1.9	88 ± 2.9	.18
	P value	<.001	<.001	
VISA	Preoperative	63.0 ± 2.1	63.0 ± 1.8	.80
	Postoperative	83.0 ± 0.9	84.0 ± 1.1	.81
	P value	<.001	<.001	
Grip strength	Preoperative	46.7% ± 9.0%	48.0 ± 9.0%	.78
	Postoperative	82.0% ± 9.0%	82.7% ± 12.0%	.28
	P value	<.01	<.01	

USO (n=23) vs AWP (n=19), follow-up periods: 2 years

- Less than 4 mm of PUV, stable DRUJ, LT joint.
- Similar clinical, radiologic outcomes, lower complication rates after AWP

### Factors that influence to choose one over the other

- USO Vs. Wafer procedure
  - Configuration of DRUJ (Tolat classification) : type III configuration (wafer procedure preferred)
  - Amount of required shortening : > 3-4mm (USO preferred)
  - Age of patient, smoking status : younger & nonsmoking (USO preferred)
  - Need for earlier return to work (wafer procedure preferred)
  - Amount of structural damage to the TFCC : intact TFCC (USO preferred)

(Oh et al. 2018; Leibig et al., 2021)

### Concomitant TFCC deep limb injury

- Ulnar impaction syndrome → increased load on the ulnar side of the joint → injuries in the TFCC → progressive increase of DRUJ instability
- USO : decreases the load on the ulnocarpal joint, increases the tension of TFCC
- UIS + DRUJ instability : if the RUL is detached from the insertion (no tensioning effect of USO), DRUJ instability remains even with increased tension of the IOM resulting from USO → could consider simultaneous TFCC repair (no consensus)

### Concomitant TFCC deep limb injury

- Comparative study : unstable TFCC + UIS
  - ✓ USO + debridement (n=16)
  - ✓ USO + repair (n=15)
  - ✓ Better outcomes in repair
  - ✓ DRUJ instability recovery repair (11/12) > debridement (4/11)

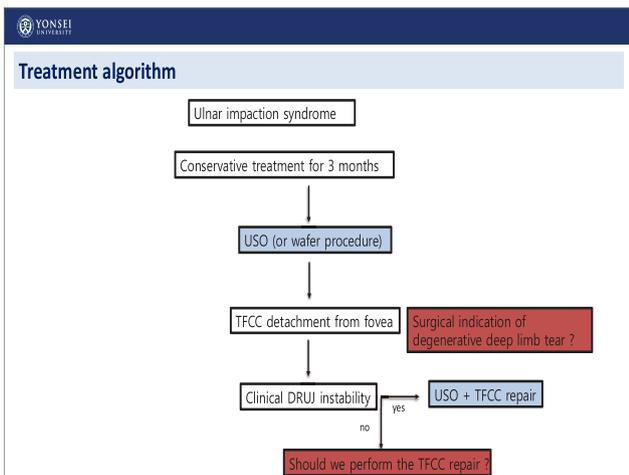
(Seo et al., 2016)

### Case 1.

- 56/f, heavy laborer, Lt wrist pain for 6 months
- Ulna fovea sign (+), pain on rotation (+)
- DRUJ instability (+)

T2 COR F

### Case 1.



# Metaphyseal osteotomy with or without TFCC repair

Department of Orthopedic Surgery The Catholic University of Korea

Joo-Yup Lee

## Ulnar Shortening Osteotomy

- Most common procedure for ulnar impaction
- Diaphyseal osteotomy
  - Wide exposure
  - Long incision
- **Not without Complications**



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## Ulnar Shortening Osteotomy: Are Complications Under Reported?

Samuel K. L. Chan<sup>1</sup> · T. Singh<sup>1</sup> · R Pinder<sup>1</sup> · S. Tan<sup>1</sup> · M. A. Craigen<sup>1</sup>

- **Overcorrection**
- **Nonunion**
- **Refracture**
- Plate irritation
- Ulnar nerve injury



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## Advantages of Metaphyseal Osteotomy

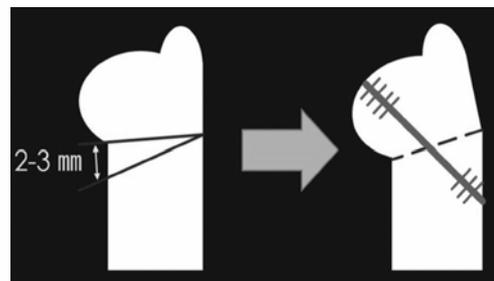
- Smaller incision
- Faster bone union
- Direct vision of ulnar styloid, ECU and TFCC
  - **Combined procedures can be possible**



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## Distal Ulnar Metaphyseal Wedge Osteotomy for Ulnar Abutment Syndrome

Nobuyuki Kubo<sup>1</sup> Hisao Moritomo, MD, PhD<sup>2</sup> Sayuri Arimitsu, MD, PhD<sup>3</sup>  
Shunsuke Nishimoto, MD, PhD<sup>4</sup> Takeshi Yoshida, MD, PhD<sup>5</sup>



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SURGICAL TECHNIQUE

### Distal Metaphyseal Ulnar-Shortening Osteotomy: Surgical Technique

Warren C. Hammett, MD, Richard B. Williams, MD, Jeffrey A. Greenberg, MD, MS

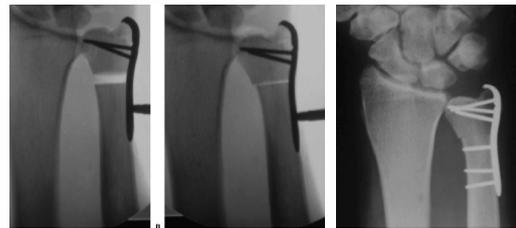


OF KOREA  
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SCIENTIFIC ARTICLE

### Metaphyseal Ulnar Shortening Osteotomy for the Treatment of Ulnocarpal Abutment Syndrome Using Distal Ulna Hook Plate: Case Series

Fiesky A. Nunez Jr, MD, PhD, Jonathan Barnwell, MD, Zhongyu Li, MD, PhD, Fiesky A. Nunez Sr, MD



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### Radiologic Results



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### No Locking Screw in Diaphysis



Post Op    4W    8W    12W    16W    20W

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## Osteotomy Technique is More Important



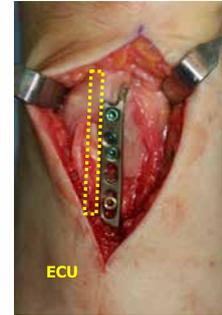
- First half: double blade
- Last half: single blade
- Irrigation to prevent heat injury



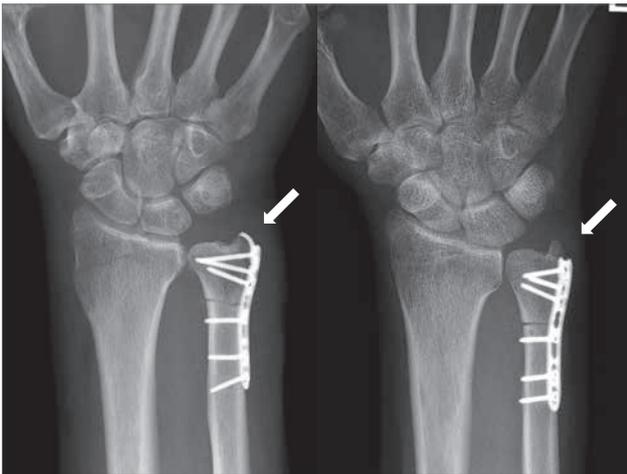
TER

## Hardware Irritation

- Removal: 9/28 (32 %)
- Due to ECU irritation
- Cut dorsal hook
- Do not repair extensor retinaculum over the plate



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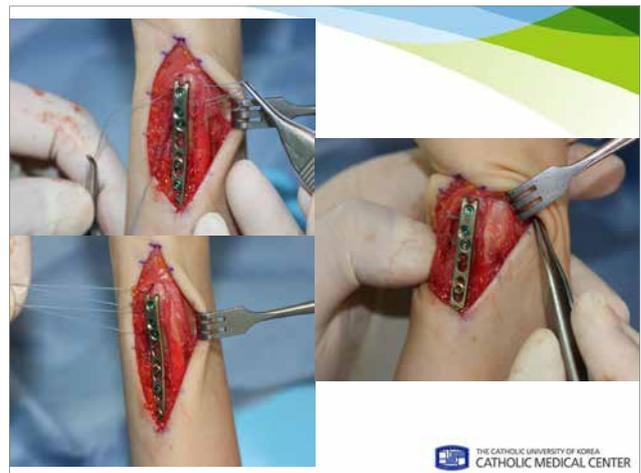
## ECU Subluxation

- Manage it simultaneously
- Iatrogenic subluxation can occur
  - Never open ECU sheath distal to the osteotomy site
- Bone tunnel on the ulnar styloid

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## Ulnar Nerve Injury

- Dorsal br: 3 cases
- Mostly Transient
- Retract to Volar Side
- **Take Great Care of the Ulnar Nerve**



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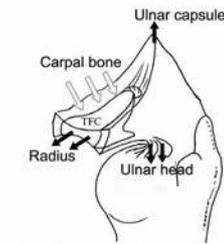
## Relationship between TFCC Tear and Ulnar Impaction Syndrome

- Not fully understood
- **They can exist simultaneously**
- Two different symptoms
- Only discuss that the TFCC wear is a result of ulnar impaction
- **TFCC foveal tear maybe a cause of ulnar impaction**

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## Function of the TFCC

- **Load bearing**
  - Like a hammock
  - Shock absorber
- **RU ligaments**
  - DRUJ stabilizer
  - Carpal stabilizer



ER

## Ulnar Impaction

- Mechanical loading
- LT tenderness
- Grinding test (+)
- Radiologic findings
- Ulnar shortening**

## TFCC Tear

- DRUJ instability
- Foveal tenderness
- Instability (+)
- Radiologic findings
- TFCC repair**

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## Metaphyseal Versus Diaphyseal Ulnar Shortening Osteotomy for Treatment of Ulnar Impaction Syndrome: A Comparative Study

Alejandro Marquez-Lara, MD,\* Fiesky A. Nuñez, Jr, MD, PhD,\* Tunc Kiyamaz, BS,\*  
Fiesky A. Nuñez, Sr, MD,† Zhongyu Li, MD, PhD\*

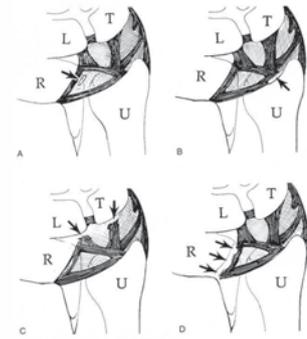
TABLE 3. Status of TFCC by Treatment Group

TFCC Status	Metaphyseal	Diaphyseal
TFCC injury	9/14 (64%)	15/21 (71%)
TFCC repair	2/9 (22%)	4/15 (26%)

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## Palmer's Classification

- **Type I**
  - Traumatic
  - **DRUJ instability**
- **Type II**
  - Degenerative
  - **Ulnar impaction**



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### Traumatic vs Degenerative ?



M/20

F/54

### Central Perforation + Foveal Tear



### Central Perforation + Foveal Tear

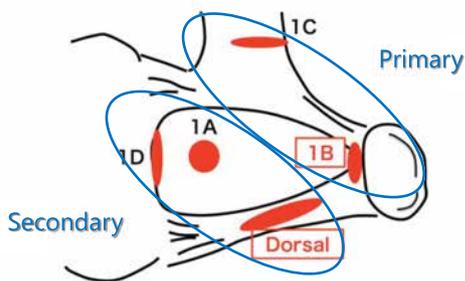


### Central Perforation + Foveal Tear

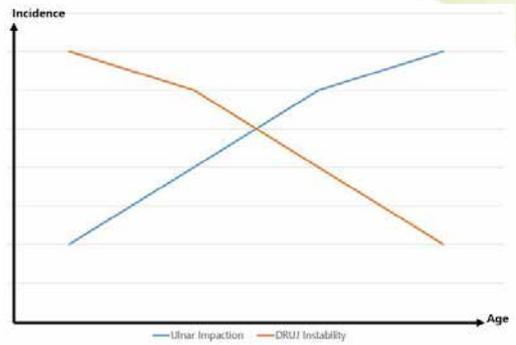
- Central, dorsal
  - Result of UIS
- Foveal, volar
  - Cause of UIS (?)



### Primary vs Secondary Lesions



### Ulnar Impaction vs Instability



**CURRENT CONCEPTS**

### The Distal Interosseous Membrane: Current Concepts in Wrist Anatomy and Biomechanics

Hisao Moritomo, MD, PhD

Proximal shortening

Distal shortening

DOB

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## Distal Interosseous Membrane

- Cannot be tighten with metaphyseal osteotomy  
- Moritomo et al
- Only 50 % of the population have this ligament
- Less strong than TFCC

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## DRUJ Instability after Shortening

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If both DRUJ instability and ulnar impaction symptoms exist in the same patient

↓

Both ulnar shortening and A/S TFCC foveal repair is needed

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### The Combined Procedure of Ulnar Metaphyseal Shortening Osteotomy With Triangular Fibrocartilage Complex Foveal Knotless Repair

Jin-Hyung Im, MD, PhD,\* Joo-Yup Lee, MD, PhD,† Han-Vir Kang, MD†

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Special Review Article

### Ulnar Impaction Syndrome and TFCC Injury: Their Relationship and Management

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A

supination weight bearing

B

pronation weight bearing



## Take Home Messages

- Osteotomy technique is most important regardless of the plating system
- Metaphyseal osteotomy can be an alternative technique with several advantages
- Beware complications !!!

**Room C**

# **Free Paper 6**

## **Wrist III**

Orthop Sug. Yeson Hosp. **Jin Ho Kim**  
Orthop Sug. Seoul National Univ. **Hyun Sik Gong**

# Radiologic and clinical results of volar wedge cancellous bone graft and headless compression screw fixation for treatment of scaphoid waist nonunion with humpback deformity

Orthop Surg. Yeson Hosp.

Kyoung-Tae Min, Jae Hoon Lee

## 목적

humpback 변형을 동반한 주상골 waist 불유합의 치료는 골이식의 종류 및 방법, 고정 방법에 따라 여러 치료 방법이 시행되고 있다. 저자들은 humpback 변형을 가진 주상골 불유합에서 5mm의 volar wedge cancellous bone graft와 headless compression screw fixation으로 치료하였다. 이 연구의 목적은 위의 수술 방법의 방사선적 변화 및 alignment의 교정 정도를 확인하고 임상적 결과를 보고하는 것이다.

Several treatment methods are being used to treat scaphoid waist nonunion accompanied by humpback deformity, depending on the type and method of bone grafting and fixation method. The authors treated a scaphoid nonunion with humpback deformity using a 5 mm volar wedge cancellous bone graft and headless compression screw fixation. The purpose of this study is to confirm the radiological changes and degree of alignment correction of the above surgical methods and report the clinical results.

## 대상 및 방법

20년 5월부터 23년 4월까지 humpback 변형을 동반한 주상골 waist 불유합 환자 중 위의 방법으로 수술한 24명의 환자를 대상으로 후향적 연구를 진행하였다. 환자들은 모두 12개월 이상 추시되었다. 남자가 21명, 여자가 3명이었으며 평균 연령은 32.5세(17-58세)이었다. 외상 후 수술까지의 기간은 평균 29개월(7-100개월)이었으며 최종 추시 기간은 평균 15.3개월(12-24개월)이었다. 저자들은 plain x-ray에서 lateral intrascaphoid angle, scapholunate angle, radiolunate angle, scaphoid length를 분석하였으며 기능적 결과로 modified Mayo wrist score(MMWS)를 평가하였다. 모든 환자에서 수술 후 9주에 CT를 촬영하여 골유합 유무를 확인하였다.

A retrospective study was conducted on 24 patients who underwent surgery using the above method among

patients with scaphoid waist nonunion with humpback deformity from May 20 to April 23. All patients were followed for more than 12 months. There were 21 men and 3 women, and the average age was 32.5 years (17-58 years). The average time from trauma to surgery was 29 months (7-100 months), and the average final follow-up period was 15.3 months (12-24 months). The authors analyzed the lateral intrascaphoid angle, scapholunate angle, radiolunate angle, and scaphoid length on plain x-rays, and evaluated the modified Mayo wrist score (MMWS) as a functional outcome. In all patients, a CT scan was performed 9 weeks after surgery to confirm the presence or absence of bone union.

### 결과

모든 환자에서 수술 후 9주에 골유합을 얻을 수 있었다. Lateral intrascaphoid angle은 41.4도에서 24.7도로 humpback 변형은 모든 예에서 교정되었다. Scapholunate angle은 64.7도에서 50.5도, radiolunate angle은 11.7도에서 2.25도로 감소하였으며, scaphoid length는 26.3mm에서 29.4mm 로 증가하였다. Wrist motion은 술 전에 비해 의미있게 호전되었다. MMWS은 술전 평균 66.3점에서 95점으로 호전되었으며 excellent가 21예, 우수가 3예, 보통이 1예이었다. 방사선적 추상골 변형 교정각도와 MMMS의 수술전 수술 후 차이와는 의미있는 차이를 보이지 않았다.

Bone union was achieved in all patients 9 weeks after surgery. Lateral intrascaphoid angle was corrected from 41.4 degrees to 24.7 degrees, and humpback deformity was corrected in all cases. Scapholunate angle decreased from 64.7 degrees to 50.5 degrees, radiolunate angle decreased from 11.7 degrees to 2.25 degrees, and scaphoid length increased from 26.3 mm to 29.4 mm. Wrist motion significantly improved compared to preoperatively. The MMWS improved from the preoperative average of 66.3 points to 95 points, with 21 cases in excellent, 3 cases in good, and 1 case in fair. There was no significant difference between the radiological scaphoid deformity correction angle and the preoperative and postoperative differences in MMMS.

### 결론

5mm volar wedge cancellous bone graft와 headless screw fixation은 humpback 변형을 교정할 수 있으며 조기 골유합을 얻을 수 있으며 임상적으로 우수한 결과를 보이는 효과적인 치료법으로 사료된다..

5mm volar wedge cancellous bone graft and headless screw fixation can correct humpback deformity, achieve early bone union, and is considered an effective treatment with excellent clinical results.

Table 1. Mean values for preoperative and postoperative radiologic measurements.

	Radiologic measurements			
	LISA(°)	SLA(°)	RLA(°)	Scaphoid length(mm)
Preoperative	41.37[3.83]	64.67[7.73]	12.50[6.79]	26.33[2.94]
Postoperative	24.71[6.30]	50.58[6.78]	2.25[5.61]	29.38[3.21]
p-value	<0.001	<0.001	<0.001	<0.001

[SD] (paired t-test)

Table 2. Mean values for preoperative and postoperative functional measurements.

	Functional measurements				
	VF(°)	DF(°)	RD(°)	UD(°)	MMWS
Preoperative	47.91[10.73]	57.92[5.50]	12.50[3.61]	20.00[4.66]	66.25[8.88]
Postoperative	58.54[4.77]	71.04[6.25]	17.08[2.92]	26.04[3.29]	95.00[6.59]
p-value	<0.001	<0.001	<0.001	<0.001	<0.001

Table 3. Correlation between correction of scaphoid deformity and function.

MMWS vs	LISA	SLA	RLA	Scaphoid length
Pearson's correlation coefficient	0.30	0.208	0.229	0.108
p-value	0.155	0.329	0.281	0.616

**고찰 (Discussion)**

Humpback 변형은 주상골의 volar 단축, Apex의 dorsal 방향 각 형성, 원위 골편의 dorsal 전위, 그리고 DISI 변형(Mathoulin and Arianni, 2018)으로 구성되는 변형이다. 정상 범위에서 Lateral Intrascaphoid Angle(LISA)은 35도 미만이지만, 주상골 불유합은 주상골 길이의 단축과 LISA의 증가를 초래하여 결과적으로 humpback 변형을 유발한다(Amadio et al., 1989).

Humpback 변형을 동반한 주상골 waist 불유합 환자의 치료에는 골이식의 종류 및 방법, 그리고 고정 방식에 따라 다양한 치료법이 적용된다. 비혈관화 골이식 방법으로는 긴 얇은 피질-해면질 골이식을 inlay 방식으로 사용하는 전통적인 Matti-Russe 술식과, volar 뼈기 모양의 중재 골이식을 사용하는 Fisk-Fernandez 술식이 있다. 전통적인 Matti-Russe 술식은 주상골의 심한 변형을 교정하는 데 한계가 있어 malunion 비율이 상대적으로 높다(Mathoulin and Arianni, 2018). 이에 비해, Fisk-Fernandez 술식은 주상골의 길이를 회복하고 volar radiocarpal ligament의 정상적인 긴장을 재설정할 수 있어 DISI 변형을 교정하는 데 효과적이며, 성공적인 결과가 보고되었다(Kim et al., 2017). 혈관화 골이식은 비혈관화 골이식에 비해 생존 가능한 골세포가 전달될 수 있어 이론적으로 우수하다고 보고되었지만, 기술적 난이도로 인해 일반적으로 사용되기는 제한적이다(Mathoulin and Arianni, 2018). 최근에는 Free flap보다는 기술적 난이도가 낮은 Pedicled vascularized Volar distal radial bone graft 등이 시도되었고 우수한 결과가 보고되고 있으나(Malizos et al., 2017), 비혈관화 골이식과 혈관화 골이식의 주상골 waist 불유합 수술에서의 유합율은 비슷하기 때문에(Pinder et al., 2015; Ammori et al., 2019), 주상골 불유합의 위치가 proximal pole이 아닌 경우에는 비혈관화 골이식을 우선적으로 고려하는 것이 권장된다(Fujihara et al., 2023).

비혈관화 골이식 중 Corticocancellous graft와 cancellous graft는 유합율에 있어서 통계적으로 유의한 차이는 없었으나, cancellous graft가 유합에 걸리는 시간이 더 짧다고 한다(Ammori et al., 2019). 고정 방법으로는 K-wire와 Screw를 사용하는 방법이 있으며, Herbert 등이 1984년에 screw를 이용한 불유합 치료를 보고한 이후 Screw 고정이 불유합 치료의 gold standard로 여겨지고 있으나, K-wire와 Screw 간의 통계적으로 유의한 차이는 없다고 보고되었다(Hegazy et al., 2021). 또한 Plate를 이용해 좋은 결과를 얻은 연구들도 있다(Putnam et al., 2019).

본 연구에서는 humpback 변형을 동반한 주상골 불유합 환자를 대상으로 5mm volar wedge cancellous bone graft와

headless compression screw 고정을 이용한 치료의 방사선학적 및 임상적 결과를 분석하여 (1) 수술 후 9주 이내에 모든 환자에서 골유합이 이루어졌으며, (2) Lateral intrascaphoid angle, Scapholunate angle, Radiolunate angle, Scaphoid length와 같은 주요 방사선학적 지표에서 유의미한 개선이 있었고, (3) ROM, MMWS와 같은 기능적 지표에서도 큰 호전을 보였다는 결론을 얻었다.

## 골유합 및 변형 교정

모든 환자에서 수술 후 9주에 골유합이 이루어진 것은 이 치료법의 유효성을 입증하는 중요한 결과이다. LISA는 평균 41.4도에서 24.7도로, SLA는 64.7도에서 50.5도로, RLA는 11.7도에서 2.25도로 감소하였으며, 이는 humpback 변형이 효과적으로 교정되었음을 나타내며, Scaphoid length도 26.3mm에서 29.4mm로 증가하여 주상골의 해부학적 구조가 복원되었음을 시사한다.

## 임상적 결과

수술 전 평균 66.3점이었던 MMWS는 수술 후 평균 95점으로 크게 개선되었으며, 환자들의 손목의 Range of motion도 유의미하게 호전되었다. 특히 VF, DF, RD, UD 각도가 모두 통계적으로 유의미하게 증가하였다. 이는 환자들의 손목 기능이 상당히 회복되었음을 의미한다.

## 방사선학적 및 기능적 결과의 상관관계

방사선학적 지표와 기능적 지표 간의 상관관계를 분석한 결과, LISA, SLA, RLA, scaphoid length와 MMWS 간에는 통계적으로 유의미한 상관관계는 없었다. 이는 변형 교정의 정도가 기능 회복과 직접적인 연관이 없을 수 있음을 시사하지만, 방사선학적 교정이 환자의 주관적 만족도와 기능적 향상에 기여할 가능성을 배제할 수는 없다.

## 한계점

이 연구는 후향적 연구 디자인과 비교적 적은 환자 수로 인한 한계점이 있다. 또한, 추적 관찰 기간이 평균 15.3개월로, 장기 추적 결과를 확인하기에는 부족할 수 있다. 향후 연구에서는 더 많은 환자 수와 장기 추적을 통해 이 치료법의 장기적 유효성과 안전성을 평가하는 것이 권장된다.

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# The outcomes and complications after all dorsal scapholunate ligament reconstruction with internal brace

W Institute for Hand and Reconstructive Microsurgery, W Hosp.

Byoung-Jin Kim, Ho-Jun Cheon, Sang-Hyun Woo

## Background

Various techniques are introduced for scapholunate ligament reconstruction. However, the reconstruction of chronic scapholunate ligament pathology remains a significant challenge for hand surgeons. The purpose of this study is to investigate the outcome and complication of all dorsal scapholunate ligament reconstruction with internal brace.

## Methods

Between February 2023 and January 2024, a total of 9 patients with chronic scapholunate ligament injury underwent all dorsal scapholunate ligament reconstruction with internal brace. Their clinical results were evaluated, including range of motion of the wrist joint, grip strength and modified Mayo wrist score. Radiographic results including scapholunate gap and scapholunate angle were also assessed.

## Results

At the last follow-up, patient's mean preoperative SL gap improved from 3.7 to 2.8, as did scapholunate angle from 65.4 to 59.6. Mean modified Mayo score was improved from 55.5 to 64.4. Grip strength, range of motion (flexion and extension arc) was showed similar results. 3 complications were acquired (2 reconstruction failure, 1 scaphoid fracture).

## Conclusions

All dorsal scapholunate reconstruction with internal brace technique showed improvement in radiologic and clinical score. However, it showed relatively high rate of complication.

# Patient-reported outcomes after open reduction internal fixation for distal radius fracture in men

Orthop Sug. Asan Medical Center, Univ. of Ulsan

Ji Hoon Ahn, Jae Kwang Kim, Byung Hoon Oh, Young Ho Shin

## Purpose

Scaphoid nonunion can lead to advanced collapse, altering carpal joint biomechanics and causing arthritis and deformities. Treatment typically involves non-vascularized bone grafting and screw fixation. The fracture's position relative to the dorsal scaphoid ridge helps assess deformity progression. Fractures distal to the ridge cause volar flexion and humpback deformity, while more proximal fractures remain relatively stable but risk reduced blood flow. This study compares treatment outcomes and deformity characteristics using the same bone graft and screw fixation methods.

## Methods

A retrospective analysis of 70 scaphoid nonunion patients with Humpback-like and Dorsal translation deformities who had surgery from 2001 to 2022 was conducted. Clinical assessments included Modified Mayo Wrist Score, DASH score, range of motion, and complications. Radiological evaluations focused on bone union status, lateral intra-scaphoid angle, scapholunate angle, radiolunate angle, scaphoid length, and SL ratio.

## Results

The study included 65 males and 5 females, averaging 36.8 years old, with 33 cases of Humpback-like deformity and 37 of Dorsal translation deformity. Among Humpback-like cases, 7 had severe deformity (LISA > 40°), and 32 achieved bone union in 4.5 months. Three cases had nonunion, with 1 requiring additional surgery due to pain. For Dorsal translation deformity, 31 achieved union in 5.8 months, while 8 had nonunion. Only 1 symptomatic case required further surgery.

## Conclusion

The study found successful bone union in most cases with minimal complications for both deformity types. However, dorsal translation deformities required a longer union time compared to humpback-like deformities, possibly due to the more proximal fracture line and reduced blood flow in that area.

**Keywords:** Scaphoid nonunion, Humpback deformity, Dorsal translation, Auto bone graft

# Comparative Outcomes of Arthroscopic Bone Grafting and Fixation in Sclerotic and Fibrotic Unstable Scaphoid Nonunions

Orthop Sug. Severance Hosp., Yonsei Univ.

Hyun-Kyo Kim, Do-Hyun Kim, Jae-Yong Cho, Sang-Hee Kim, Won-Taek Oh, Il-Hyun Koh, Yun-Rak, Choi

## Introduction

Enhancing biologic healing capacity by exposing healthy cancellous bone is important to increase the possibility of bone healing in the treatment of unstable scaphoid nonunion. This debridement procedure can be difficult when there are sclerotic seals on the nonunion sites (sclerotic nonunions). This study aims to compare the clinical and radiological outcomes of arthroscopic bone grafting and fixation in patients with sclerotic scaphoid nonunions and fibrotic (non-sclerotic) nonunions.

## Methods

Between March 2009 and May 2022, patients with scaphoid nonunion underwent arthroscopic bone grafting and internal fixation were included. The patients were divided into two groups based on initial radiographs whether sclerotic seals on the nonunion sites were presents (Group S) or not (Group F). One senior surgeon performed arthroscopic osteosynthesis for the same surgical indications. Visual analog scale score, grip strength, active range of motion, Mayo wrist score (MWS), and Disabilities of Arm, Shoulder, and Hand score were assessed preoperatively and postoperatively. Union was determined by computed tomography 8 to 10 weeks postoperatively with bridging trabecula at the nonunion site. Scapholunate angle (SLA), radiolunate angle (RLA), and lateral intrascaphoid angle (LISA), plus height/length ratio (HLR) served to gauge carpal bone alignment in preoperative and postoperative radiographs.

## Results

A total of 47 patients were enrolled in this study. Bony union was achieved in 44 patients and nonunion rates did not differ by patient subset (Group S, n=2, 7.1%; Group F, n=1, 5.3%; p=1.000), and there was no significant

difference found when comparing the average union time among patients who achieved bony union (Group S, average union time =  $2.4 \pm 1.1$  months; Group F, average union time =  $2.3 \pm 1.0$  months;  $p=0.678$ ). Within both groups, visual analog scale score, grip strength, range of motion, Mayo Wrist Score, and Disabilities of Arm, Shoulder, and Hand scores were similar at the last follow-up. In radiographic assessments, SLA, RLA, and LISA was also similar between groups at the last follow-up.

## Conclusion

Arthroscopic bone grafting and internal fixation in treating scaphoid nonunions with or without sclerotic seals did not show any significant differences in clinical and radiologic outcomes at the minimum of 2 years after operation.

**Keywords:** Scaphoid, nonunion, arthroscopy, computed tomography

Figure Legends



Fig.1. Preoperative CT scans on coronal view. (a) Sclerotic nonunion and (b) non-sclerotic nonunion

# Retrograde headless compression screw fixation via volar approach for Type B1 and B2 scaphoid nonunion

<sup>1</sup>Orthop Sug. Kyung Hee Univ. Hosp., <sup>2</sup>Orthop Sug. Yeson Hosp.

Duke Whan Chung<sup>1</sup>, Jae Hoon Lee<sup>2</sup>, Jong Hun Baek<sup>1</sup>, Ki-Hyeok Ku<sup>1</sup>

## Purposes

Distal type scaphoid nonunion (type B2) is treated with the bone grafting and headless compression screw fixation through volar approach. While the dorsal approach is recommended in case of proximal type scaphoid nonunion (type B1) because screw insertion from the dorsal side allows vertical fixation of the fracture site. However, antegrade screw fixation via dorsal approach endangering the vascular supply. This study compares radiographic outcomes of type B1 and B2 scaphoid nonunion treated with retrograde headless screw fixation and bone grafting.

## Patients and Methods

In a retrospective study, 33 patients who had underwent autogenous bone graft and retrograde headless compression screw fixation for scaphoid nonunion with a follow-up period of  $\geq 1$  year were included. The patients were categorized into two group: Group A (Type B1, n=16), and Group B (Type B2, n=17). Outcomes were assessed based on the fracture union and progression of arthritic changes.

## Results

No significant difference was found in union rate. All patients in Group A obtained a bone union at the last follow-up. In Group B, nonunion observed in one patient at the last follow-up. There was significant difference in the mean union period between the groups (9.08 and 4.23 months in Group A and B, respectively). The average DASH score was 20.9 points (range 8 to 47) at last follow-up. There was no difference in progression of arthritic changes.

## Conclusion

Fracture union rate did not differ between groups at the last follow-up. Therefore, retrograde headless compression screw fixation for the type B1 scaphoid nonunion is considered a useful treatment option.

**Key Words :** scaphoid nonunion, retrograde screw fixation, volar approach

# Scapholunate Ligament Reconstruction with Internal Brace Augmentation Techniques for Chronic Scapholunate Dissociation: A clinical follow-up study

Orthop Sug. Eulji Univ.

Je-Chan Lee, Sang Ki Lee

## Introduction

The scapholunate ligament (SLL) is the most important stabilizer of the scapholunate articulation. The management of chronic irreversible injuries of this ligament in the absence of pre-existing arthritis of the wrist joint remains controversial. Recently, surgeons introduced a novel surgical technique using an internal brace (IB). Several biomechanical studies on this technique have been conducted using cadavers; however, no study has yet discussed the results in detail in actual clinical practice. Therefore, herein, we investigated the radiological and functional results of patients who underwent IB augmentation as a treatment for chronic scapholunate dissociation (SLD).

## Methods

This retrospective study was conducted from April 2018 to May 2022. Twenty-two patients with chronic SLD were treated using the IB augmentation technique, of whom 17 were followed-up for at least one year. Radiological results, including scapholunate distance, scapholunate angle, and radioscapoid angle, were collected. Furthermore, clinical parameters, such as the visual analog scale (VAS, preoperative and at final follow-up), the Disabilities of the Arm, Shoulder, and Hand (DASH) scores (preoperatively and at 3, 6, and 12 months postoperatively), and Mayo wrist scores (preoperative and at final follow-up), were measured.

## Results

The scapholunate distance increased significantly following SLD, indicating improvements following reconstruction in all wrist positions. The scapholunate angle significantly increased after SLD compared with that of the unaffected wrist in all positions except for extension and improved after reconstruction in all wrist positions.

The radioscapoid angle significantly increased following SLD compared with that of the unaffected wrist in all positions except for extension and clenched fist. This angle improved after reconstruction in all wrist positions except for extension. The VAS score (7 to 2, preoperatively and at final follow-up) and Mayo wrist score (53 to 82, preoperatively and at final follow-up) improved after surgery. The DASH scores also improved after surgery (68, 53, 30, 7, preoperatively and at 3, 6, and 12 months postoperatively).

### Conclusions

This study revealed that SLL reconstruction using an autologous tendon and suture tape is a good reconstruction technique that can improve clinical symptoms and radiographic parameters with a shorter operation time and fewer complications than other reconstruction methods.

**Keywords:** scapholunate ligament, scapholunate dissociation, ligament reconstruction, internal brace augmentation

# A Radiological Effectiveness of Fixed-Angle C-arm Tomosynthesis Image to Ensure Proper Screw Position at Scaphoid Fracture Models

Yeson Hosp.

Joonha Lee

## Purpose

The use of portable tomography devices in limb fracture is limited. In this study, the authors introduce a newly developed portable tomography device (Fixed-angle C-arm tomosynthesis image; FACT) and report its effectiveness in ensuring proper screw placement and alignment for percutaneous screw fixation in the scaphoid waist fracture model.

## Methods

The following seven 7 wrist models were designed using radio-opaque synthetic bone (Synbone®). There was one scaphoid waist fracture model, 2 types of models with guide-pin inserted (proper v.s. deviated axis), and 4 types of models with screw inserted (proper axis with/without screw penetration and deviated axis with/without screw penetration).

A total of 80 orthopedic surgeons participated in the study. Participants were provided with a fluoroscopy image or tomography image by FACT for each model, and responded to the questions regarding the presence or absence of fractures, appropriateness of alignment, and joint penetration of the screw.

## Results

A total of 80 people, 40 orthopedic surgeons and 40 hand surgery subspecialists, participated in the study. Fracture detection rate was 92.5% by fluoroscopy and 100% by Tomography ( $p=0.077$ ). For guide-pin inserted model, the sensitivity of tomography to detect correct axis of guide-pin was significantly higher than it of fluoroscopy (92.5% v.s. 50.0%,  $p < 0.001$ ). For screw inserted models, Tomography showed significantly higher specificity in detection of joint penetration of screw than fluoroscopy (83.5% v.s. 65.0%,  $p=0.017$ ).

## Conclusion

FACT is useful in diagnosing fractures, determining the correct orientation of the implant, and detection of articular penetration of screw while performing percutaneous screw fixation in scaphoid fracture models.

**Key Terms:** Portable tomography, fluoroscopy, scaphoid fracture, percutaneous screw fixation

**Room C**

# **Symposium 3: Show me the way**

## Case Symposium

Plast Reconstr Sug. Korea Univ. **Seong Ho Jeong**

# Show me the way (Skin coverage)

Department of Plastic and Reconstructive Surgery Incheon St. Mary's Hospital, College of Medicine,  
The Catholic University of Korea

Jun Yong Lee

### Case 1

- **Pigmented skin s skin coaptation**
  - Consider underlying chronic process
- **Joint surface, bursa area**
  - Requires thin, elastic skin coverage
  - Soft tissue padding
  - Anti-RSTL scar surface
- **Layer disruption**
  - Disruption of superficial fascia
  - Preservation of deeper layer



### Case 2

- **Swollen, granulating deep open wound with pinning**
  - Consider subacute process after trauma
- **Dorsal exposure of tendon**
  - Requires thin, elastic flap coverage
  - Soft tissue padding
  - Anti-RSTL scar surface
- **Layer disruption**
  - Disruption of superficial & deep fascia



### Considerations

- **Subacute phase of wound**
  - Granulating, large scar area
  - Surrounding edema with open fascia
- **Functional aspects (Joint area)**
  - Minimize scarred area
  - Recover soft tissues reservoir for motion
  - Restore layer-by-layer anatomical structures
  - Rehabilitation of gliding mechanism
- **Aesthetic aspects**
  - Hands and forearm: Exposed area of daily living



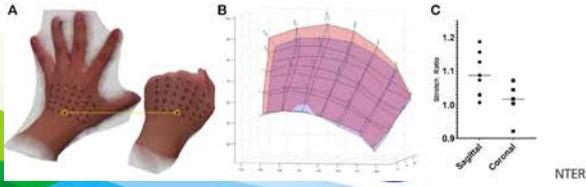
### Acute vs. Subacute wound

	Acute wound	Subacute wound
Period	2-3 weeks to heal	4-6 weeks to heal
Wound healing phase	Progress as expected	Slow progression
Discharge	Decrease as healing progresses	May persist longer than acute wound
Scarring	Minimal scarring	<b>Pronounced scarring</b>
Wound management	Routine wound care	Advanced dressing or <b>surgical interventions</b>
Clinical implications	Heals without complications	Potentially <b>progress into chronic wound</b> <b>Correction of underlying factors</b> are required (infection, circulatory problems, etc.)

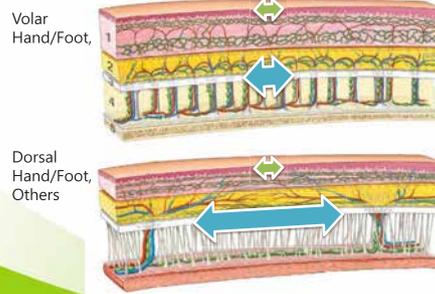


### Soft tissue reservoir

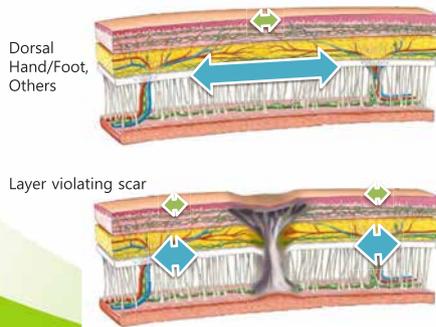
- Potential soft tissue deformation on motion
- 3D evaluation of stretch ratios
  - Up to 1.19 in the sagittal plane, 1.07 in coronal plane
- Failure of restoration limit proper joint motion



### Superficial integument to deep fascia

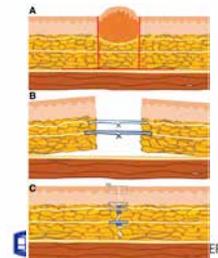
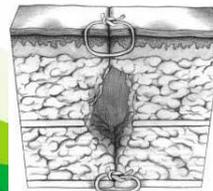


### Scar tethering



### Restore layer-by-layer anatomical structures

- Layer-by-layer closure
  - To prevent tethering by layer-violating scarring
  - Ensure layer continuity when flap inset
  - Avoid dead space
  - Avoid iatrogenic fat necrosis

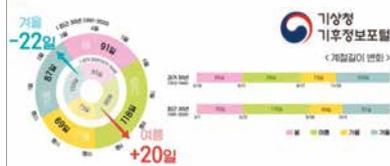


### Rehabilitation of gliding mechanism

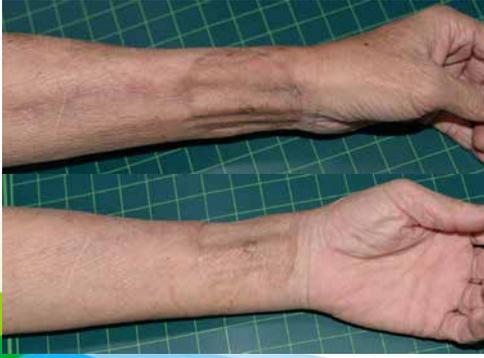


### Exposed area – Hand & Forearm

- Aesthetical considerations
  - Avoid depressed scars or uneven surface
  - Avoid use of exposed area-based flap (RFF)
  - Localize the damaged/reconstructed area
  - Designing scars on ulnar side



### Distal forearm donor



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### Distal forearm donor



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### Coverup Tattoos



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### More proximal forearm donor



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### Coverup Tattoos



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### Localize damaged/reconstructed area



TER



### Designing scars on ulnar side, rather than radial side



### Approach

- 1<sup>st</sup>: **Extended NPWT-assisted dermatotraction**
  - Reduce edema
    - Restoration of soft tissue reservoir
  - Approximating fascial dehiscence
    - Decreasing scar area
    - Accommodate layer-by-layer architecture restoration
- 2<sup>nd</sup>: 1) **Delayed closure**  
 2) **STSG c dermal matrix, Secondary revision**  
 3) **(Reverse) radial forearm fasciocutaneous flap**



### Extended NPWT-assisted Dermatotraction

- **Open fasciotomy wound**
  - Decreased tissue pressure → persisting edema → marginal contraction & inversion → aggravate wound widening
  - Coverage with grafting or flap → suboptimal coverage
  - Solution: **Reversing the fasciotomy wound-widening cascade**



### Restoration of the tissue pressure provided by fascia and skin

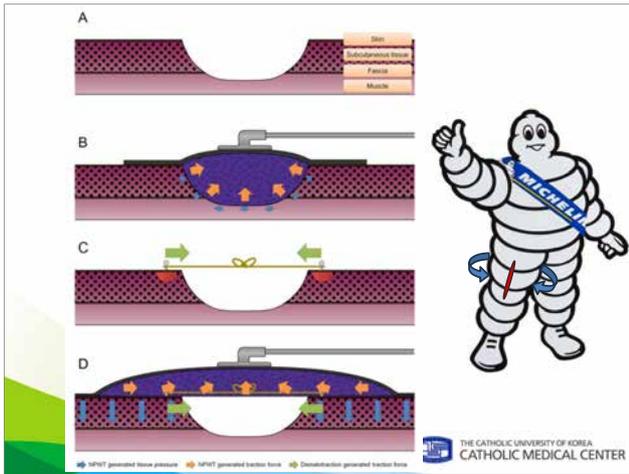
- NPWT: limited in tissue pressure↑ & swelling↓
- Dermatotraction: weakly tissue pressure↑, skin necrosis
- **Extended NPWT**: assist tissue pressure↑
  - Wide sponge application, extended surgical draping
  - -100mmHg suction pressure
  - Act as a **compression garment** – centripetal compression
- **Dermatotraction** assist under extended NPWT
  - Vessel loop – allowing **stress relaxation** of contracted skin

RESEARCH ARTICLE

Extended negative pressure wound therapy-assisted dermatotraction for the closure of large open fasciotomy wounds in necrotizing fasciitis patients

Citations +66

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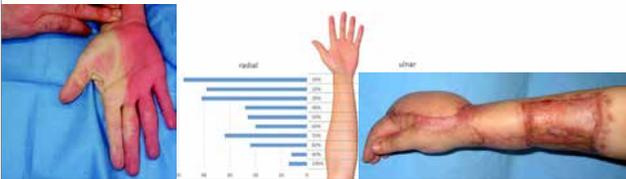
### Radial forearm fasciocutaneous flap

- Good soft tissue padding
- Thick, less pliable – protrude when elbow extension
- Unsightly scar on distal forearm

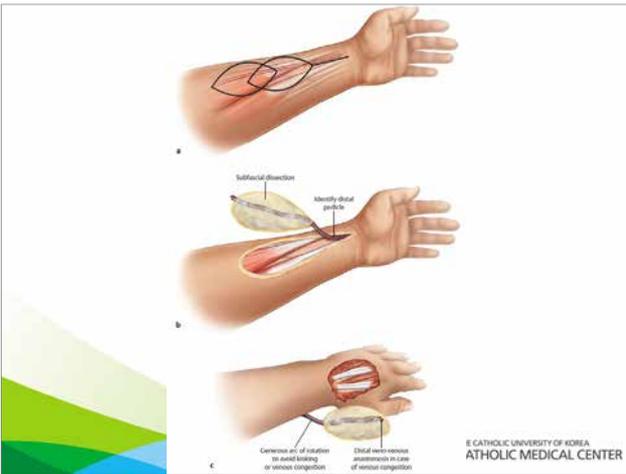
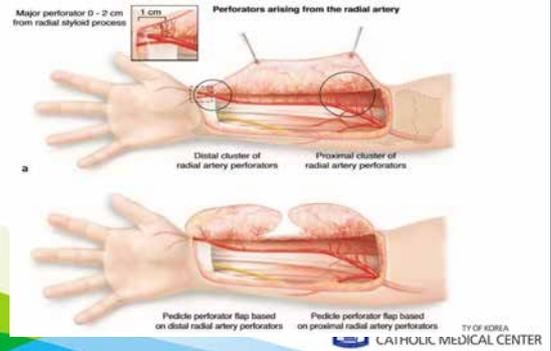


## Reverse radial forearm FC flap

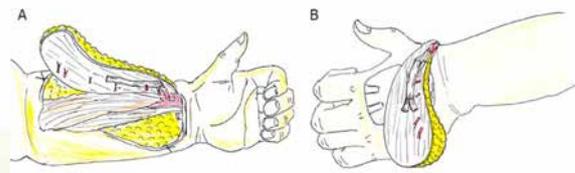
- Check palmar arch – Allen test
- Design flap on the proximal perforators cluster
- Proximal forearm – thicker than distal forearm
  - Consider recipient thickness
  - May leave depressed unsightly scar on proximal forearm



## Reverse radial forearm FC flap

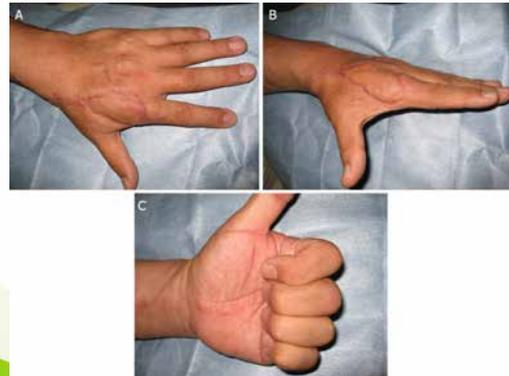
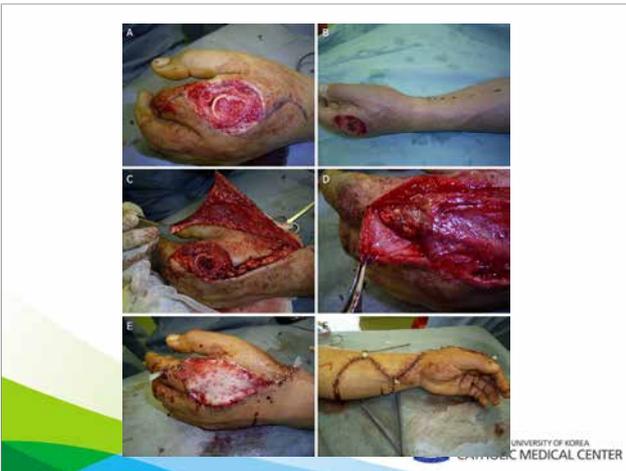


## Radial artery perforator-based adipofascial flap



Plast Aesthet Res 2009;7:24.

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## Summary

- **Careful wound status evaluation**
  - Healing phase, depth & extent, involved layer, joint motion, scar area-RSTL, underlying cause of delayed healing (infection, vascular supply, etc.)
- **Functional aspects (Joint area)**
  - Minimize scarred area
  - Recover reservoir soft tissues for motion
  - Restore layer-by-layer anatomical structures
  - Rehabilitation of gliding mechanism

## Summary

- **Aesthetical considerations**
  - Avoid depressed scars or uneven surface
  - Avoid use of exposed area-based flap (RFF)
  - Localize the damaged/reconstructed area
  - Designing scars on ulnar side
- **Selection of coverage option**
  - Reconstruction ladder
  - Thickness and pliability of covering tissue
  - Discuss with patient for potential pros and cons

# Skin and soft tissue reconstruction at the elbow / hand dorsum Pedicled lateral arm flap / reverse radial forearm fascial flap and STSG

인하대병원 성형외과

홍민기

Skin and soft tissue defect 를 cover 하는 방법은 결손 위치나 크기에 따라 secondary intention, primary closure, delayed primary closure, Skin graft, Local flap, Regional flap, Tissue expander, Free tissue transfer 등의 방법들을 이용할 수 있다. 예전에는 Reconstructive ladder 개념을 이용하여 간단한 방법부터 차근차근 올라가는 방법이 이용되었지만 최근에는 reconstructive pie 또는 reconstruction supermarket 개념을 이용하여 수술자가 본인이 가장 원하는 적합한 방법을 골라 재건에 사용한다.

본 두개의 케이스에서도 위의 여러가지 방법들이 사용될 수 있겠지만 본 저자는 elbow defect 에 대하여 pedicled lateral arm flap 을 이용한 케이스, 손등의 결손부위에 대하여 reverse radial forearm fascial flap 후 STSG 를 시행한 케이스를 소개하고자 한다.

# Reconstruction with ALT free flap

W병원 성형외과

남현재

The ALT flap has found application in elective upper limb defects on account of its ability to be tailor made for individual defects.

In complex elbow injuries, the ALT flap has many advantages which include abundant skin and subcutaneous tissue; vascularized vastus lateralis muscle that was used in our series to obliterate dead space, provide a vascular bed for nerve grafts and combat infection; and, access to fascia lata grafts for reconstruction of the triceps tendon.

ALT free flap has numerous advantages in covering defects at the posterior elbow

Skin grafting is not a good option for reconstruction of large dorsal and palm defects of the hand because the soft tissues of the dorsal and palmar region are exposed to blood vessels, nerves, and tendons.

Surgery using a free flap can be considered, and among the various flaps, ALT flaps from one donor site are a good choice for the repair of large dorsal and palm defects of the hand with minimal donor site morbidity. The flap may be thicker than the skin on the back of the hand, but this can be reduced during or after surgery using defatting.

The ALT flap can also be useful as a flap to cover the defect area in the hand.

**Room C**

# **Free Paper 10**

## **Basic Research & Miscellaneous II**

Orthop Surg. Chonnam National Univ. **Myung Sun Kim**  
Plast Reconstr Surg. Wonkwang Univ. **Young Cheon Na**

# Is the 'Safe Zone' Identified in Preoperative Computed Tomography Helpful for Choosing Optimal Implant for Fixation of Radial Head Fracture? : Conventional Cortical Screw versus Headless Compression Screw versus Locking Plate

Orthop Surg. Eulji Univ.

Je-Chan Lee, Sang Ki Lee

## Introduction

The purpose of this study is to assess the clinical significance of the radiologic safe zone based on computed tomography and to compare the outcomes of three different implants for fixation of isolated radial head fractures.

## Patients and Methods

We retrospectively reviewed 367 patients who underwent internal fixation for isolated radial head fractures. We newly defined two subtypes of Mason type II fractures associated with the radiographic safe zone (IIA, two-part fracture allowing for safe fixation of plate; IIB, two-part fracture not allowing for safe fixation).

## Results

170 patients (CCS group, n = 82; HCS group, n = 31; plate group, n = 57) were investigated with no significant differences in demographics. The range of pronation and supination at 1 month postoperatively (P = 0.04 and P = 0.04) and the range of supination at 6 and 12 months postoperatively (P = 0.03 and P = 0.03) were significantly smaller in the plate group. In Mason type IIB fractures, the average MEPS was higher in the CCS and HCS groups than in the plate group (P = 0.01 and P = 0.02). And the average DASH score was lower in the CCS and HCS groups (P < 0.01 and P < 0.01).

## Conclusions

Evaluation of the radiologic safe zone is potentially helpful in selecting better surgical fixation option. For type III fractures, 2.3-mm cortical screws would be a better option than Acutrak screws. Plates would not be suitable for type IIB radial head fractures.

**Key Words:** Radial head fracture, Mason classification, Safe zone, Cortical screw, Headless compression screw, Plate

# Automatic assessment of radiologic parameter of distal radius using hybrid approach combining deep learning and computer-aided diagnosis algorithm

<sup>1</sup>Vision AI Business Team, LG CNS, <sup>2</sup>Orthop Surg. Hosp. of Chung-Ang Univ.,

<sup>3</sup>Orthop Surg. Chung-Ang Univ. Gwangmyeong Hosp.

Sang-Jeong Lee<sup>1</sup>, Minji Kang<sup>1</sup>, Jae-Sung Lee<sup>2</sup>, Kyu-Tae Kang<sup>2</sup>, Hyoung-Seok Jung<sup>3</sup>

## Purpose

The use of deep learning algorithm has been increasing rapidly in the medical imaging. This study aims to develop an automated hybrid approach of deep learning architecture and the conventional computer-aided diagnosis approach to detect the anatomical landmarks and measure the radiologic parameters on the wrist radiography.

## Methods

A total of 487 wrist radiographs were randomly sampled for training and validation and 50 radiographs were used as the test set. Landmarks for four commonly used parameters, such as radial inclination (RI), radial length (RL), ulnar variance (UV) and volar tilt (VT) were identified and labeled. A developed a two-step hybrid method to measure the radiologic parameters using the anatomical landmarks by combining the deep learning model with a conventional computer-aided diagnosis. Measurements were obtained through landmarks on the test set. The mean of each parameter obtained by two hand surgeons was used as the reference standard. The successful detection rate (SDR), intraclass correlation coefficient (ICC), Pearson correlation coefficient (r), mean absolute error (MAE), and Bland-Altman plots were used to determine the performance of deep learning algorithm.

## Results

SDR of the model range was 94 % to 96 % at 2 mm distance threshold and 97% to 99% at 3mm distance threshold. The RL, RL, VT and UV generated by the model were  $25.20^\circ \pm 4.70^\circ$ ,  $11.17\text{mm} \pm 2.57\text{mm}$ ,  $9.70^\circ \pm 9.78^\circ$

and  $2.69\text{mm} \pm 1.75\text{mm}$ , respectively. There were good reliability in RI and VT (ICC 0.82 and 0.79, respectively) and moderate reliability in RL and UV (ICC 0.60 and 0.54, respectively).

## Conclusion

The novel automated method using hybrid method can accurately identify landmarks on wrist radiographs and automatically generate radiologic parameters of distal radius. It had the advantage of saving time and human labour in creating datasets for training segmentation models and developing image processing algorithms.

# Novel Patient-Specific Coronoid Reconstruction Using 3D Metal Printing for Comminuted Coronoid Process Fracture: A Prospective Cadaveric Study with Clinical Applications

Orthop Surg. Chonnam National Univ.

Jun-Hyuk Lim, Myung-Sun Kim

## Introduction

The coronoid process of the ulna plays a crucial role in maintaining elbow joint stability during flexion, particularly in patients with elbow dislocations where coronoid fractures are prevalent. Such fractures can lead to axial or varus instability and compromise the surrounding soft tissues, resulting in additional instability. Coronoid fractures are typically classified by the Regan and Morrey and O'Driscoll classification systems. While early fixation is necessary for type III fractures that threaten primary elbow stability, some cases may require coronoid reconstruction due to the impracticality of fixation or functional impairment. Various autograft techniques have been explored for coronoid reconstruction, each with specific advantages and limitations, prompting interest in coronoid prostheses as an alternative. Recent studies have reported promising outcomes using custom-designed coronoid prostheses, though challenges remain regarding anatomical conformity. Advances in three-dimensional (3D) technology have enabled better planning and modeling in orthopedic surgeries, with evidence suggesting positive clinical results in other joint arthroplasties. However, the application of 3D metal printing for creating patient-specific coronoid prostheses has not yet been documented in clinical studies, and commercially available options are lacking. Our study aims to introduce the design and manufacturing process of a patient-specific coronoid prosthesis through a cadaveric study, as well as to present the appropriate surgical approach for the new coronoid prosthesis. Furthermore, we seek to report the clinical outcomes associated with the application of our novel coronoid prosthesis.

## Material and methods

This prospective study, approved by the Institutional Review Board of Chonnam National University Hospital involved a cadaveric examination to develop a patient-specific coronoid prosthesis and an optimal surgical

approach. We evaluated three medial approaches to the elbow and selected the flexor carpi ulnaris (FCU) splitting approach for prosthesis placement, which minimizes soft tissue injury while allowing stable fixation. Our initial design of a single-piece prosthesis faced challenges regarding soft tissue injury and inadequate coronoid visualization. Consequently, we created an integrated prosthesis that combines a plate section for direct screw fixation at the ulna metaphyseal area with a reconstruction section for coronoid reconstruction. A cutting guide was developed to ensure accurate preparation of the fracture site while preserving the anatomy of the medial collateral ligament.

To manufacture the customized 3D-printed prosthesis and cutting guide, we utilized computed tomography (CT) images of both the affected and unaffected coronoid processes. 3D modeling was performed using specialized software, and the final products were created with a Selective Laser Melting 3D printer using Ti-6Al-4V material, featuring a locking system for enhanced stability during surgical application.

## Results

The patients' demographic data revealed a mean age of 50 years, a Visual Analog Scale (VAS) pain score of 1, a Mayo Elbow Performance Score (MEPS) of 92.5, and a Disabilities of the Arm, Shoulder, and Hand (DASH) score of 8.4. Paresthesia was noted in one patient without any implant-related complications. Follow-up CT scans at an average of 6 months postoperatively demonstrated bone ingrowth in the reconstructed coronoid area.

Patient 1 was a 59-year-old male with a comminuted O'Driscoll Type III-1 coronoid fracture sustained from a fall. The FCU splitting approach was used for reconstruction, leading to stable fixation of the patient-specific prosthesis. Postoperative imaging showed successful bone integration, and at 15 months post-surgery, the patient reported high satisfaction, a VAS score of 0, and normal range of motion with a MEPS of 100 and DASH score of 4.3.

Patient 2 was a 41-year-old male who suffered a terrible triad injury, with a coronoid fracture classified as O'Driscoll Type II-2. The surgical approach involved a posterior incision and FCU splitting, with stable fixation achieved through bone grafting at the radial head defect. At the 1-year follow-up, no implant-related complications were observed, with a VAS score of 1, full elbow stability, and a MEPS of 85 and DASH score of 12.5, demonstrating satisfactory outcomes.

## Conclusions

In conclusion, our novel patient-specific coronoid prosthesis, created using a 3D metal printing technique, demonstrates anatomical conformity, allowing for the successful restoration of a pain-free and stable elbow in cases of comminuted coronoid fractures.

# A comparative study of radiation exposure between C-arm fluoroscopy and portable X-ray camera

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## Introduction

A portable X-ray camera has been developed for surgical field. However, studies comparing its radiation exposure to C-arms have not been reported yet. This study aimed to compare radiation exposure to a phantom foot from a portable X-ray camera, a mini C-arm, and a conventional C-arm.

## Methods & Materials

An anthropomorphic phantom foot was imaged 200 times with each device: a conventional C-arm, a mini C-arm, and a portable X-ray camera. The C-arm was in a continuous and auto-adjustment mode and the X-ray camera was in a snapshot mode, which was the default setting. In the first experiment, direct radiation exposure was measured with a multi-quality assurance dosimeter (MQAD) and an optically stimulated luminescence dosimeter (OSLD), along with 12 other OSLDs placed 40 cm away for scattered radiation exposure. In a second experiment, only 13 OSLDs were used due to interference of MQAD by the C-arm's automatic self-regulation function.

## Results

The mini C-arm recorded the highest radiation exposure (6.35 mGy), followed by the portable X-ray camera (3.09 mGy) and the conventional C-arm (1.12 mGy) under MQAD. The measurement from OSLD was the lowest with the portable X-ray camera (0.03 mSv with MQAD and 0.01 mSv without MQAD on the detector). Scattered radiation exposure was scant regardless of the use of any imaging devices.

## Discussion

The mini C-arm exhibited the highest radiation dose among the three devices, higher than the conventional C-arm, contrary to previous reports. The portable X-ray camera showed significantly lower radiation exposure than the mini C-arm. Differences in results between a portable X-ray camera and a conventional C-arm were likely due to dosimeter sensitivity, distance variations, and operating modes of devices.

## Conclusion

While many orthopedic surgeons use mini C-arms to mitigate radiation exposure, this choice does not automatically guarantee the safety of the patient or the doctor, especially when compared to the use of a traditional C-arm. Using a portable X-ray camera could be a viable alternative for reducing radiation exposure.

# Introduction of A New Horizon in Surgical Fixation of Distal Phalanx Base Fracture with Preservation of Dorsal Skin (Park-Heo technique)

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## Purpose

Using a Kirschner wire to fixate the distal phalanx base fracture such as mallet finger or Jersey finger does not always guarantee a firm and rigid fixation due to tendons' strong traction power. If dorsal skin is incised for techniques like pull-in sutures, there lies a risk of skin necrosis and nail dystrophy. In order to prevent complications resulting from opening the dorsal skin, we introduce a dorsal two-point subcutaneous suture penetration technique, in which suture material is passed subcutaneously through two dorsal slit incisions and then to either dorsal or volar side opposite to the fractured site, consequently fixating the bone. And we also recommend "M" endo button fixation technique for reduction of severely comminuted FDP avulsion fracture.

## Material and Methods

Of the 12 cases of distal phalanx base fractures, one was bony mallet fracture, two involved both dorsal and volar base fracture, 8 cases were severely comminuted fractures, and one was comminuted FDP avulsion fracture with underlying enchondroma. The operation was performed by suturing the tendons and bones all together with suture material with dorsal two-point suture subcutaneous penetration method. In cases of simple dorsal and simple intra-articular comminuted fracture, percutaneous reduction and pull-out with button tie technique was applied. In cases of fracture with FDP avulsion with intact volar cortical bone, zig-zag open and firm tie on FDP insertion site was done. In cases of severely comminuted fracture of FDP insertion site, we used the custom made "M" endo button in attempt to support the entire articular surface of the comminuted fragment.

## Result

In all cases, there were no wound-related complications especially skin necrosis. Bone union was achieved in all

cases, and the articular surface of the distal phalanx was well maintained.

### Conclusion

The dorsal two-point suture subcutaneous penetration method without opening the dorsal skin should be considered a good surgical option when treating the distal phalanx base fracture. As finger tip skin and nail are vulnerable to injury and subsequent deformation, especially in women with small-sized fingers, this technique may alleviate these concerns. Moreover, if the fractured bony fragment is too small, subcutaneous soft tissue can be sutured together. In this way, there is an advantage of minimizing damage to the bone fragment. And in cases of severely comminuted fracture of FDP insertion site, in which we used the “M” endo button, we obtained satisfactory results.

# An osteolytic lesion of the proximal ulna in a patient with Maffucci syndrome: a case report

Orthop Surg, Dong-A Univ. Hosp.

Hyeon Jun Kim, Sung Yoon Jung, Ji Woong Kim

Maffucci syndrome is a rare, congenital, and nonhereditary syndrome characterized by the occurrence of multiple enchondromas and hemangiomas. According to previous studies, patients diagnosed with Maffucci syndrome have a higher risk of developing malignant tumors, such as ovarian cancer, pancreatic cancer, breast cancer, and central nervous system cancer, in addition to malignant transformations of enchondromas. The authors report a case of a 37-year-old male patient with Maffucci syndrome who presented with multiple enchondromas and hemangiomas. This patient's presentation and management are discussed, along with a review of the literature. Maffucci syndrome should be expected when encountering a patient with multiple enchondromas and suspected hemangiomas in the limbs. Even if benign lesions such as enchondromas or hemangiomas are diagnosed, regular follow-up is required to monitor for malignant transformations and the development of malignant tumors in other organs.

**Keywords:** Maffucci syndrome, Enchondroma, Hemangioma.



Fig. 1. (A) Characteristic venous malformations on the patient's left upper extremity. (B,C) Multiple hemangiomas are seen on the right foot.

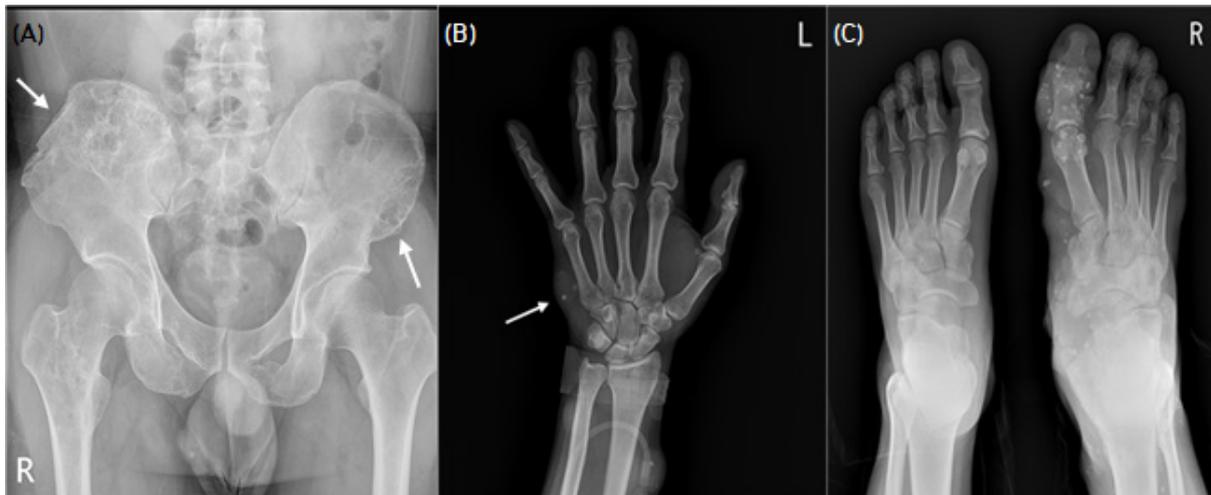


Fig. 2. (A) X-ray of pelvis AP shows local uneven bone density and multiple cystic lesions with irregular sclerosis around them. (B,C) Both foot and hand x-ray shows multiple soft tissue masses demonstrating calcifications on left hand and right foot.

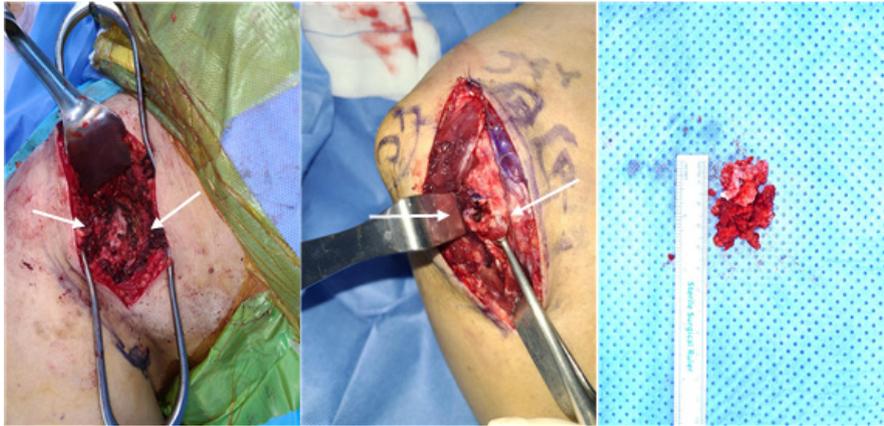


Fig. 3. (A,B) A well defined lobulated intramedullary metaphyseal lesion occupying the proximal ulna displaying low signal on T1(A), bright signal on T2(B). (C,D) Size of the lesion is about 2.8 x 2.1 x 1.8cm Pelvis MRI shows multiple lobulated mass lesions with extrasosseous extension with cortical bone destruction in the both pelvic bones which have T1 low signal intensity(C) and T2 heterogeneous high signal intensity(D). (White arrows : osteolytic mass in proximal ulna)



Fig. 4. In the operation, erosion and abnormal bony lesions were found. (A) Intraosseous masses found at right iliac wing (B) An intraosseous mass found at right proximal ulna (C) Specimen taken from right iliac wing and right proximal ulna for biopsy (White arrows : avascular wax-like masses in right iliac wing)

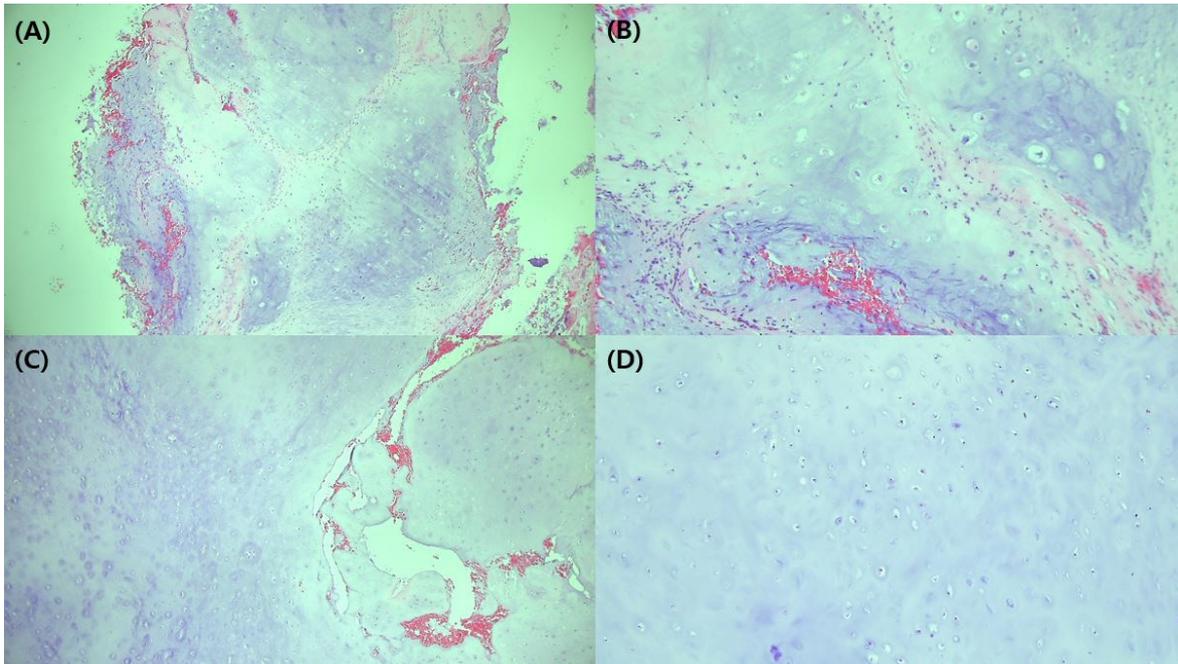


Fig. 5. Histopathologic findings of proximal ulna (A,B) and iliac wing (C,D). Both tumors were composed of mature hyaline cartilage and showed multinodular architecture. (Hematoxylin-Eosin, x40 magnification)  
(A,C). Both tumors showed slightly increased cellularity, but chondrocytes lie in lacunae and have small round nuclei without marked cytologic atypia. (Hematoxylin-Eosin, x 100 magnification)

# Rupture of a pseudoaneurysm after radial artery catheterization in a patient with unilateral high bifurcation of the brachial artery: a case report

Plast Reconstr Sug. Chonnam National Univ.

Jun Ho Choi, Kwang Seog Kim, Seung Hyun Kim, Dong Wan Kim, Jae Ha Hwang

## Background

Unilateral high bifurcation of the brachial artery is a rare anatomical variation with varying prevalence across populations, more common in African-Americans. This variation increases the risk of pseudoaneurysm in the bifurcated artery, complicating radial artery catheterization and leading to critical complications if the pseudoaneurysm ruptures. We present a case of 78-year-old Asian woman who experienced such a rupture of radial artery pseudoaneurysm following arterial catheterization.

## Method

A 78-year-old woman with a history of chronic obstructive pulmonary disease, hypertension, right ventricular dysfunction, severe pulmonary hypertension, constrictive pericarditis, thymoma, dementia, and arthritis, was admitted following a right femur neck fracture caused by a slip down. She experienced chest pain and elevated cardiac enzymes, which led to the diagnosis of pericarditis, and she was subsequently transferred to the intensive care unit. During her stay, she developed painful upper arm swelling after radial artery catheterization, which was promptly removed. ACTA revealed unilateral high brachial artery bifurcation and a ruptured 3cm radial artery aneurysm, causing significant bleeding and hematoma (Fig. 1). Her hemoglobin dropped to 6.8 g/dl, requiring a transfusion. No compartment syndrome was observed.

## Result

Conservative management with elevation, compression, and ice packs was implemented. Embolization was deemed unfeasible due to the risk of upper extremity embolism. Follow-up ACTA after five days showed no active bleeding and hematoma resolution (Fig. 2).

### Conclusion

This case underscores the importance of recognizing unilateral high bifurcation of the brachial artery, particularly when radial artery aneurysm rupture occurs. Rapid ACTA imaging and conservative management can be effective, potentially avoiding invasive procedures.

Figure legends

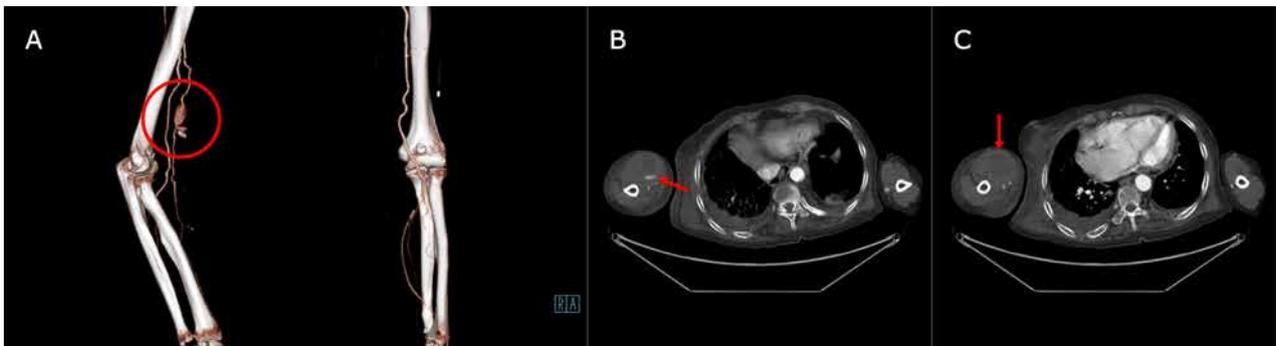


Figure 1. A 78-year-old woman with rupture of radial artery pseudoaneurysm with right brachial artery unilateral high bifurcation following radial artery catheterization. (A) Angiographic computerized tomography angiography (ACTA) showing the rupture of the radial artery (red circle). (B) Contrast enhancement at the site of the pseudoaneurysm rupture with evidence of active bleeding (red arrow). (C) Hematoma in the right biceps brachii muscle (red arrow).

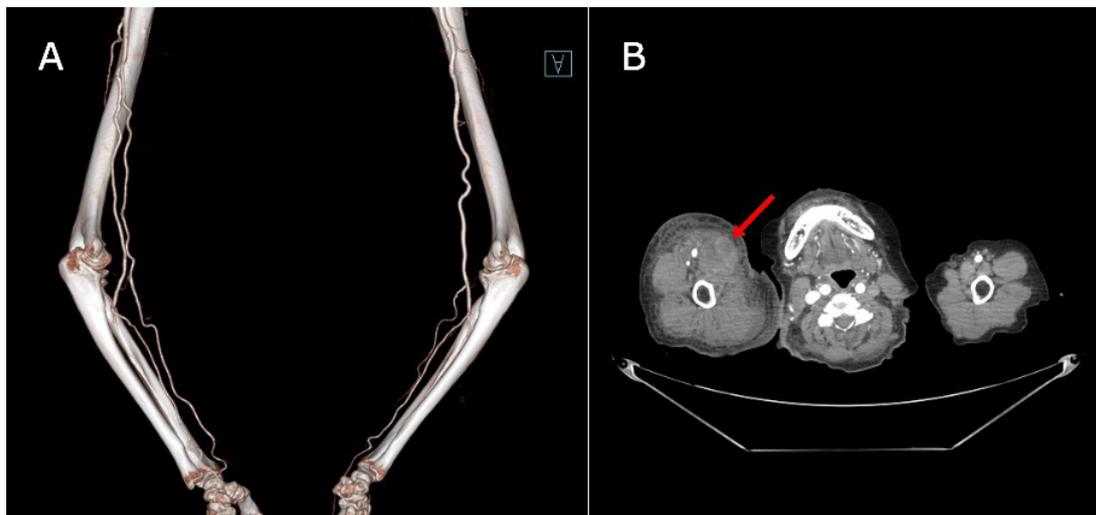
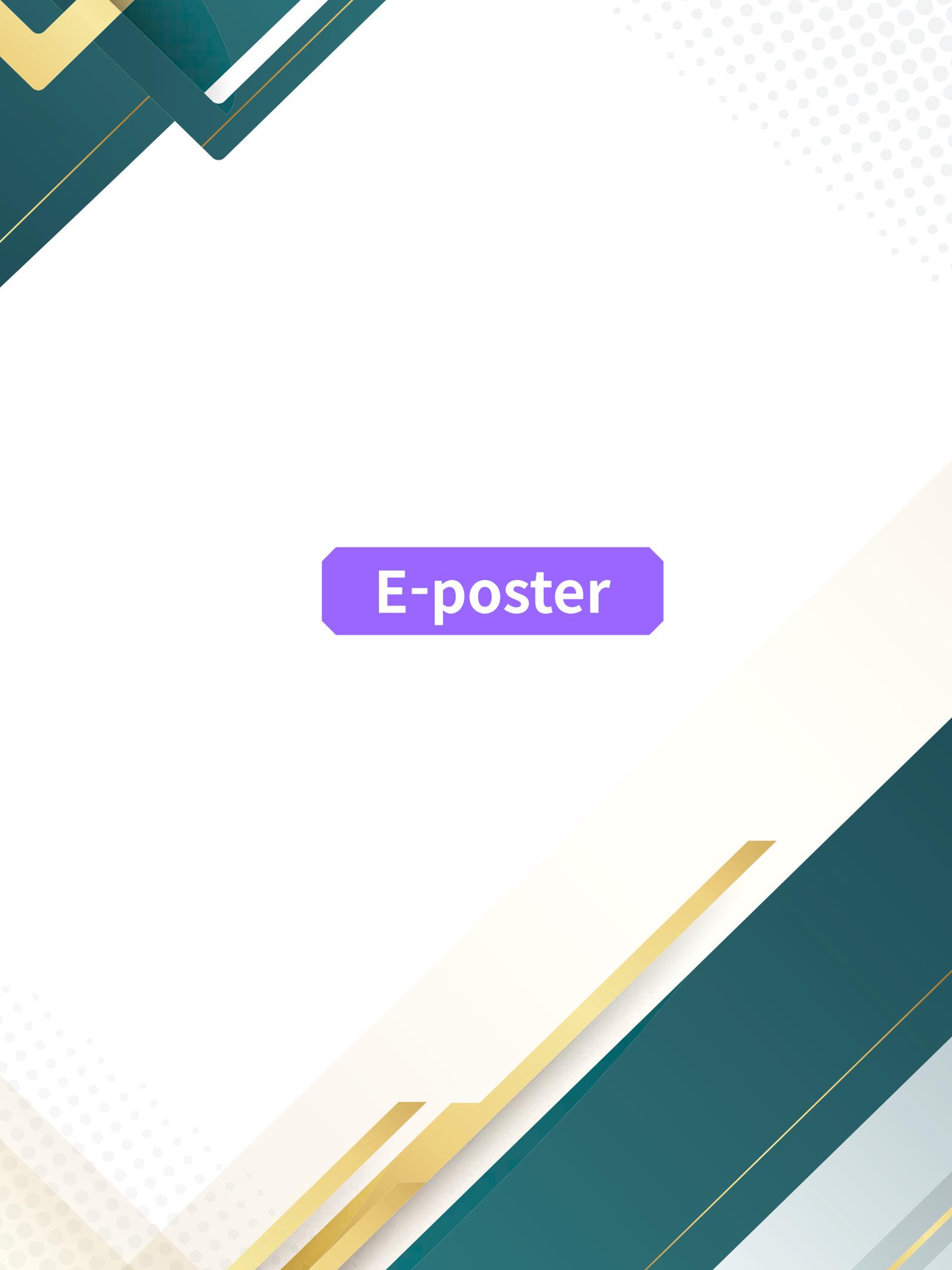


Figure 2. ACTA showing 5 days after conservative treatment for right upper arm hematoma. (A) resolution of the pseudoaneurysm rupture site. (B) Significant absorption of the hematoma in the biceps brachii muscle (red arrow).

The background features a white central area surrounded by abstract geometric shapes. In the top-left and bottom-right corners, there are overlapping layers of dark teal and gold-colored shapes, some with thin white lines. In the top-right and bottom-left corners, there are patterns of small, light gray dots arranged in a grid-like fashion that fades out towards the center.

**E-poster**

# Radiological parameters for predicting the risk of flexor tendon rupture after volar plate fixation for distal radius fracture

The Catholic Univ. of Korea

Soo Hwan Kang, Il-Jung Park

## Background

In this study, we aimed to investigate postoperative radiographic parameters for predicting flexor tendon rupture after volar plate fixation for distal radius fractures.

## Methods

In this retrospective cohort study, postoperative radiographs of 15 cases of flexor tendon rupture were included as a flexor tendon rupture group. Additionally, data from 45 patients with non-flexor tendon rupture (control group), matched in terms of age, sex, and fracture type (1:3) to the flexor tendon rupture group, were reviewed in terms of fracture reduction and plate position. We assessed the Soong grade, plate-to-critical line distance (PCLD), and plate-to-volar rim distance to determine plate position and used other parameters to analyze anatomical reduction including radial tilt, ulnar variance, coronal carpal translation, radius-radial styloid distance, volar tilt, sagittal carpal alignment, radius-volar lip distance (RVLD).

## Results

We identified three significant predictive factors for flexor tendon rupture after volar plate fixation for distal radius fractures. The mean PCLD and sagittal carpal alignment were significantly greater in the flexor tendon rupture group than in the control group ( $p < 0.001$ ). The mean RVLD was smaller in the flexor tendon rupture group than in the control group ( $p = 0.033$ ). Logistic regression analysis was performed to examine the importance of the variables.

## Conclusions

Our findings revealed that PCLD, sagittal carpal alignment, and RVL D are important risk factors for ruptured flexor tendon. In patients with these risk factors, more careful monitoring for the plate irritation sign and considering preemptive plate removal may help prevent tendon rupture.

**Keywords:** Distal radius fracture, Flexor tendon rupture, Volar plate, Fracture reduction, Plate position

# Abnormal Course of Dorsal Sensory Branches of Ulnar Nerve: Case Series

Orthop Surg. Korea Univ., Ansan Hosp.

Chi-Hoon Oh, Young Jeon, Jong Woo Kang

A dorsal sensory branch of ulnar nerve commonly arises from ulnar nerve at distal thirds of forearm and at the level of ulnar styloid process, it is situated dorsally and medially. It is mandatory to know the anatomical course of the dorsal sensory branches of the ulnar nerve in the surgical and medical procedures dealing with ulnar sided wrist or distal ulna. In this report, we present a case of an abnormal course of dorsal sensory branches of the ulnar nerve. The abnormality was observed in the ulnar shortening osteotomy of a right forearm of a 38 year old female. The dorsal sensory branch of ulnar nerve ran ulnodorally across ulnar border of forearm at proximal 4 cm from ulnar styloid process in this case. To our knowledge, this type of variation has never been published before. This type of variation may be useful during surgeries and electrophysiological examinations of the area.

# Cubital Tunnel Syndrome Caused by Intranearal Ganglion Cyst: Case Report and Review of literature

Orthop Surg. NHIS Ilsan Hosp. Orthop Surg. Wonkwang Univ. Hosp.

Hyun Tak Kang, Hong Je Kang

Cubital tunnel syndrome is a second most common peripheral nerve compression syndrome. The causes of cubital tunnel syndrome are idiopathic but it can be caused by trauma, bone deformity and space occupying lesions like a tumor. Ganglion cyst is a relatively common cause of cubital tunnel syndrome. However, the cubital tunnel syndrome caused by intraneural ganglion cyst has been rarely reported. The authors experienced 3 cubital tunnel syndrome cases of intraneural ganglion cyst. Therefore, we report the cases with literature review

# Fixation Using Percutaneous Multiple Threaded K-wires in Bryan and Morrey Type II and III Capitellum Fractures: A Report of Three Cases

Orthop Surg. Yonsei Univ.

Il-Hyun Koh, Do-Hyun Kim, Won-Taek Oh, Jae-Yong Cho, Yun-Rak Choi

**Abstract:** In cases of capitellum fractures where bone fragments are small or comminution is severe, making internal fixation with headless screws difficult, we report cases where union was achieved by percutaneously inserting multiple threaded K-wires from the posterior aspect of the capitellum toward the anterior articular surface.

1. A 59-year-old male patient fell while climbing a wall, resulting in a Bryan and Morrey type II capitellum fracture and a Mason type III radial head fracture. The capitellum was fixed using multiple threaded K-wires, and the radial head was fixed using two headless compression screws. At the final follow-up after 3 years and 8 months, the fracture had united, but post-traumatic arthritis was noted. The range of motion was measured as 5–140 degrees.
2. A 17-year-old male patient fell while skateboarding and landed on his hand, resulting in a Bryan and Morrey type II capitellum fracture and a Mason type I radial head fracture. The capitellum was fixed using multiple threaded K-wires, and the radial head was fixed using a headless compression screw. At the final follow-up after 1 year and 5 months, the fracture had united, and the range of motion was measured as 0–140 degrees.
3. A 53-year-old female patient misstepped on stairs and landed on her hand, resulting in a Bryan and Morrey type III capitellum fracture. On-table fixation was performed using K-wires and a headless compression screw to create a single bone fragment, followed by fixation of the fracture by inserting multiple K-wires from the posterior aspect of the capitellum. At the follow-up after 2 years and 6 months, the fracture had united, but post-traumatic arthritis was noted. The range of motion was measured as 0–120 degrees.

# Distal radioulnar joint orientation and lunate morphology as protective factors of symptomatic idiopathic ulnar impaction syndrome in ulnar positive variant patients

Seoul Medical Center

Kyu Jin Kim

## Background

Ulnar-positive variance is widely recognized as a risk factor for idiopathic ulnar impaction syndrome (UIS). However, not all patients with ulnar-positive variance progress to symptomatic UIS. Other factors, such as the shape of the lunate or the distal radioulnar joint (DRUJ), may also play a role. This study aims to elucidate the relationship between the shape of the lunate and the structure of the DRUJ and idiopathic UIS.

## Patients and Methods

A cohort of 40 cases diagnosed with idiopathic UIS (UIS group) and 87 control subjects with ulnar-positive variance but without symptoms were compared. Lunate shape was assessed by measuring the lunate type and radiolunate angle (RLA), while DRUJ morphology was evaluated using the sigmoid notch angle (SNA), DRUJ subluxation ratio, and DRUJ inclination. Independent t-tests were conducted to analyze differences in radiographic metrics between the two groups, and logistic regression analyses were used to examine risk factors for idiopathic UIS. Receiver operating characteristic (ROC) curves were utilized to determine the cutoff values for statistically significant variables.

## Results

Significant differences were observed between the two groups in terms of RLA, DRUJ subluxation ratio, and DRUJ inclination ( $p < 0.05$ ). Logistic multiple regression analysis revealed a negative correlation between idiopathic UIS occurrence and both RLA (odds ratio [OR] 0.92; 95% confidence interval [CI] 0.87 to 0.96;  $p < 0.001$ ) and the DRUJ subluxation ratio (OR 0.01; 95% CI 0 to 0.07;  $p = 0.002$ ). Conversely, a positive correlation was found between UIS occurrence and DRUJ inclination (OR 1.06; 95% CI 1.01 to 1.12;  $p = 0.021$ ).

## Conclusion

In patients with ulnar-positive variance, the incidence of symptomatic UIS decreases when the lunate extends more relative to the radius, and when the DRUJ subluxation ratio increases or DRUJ inclination decreases.

Level of Evidence: Level III, case-control study

**Keywords:** ulnar impaction syndrome, ulnar positive variance, lunate, distal radioulnar joint, protective factors

# Acute Irreducible Distal Radioulnar subluxation due to extensor carpi ulnaris tendon entrapment : A case report

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Ki Tae Kim<sup>1</sup>, Jae Woo Shim<sup>2</sup>

## Introduction

: Acute distal radioulnar joint (DRUJ) dislocations are rare and can be easily missed without careful examination and radiographic analysis. These injuries often occur alongside other fractures, such as Galeazzi or ulnar styloid fractures, and may involve soft tissue or bone entrapment that complicates reduction, classifying them as complex DRUJ dislocations.

We present a case of complex distal radioulnar joint (DRUJ) dislocation characterized by acute irreducible subluxation with volar displacement, associated with an ulnar styloid fracture, where the ulnar styloid fragment has entrapped the extensor carpi ulnaris (ECU) tendon, maintaining some degree of DRUJ congruity.

## Materials & methods

: A 63-year-old right-handed male presented to the emergency room with a work-related injury. He injured his right hand while grasping a pipe that rotated unexpectedly.

The true wrist PA view revealed an ulnar styloid fracture, with no notable DRUJ diastasis, and the radius was intact. The true lateral view showed a slight dorsal subluxation of the ulnar head, but it was not prominent.

Wrist MRI confirmed the state where the extensor carpi ulnaris (ECU) tendon was entrapped in the distal radioulnar joint (DRUJ), accompanied by volar displacement of an ulnar styloid tip fracture.

We performed the surgery using a dorsal approach to access the DRUJ, opened the joint capsule through the 5th extensor compartment, repositioned the ECU, reduced and fixed the ulnar styloid, and reconstructed the ECU subsheath using harvested extensor retinaculum.

## Results

At the one-year follow-up, a wrist X-ray showed residual mild dorsal subluxation of the ulnar head. Wrist range of motion was relatively good with 85° flexion, 80° extension, 70° pronation, and 90° supination. The DRUJ stress test was negative. Clinical scores showed pVAS at 1, quick DASH at 4.5, and modified mayo wrist score (MMWS) at 85.

## Conclusion

: In cases of irreducible DRUJ dislocation associated with severe rotational trauma, MRI should be used to evaluate for complex DRUJ dislocation, and appropriate intervention should be performed. An atypical position of ulnar styloid displacement on X-ray can suggest tendon entrapment in DRUJ.

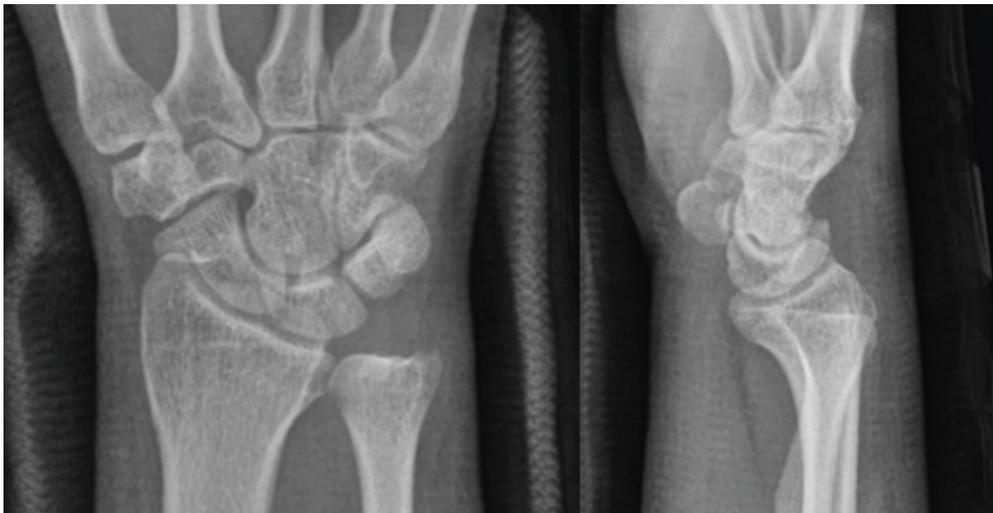


Figure 1) Initial X-ray taken at the time of emergency department admission

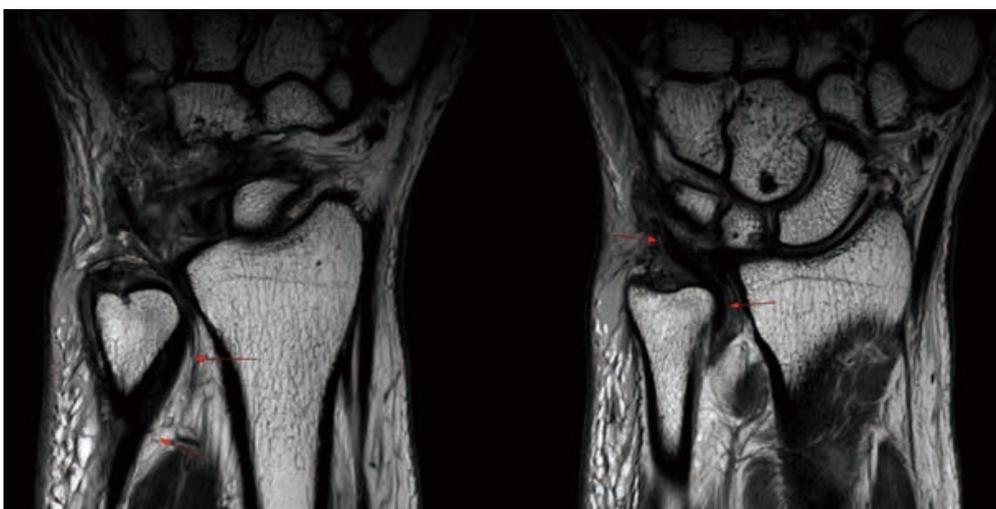


Figure 2) Preoperative MRI coronal view : The ECU tendon is observed kinking at the DRUJ(red arrow)

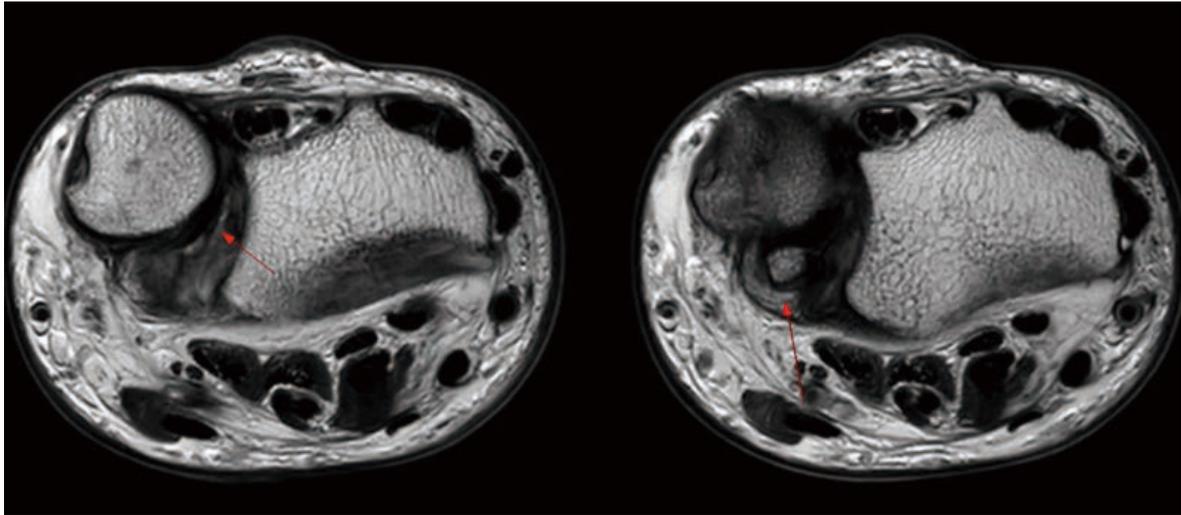


Figure 3) Preoperative MRI axial view : The ECU tendon is entrapped on the volar side of the ulnar head, displacing the dorsal distal radioulnar ligament, along with a displaced ulnar styloid fragment.(red arrow)

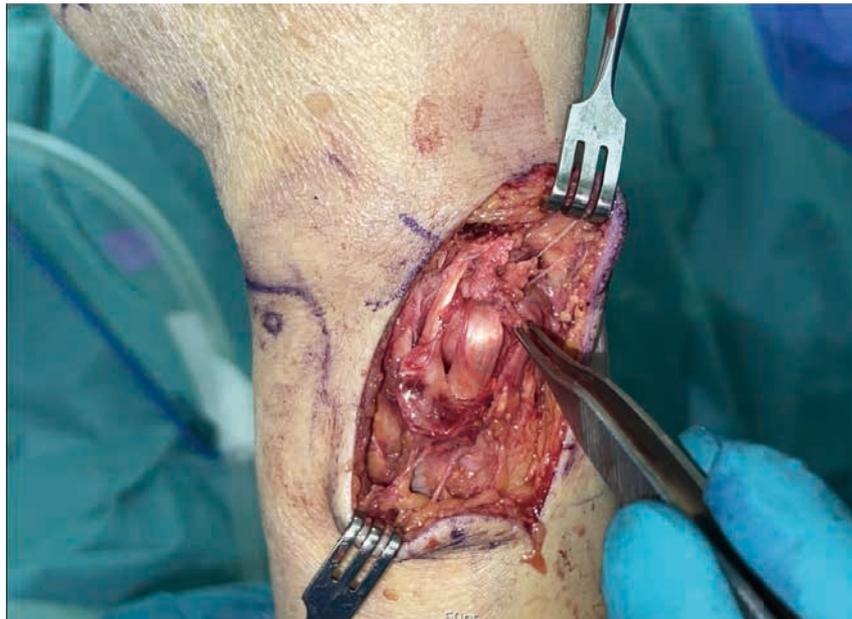


Figure 4) The ECU tendon is entrapped within the DRUJ, and severe adhesions are observed



Figure 5) Clinical photograph taken after completing the procedure



Figure 6) Intraoperative arthroscopy image(suction test, trampoline test, Hook test)

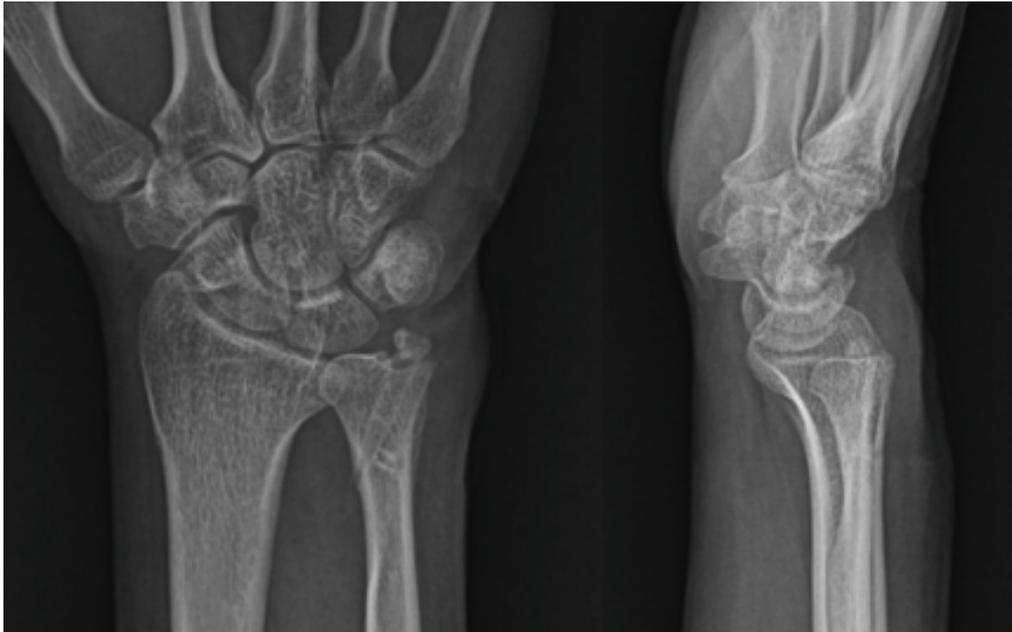


Figure 7) X-Ray after hardware removal

# Comparison of transverse and H-shaped skin incision methods for finger contracture release

Plast Reconstr Surg. Chonnam National Univ.

Dong-wan Kim, Jun Ho Choi, Jae Ha Hwang, Kwang Seog Kim

## Purpose

Finger contractures, caused by various factors, can severely impair daily functioning. For skin and fascia-related contractures, the transverse skin incision is commonly used. This study introduces and evaluates the H-shaped skin incision, comparing its efficacy with the transverse method, particularly in improving contracture release and TAM.

## Methods

A retrospective review of medical charts from January 2008 to June 2023 was performed for patients undergoing skin release surgery for finger contractures. Patients were divided into Group A (transverse incision) and Group B (H-shaped incision). A comparative analysis assessed TAM improvement and skin graft dimensions, including width, length, and area.

## Results

Of the 73 patients reviewed, 13 (29 fingers) met the criteria: 14 fingers in Group A and 15 in Group B. Group B showed significantly greater TAM improvement at 1 and 6 months post-op ( $P < 0.05$ ). Group A had a mean TAM improvement of  $16.00^\circ \pm 6.46^\circ$  at 1 month and  $12.57^\circ \pm 7.96^\circ$  at 6 months, while Group B improved by  $29.07^\circ \pm 10.79^\circ$  and  $25.33^\circ \pm 10.21^\circ$ , respectively. Group B also required longer grafts (mean  $2.05 \pm 0.47$  cm vs.  $1.24 \pm 0.33$  cm), with 2.18 times larger graft areas ( $P < 0.001$ ).

**Conclusion:** The H-shaped skin incision demonstrated superior efficacy in releasing finger contractures compared to the conventional transverse incision. It should be considered a valuable alternative in the surgical management of finger contractures.

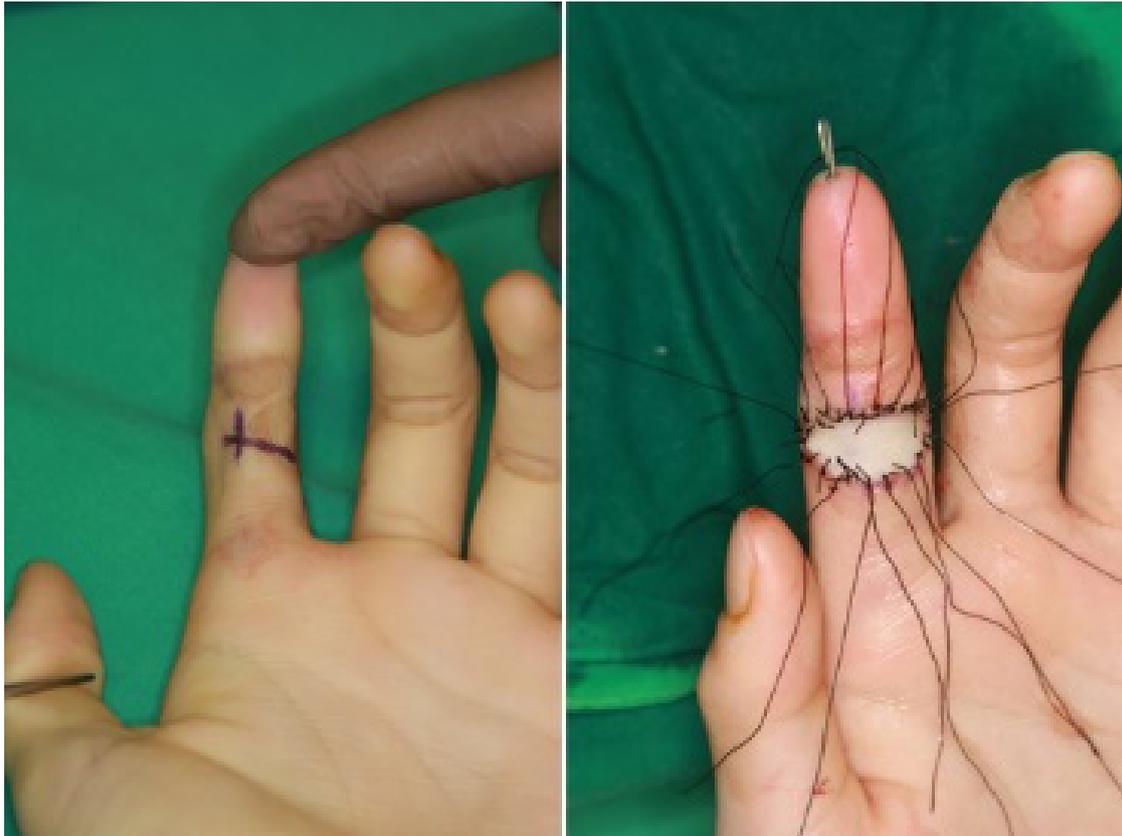


Fig. 1. Transverse incision method



Fig. 2. H-incision method

	Group A (N=14)	Group B (N=15)	P-value
Preoperative total active motion (TAM)	246.29±19.46	237.20±12.51	0.081
TAM 1 month postoperatively	262.29±14.59	266.27±8.22	0.810
TAM 6 months postoperatively	258.86±14.73	262.53±7.39	0.411
TAM improvement 1 month postoperatively	16.00±6.46	29.07±10.79	0.001
TAM improvement 6 months postoperatively	12.57±7.96	25.33±10.21	0.001

Table 1. At both 1 month and 6 months postoperatively, Group B demonstrated a statistically significant increase in TAM improvement over Group A ( $p < 0.05$ )

	Group A (N=14)	Group B (N=15)	P-value
Width (cm)	1.82±0.20	1.84±0.36	0.690
Length (cm)	1.24±0.33	2.05±0.47	<0.001
Skin graft area (cm <sup>2</sup> )	1.78±0.50	3.88±1.64	<0.001

Table 2. The length and the area of skin graft was significantly larger in Group B than in Group A ( $p < 0.001$ )

# Supplemental intermediate column fixation of metaphyseal comminuted distal radius fracture with a mini plate

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Dong Hee Kim<sup>1</sup>, Jin Woo Jin<sup>1</sup>, Chul Ho Lee<sup>1</sup>, Sang Hyun Lee<sup>2</sup>

## Purpose

This study introduces a surgical technique for stabilizing metaphyseal comminuted distal radius fractures using a mini-plate to support the intermediate column, followed by a volar locking plate for additional stabilization, and presents the clinical outcomes of this technique

## Subjects and Methods

From 2013 to 2023, eight cases of distal radius fractures involving comminution extending to the metaphysis that were treated surgically at ██████████ Hospital were retrospectively analyzed. All patients had distal radius fractures with severe comminution at the metaphysis, a mini plate was used to fix the fragments before applying the final volar locking plate. Using the medical records, the mechanism of injury, presence of osteoporosis, type of fracture, final range of motion of the wrist, and DASH scores were investigated.

## Results

The average age of the participants was 66 years. After an average follow-up of 30.1 months, all patients achieved proper bone union. The mean total range of motion of the wrist joint was 110.6°(Range,40°-170°) at final follow-up. DASH score was 35.6 points and Mayo score was 75.2 points.

## Conclusion

Restoration of the intermediate column is a key component in anatomical reduction for severe metaphyseal comminuted distal radius fractures. Reinforcing the distal radius with mini plates facilitated maintenance of the intermediate column length, simplifying the reduction of the volar ulnar fragments. and can be useful in obtaining an appropriate anatomical reduction.

**Keywords:** Comminuted, Metaphyseal, Distal radius, Fracture

# Tenosynovial giant cell tumour infiltrating bone marrow cavity after repair of the tendon rupture: A case report

Plast Reconstr Surg. The Catholic University of Korea

Rah Yoon Kim, Gyeong Won Jeong, Hye Ju Han, Sang Oon Baek,  
Gyeol Yoo, Jun Yong Lee

## Purpose

Tenosynovial giant cell tumour (TGCT) is a rare mesenchymal tumour arising from the synovium, tendon sheath, and bursae. We present a unique case where TGCT developed after tenorrhaphy of a ruptured flexor digitorum profundus (FDP) tendon.

## Methods

A 65-year-old male presented with a palpable, slow-growing mass over 5 years. He had previously undergone post-traumatic FDP repair on the same finger 7 years ago. Magnetic resonance imaging (MRI) revealed a large soft tissue tumour measuring 2.4 x 2.5 x 2cm on the ulnar and volar aspects of the middle phalangeal bone, involving the deep portion of the flexor digitorum tendon and invading the bone marrow cavity (Fig. 1). Under general anaesthesia, the mass formed a cavity within the middle phalanx (Fig.2) and was completely removed while preserving the neurovascular bundle (Fig. 3).

## Results

The permanent pathology report confirmed the diagnosis of TGCT. Although the patient experienced mild scar hypertrophy, he recovered well with a full range of motion (Fig. 4).

## Conclusion

While TGCT is generally considered to have an indolent clinical course and is usually not life-threatening, this case demonstrated locally aggressive behavior involving tendon sheath and bone marrow. Early recognition and surgical removal of the mass area crucial to prevent severe disability.



Fig. 1. Initial MRI of the mass

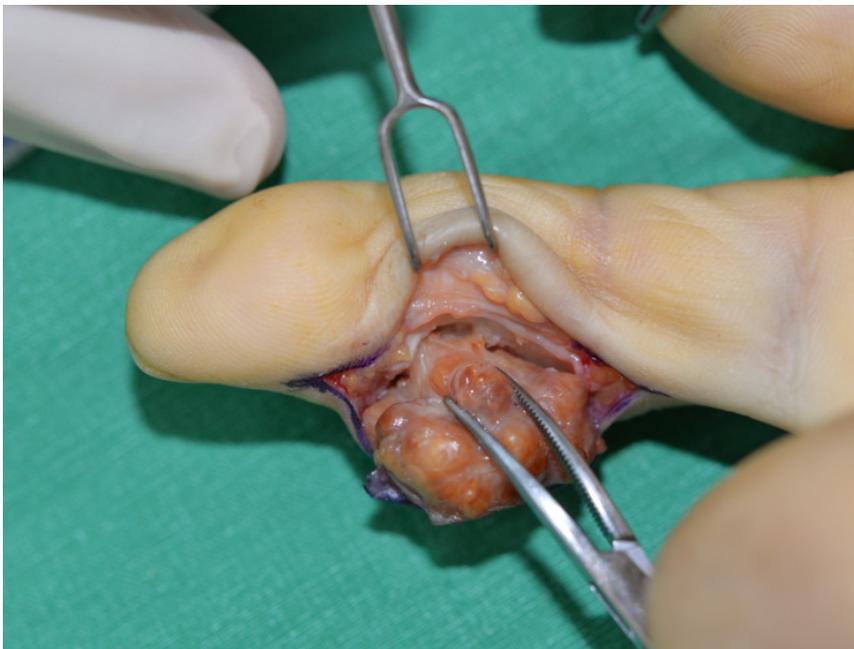


Fig. 2. Intraoperative image showing the mass invading the middle phalanx



Fig. 3. Intraoperative image following the total excision of the mass



Fig. 4. Postoperative clinical photo

# Finger compartment syndrome after an air paint sprayer injury : a case report

Plast Reconstr Surg. Chonnam National Univ.

Seung Hyun Kim, Dong Wan Kim, Jun Ho Choi, Jae Ha Hwang, Kwang Seog Kim

## Purpose

Compartment syndrome is defined by high pressure in a closed myofascial compartment. Elevated intra-compartmental pressure can result from extrinsic, intrinsic, or a combination of both factors. While compartment syndrome in the fingers is uncommon, it leads to compression of neurovascular bundles within a confined space. In this report, we describe a case of compartment syndrome in a finger, which was induced by a high-pressure paint sprayer injury and further complicated by a foreign body reaction.

## Methods

A 47-year-old man employed in the shipbuilding industry sustained an injury to his left middle finger one day prior to presenting at the clinic. The injury occurred while he was operating an air paint sprayer, which injected paint and thinner into his finger at high pressure. The patient reported severe tenderness and numbness at the fingertip. Examination revealed a puncture wound at the base of his left middle finger, which displayed green-stained skin. Several bullae had developed on the middle finger, and erythematous swelling extended to the index finger and the dorsum of the hand. A delayed capillary refill was also noted. Enhanced hand CT imaging showed subcutaneous air foci. Treatment at the site of injury included fasciotomy and debridement using a Bruner incision. Additional procedures involved a unilateral midline incision for fasciotomy on the distal finger and a longitudinal incision on the hand dorsum to facilitate decompression.

## Results

On the third postoperative day, the swelling had not improved, and laboratory tests revealed elevated levels of WBC and CRP. Despite this, the patient's vital signs remained stable, and the tissue culture showed no

growth. Serial debridement and irrigation were conducted on areas of tissue stained green. By the sixth day, laboratory tests indicated stabilization and an improvement in symptoms. The fasciotomy wound healed either by primary closure or by secondary intention. Two months post-surgery, the patient exhibited no neurovascular complications, except for ankylosis of the PIP joint in the middle finger.

## Conclusion

Although finger compartment syndrome is uncommon, outcomes are generally better with decompression via fasciotomy. However, if symptom recovery is slow even after decompression, it is crucial to identify and address any other underlying causes. In our case, the compartment syndrome was primarily due to inflammatory cytokinesis triggered by foreign body reactions, rather than a soft tissue infection.



Fig. 1. Preoperative photograph, showing the green-stained injury site and swelling with bullae on the left middle finger



Fig. 2. Preoperative CT, demonstrating subcutaneous edema with air foci in the left middle finger, hand dorsum, and palm.

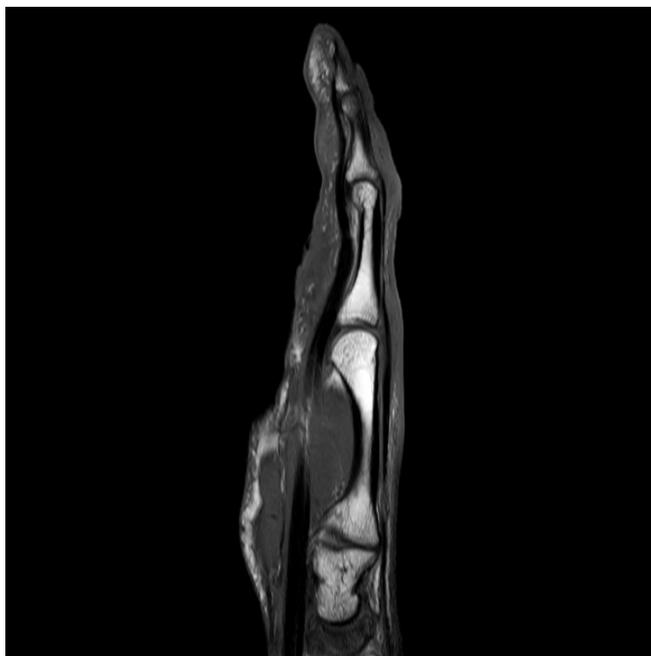


Fig. 3. MRI(T1) at 1 month, showing no definite abnormal enhancing lesion.



Fig. 4. Photograph at 2 months, demonstrating ankylosis and scarring of the middle finger PIP joint

# Usefulness of the osteocutaneous lateral arm free flap for small to moderate bone and soft tissue defects of hand

Duson Hosp.

Yong Hwan Kim, SangWoo Kim, Hyunsik Park, Jong Ick Whang

**Purpose:** Reconstructive options for multidigit or soft tissue defects of the hand are varied, yet complex hand defects remain particularly challenging. These cases often necessitate microvascular reconstruction using osteocutaneous free flaps to achieve functional limb salvage. In this paper, we present the two cases of osteocutaneous lateral arm free flap surgery performed at our institution, demonstrating the efficacy of this technique in managing complex hand defects.

**Methods:** This study included the 2 cases: One case is severe crushing injury on an index finger with only the ulna-side neuro-vascular bundle remaining, the other is crushing injury on the first web space with severe comminuted 1<sup>st</sup> metacarpal bone. After an emergency simple debridement, the reconstructive surgery was performed using osteocutaneous lateral arm free flap a few days later.

**Results:** All 2 cases healed without necrosis. Although both patients lost the Interphalangeal joint function, they were able to maintain grasping function and length of the finger without finger amputation.

**Conclusion:** The osteocutaneous lateral arm free flap is an effective reconstruction method for addressing combined small to moderate segmental bone and soft-tissue defects of the hand caused by trauma. This procedure can be conveniently performed in a single session under regional anesthesia.

# Sclerotic lines around the radial tuberosity of the proximal radius in patients with atypical femoral fractures associated with long-term bisphosphonate use - A preliminary report -

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Yong Hwan Kim<sup>1</sup>, Soo Min Cha<sup>2</sup>, In Ho Ga<sup>3</sup>

## Purpose

Sclerotic lines have been detected at specific locations on the forearm and metaphysis of the lower extremities (femur and tibia) in some patients with atypical femoral fractures (AFF), associated with long-term bisphosphonate (BP) use. Furthermore, there are few studies that investigate the association between the sclerotic line and AFF in patients with long-term bisphosphonate (BP) use. Thus, we present our preliminary data relating to the factors associated with the occurrence of the sclerotic line in patients diagnosed with AFF.

## Methods

We inspected the clinical charts of the patients who were prescribed a BP at our institution between 2010 and 2020. Fifty-six patients were finally investigated, including patients with sclerotic line lesions at the radial tuberosity (group 1, 21 patients), and those without any pathognomonic lesions on either radius on a simple radiograph (group 2, 35 patients).

## Results

No significant differences in the basic demographic characteristics, bone mineral density, or total period of BP administration were observed between the groups ( $P > 0.05$ ). Multivariate analyses of the variables that were significantly different between the groups in univariate analyses demonstrated that the time from the last BP administration at the time of AFF diagnosis (OR = 0.441) and the concurrent presence of similar lines on the

femur (OR = 36.00) were significantly associated with the presence of sclerotic lines on the proximal radius. The cut-off time after the last BP administration at the time of an AFF diagnosis was 16.5 months, which may serve as a predictor for the development of a sclerotic line around the radial tuberosity.

**Conclusions:** Some AFF patients have sclerotic lines on the proximal radius. These lines were detected more frequently in patients who had been recently treated with a BP, and almost identical lines were observed on the lower extremities. However, more studies are needed to determine whether these lines are a precursor to an atypical fracture.

**Level of Evidence:** Level III, retrospective case-control study

**Keywords:** Atypical fracture; femur; ulna; radius; sclerotic lines

# Comparative analysis of inpatient costs for the surgical treatment of distal radial fractures in children and adults : a retrospective cohort study from a single surgeon's experience

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## Purpose

Distal radial fractures are common in children and older adults, and numerous studies have analyzed their medical costs. However, no study has attempted to compare the medical costs of distal radial fractures in children and adults requiring surgical treatment in Korea. We therefore investigated this issue for the first time.

Methods: The study retrospectively analyzed 96 pediatric and adult patients who underwent surgery for distal radial fractures performed by a single surgeon between January 2021 and January 2023. Patients were divided into adult (>16 years) and pediatric (≤16 years) groups. We examined patients' demographic factors, surgical details, and inpatient costs.

## Results

The average total inpatient cost in the pediatric group was 1,640,000 Korean won (KRW), compared to 2,940,000 KRW in the adult group. The largest difference was in surgical material costs, which were approximately 700,000 KRW more expensive in adults. Kirschner wires were mainly used during surgery for pediatric patients, whereas volar locking plates were mainly used for adults. The number of C-arm fluoroscopy images obtained during surgery was higher in pediatric patients than in adults. The reoperation rate was higher in pediatric patients.

## Conclusions

The inpatient costs of surgical treatment for pediatric patients with distal radius fractures were lower than for adults, primarily due to differences in the costs of surgical materials. However, the reoperation rate was higher in the pediatric group, and radiation exposure was also greater. Policy adjustments may be necessary to address

these unique challenges in the treatment of pediatric wrist fractures.

**Level of Evidence:** Level IV, Retrospective study.

**Keywords:** Wrist fractures, Kirschner wires, Volar locking plates, Costs and cost analysis, Radius fractures

# A Case Report of Intramuscular Osteolipoma in the Shoulder; Extremely Rare Presentation

Plast Reconstr Surg. Eunpyeong St. Mary's Hosp., The Catholic Univ. of Korea

Jihyoung Chang, Jeeyoon Kim

## Purpose

Osteolipoma is the rarest variant of lipoma subtype, containing mature osseous element within lipoma tissue. It is common in the head and neck region. We present a case of pure intramuscular osteolipoma located in the shoulder.

## Methods

A 15-year-old male visited with a painless mass on his left shoulder. The mass was incidentally discovered as a soft tissue mass with calcification in the left shoulder during a pediatric medical check-up chest X-ray(Fig.1). Physical examination showed about 4cm sized mass without tenderness or an open wound. Magnetic resonance imaging (MRI) revealed a well-defined intramuscular mass with internal calcification in posterior deltoid muscle(Fig.2.).

## Results

An excisional biopsy was undertaken. The tumor was found to be located in the deltoid muscle, and the base was adhered to the infraspinatus and teres minor muscle fascia. The resected specimen consisted of a mass measuring 7 x 4 x 3 cm with a smooth muscle(Fig.3). Pathology showed lipoma tissue with bone fragments surrounded by thin fibrotic capsule(Fig.4). The patient was discharged without any postoperative complications.

## Conclusion

Osteolipomas are usually located in the intraosseous region or adjacent to bone. However, in this case, it was a pure intramuscular lipoma located between the deltoid, infraspinatus, and teres minor muscles, which is very

rare in the upper extremity. Although it could be incidentally discovered on an X-ray due to the calcification component, an MRI is useful for differentiating it from ossified benign tumors (hemangioma, calcified myositis, etc.) or malignant tumors (osteosarcoma, synovial sarcoma, etc.). Surgical excision is necessary for a definitive pathological diagnosis, and recurrence is rare.

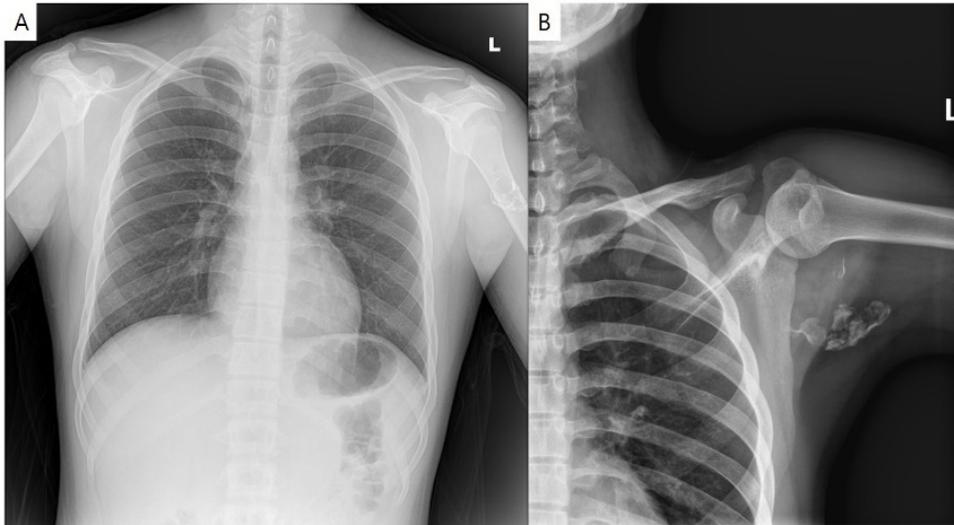


Figure 1: (A) A calcified mass was incidentally discovered in the left shoulder area during a pediatric health check-up via plain chest X-ray. (B) An X-ray taken after left arm abduction shows a calcified lesion in the soft tissue.

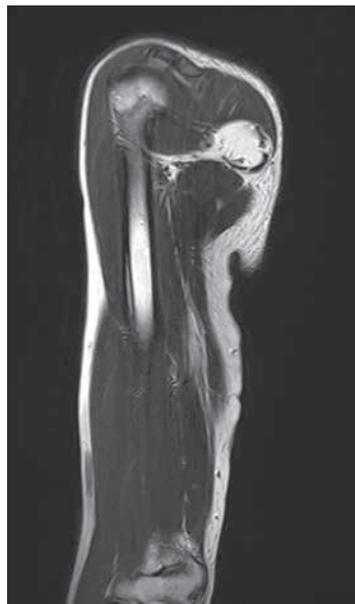


Figure 2: The T2-weighted MRI of the left shoulder shows an ossifying mass surrounded by the deltoid, infraspinatus, and teres minor muscles. There is no contact with the bone.



Figure 3: The excised mass measures 7x4x3 cm and is well encapsulated overall.



Figure 4: Pathology showed lipoma tissue with bone fragments surrounded by thin fibrotic capsule.

# Treatment of Hand Degloving Injury using SIEA Abdominal flap and Skin Graft

Plast Reconstr Surg. Konkuk Univ.

Junghwan Yoo, Jeenam Kim, Hyungon Choi, Donghyeok Shin, Myungchul Lee

## Purpose

Considerable skin and soft tissue defect is a hard-to-treat traumatic injury of the hand. Metacarpal or phalangeal bone exposure and adjacent tendons should also be considered to achieve a successful reconstructive outcome. We present a patient with hand degloving injury, and the treatment process using a superficial inferior epigastric artery (SIEA) abdominal flap in combination with a full-thickness skin graft (FTSG).

## Methods

A 50-year-old male patient was injured on his left hand by a power press machine. Skin and soft tissue defects were noted on both dorsal and volar surfaces. Extensor tendons of the thumb and fingers could be observed. A significant disarticulation of the thumb metacarpophalangeal joint was shown in the plain X-ray. The patient initially visited another hospital, where the joint disarticulation was treated with open reduction and external K-wire fixation. Thereafter, he was transferred for further treatment. We covered the considerable skin defect using an SIEA abdominal flap, and additional FTSG was performed for the thumb skin defect.

## Results

The significant skin and soft tissue defects were reconstructed using SIEA abdominal flap and additional FTSG. The thumb metacarpophalangeal joint was dislocated severely, and joint movement could not be observed. Nonetheless, the remaining index-to-little fingers showed an adequate range of motion. The patient underwent postoperative rehabilitation for hand gripping and pinching. The thumb was assisted using a customized prosthesis for additional grip strength.

## Conclusion

A significant soft tissue defect in the hand should be reconstructed using adequate surgical procedures. Bone and tendon exposures are another hurdle to consider. The SIEA abdominal flap and FTSG are operative options for the reconstruction. Postoperative rehabilitation and customized prostheses can assist in an adequate range of motion.



Figure 1. A 50-year-old male patient was injured on his left hand by a power press machine. Skin and soft tissue defects were noted on both dorsal and volar surfaces. Extensor tendons of the thumb and fingers could be observed. A significant disarticulation of the thumb metacarpophalangeal joint was shown in the plain X-ray.



Figure 2. The considerable skin defect was treated using an SIEA abdominal flap, and additional FTSG was performed for the thumb skin defect.



Figure 3. The patient underwent postoperative rehabilitation for hand gripping and pinching. The thumb was assisted using a customized prosthesis for additional grip strength.

# Treatment of Near Total Amputation Injury using Strategic Revascularization and Postoperative Rehabilitation

Plast Reconstr Surg. Konkuk Univ.

Junghwan Yoo, Jeenam Kim, Hyungon Choi, Donghyeok Shin, Myungchul Lee

## Purpose

Considerable phalangeal bone fractures with tendon injuries can lead to a significant burden since adequate reduction and anastomosis of injured structures should be achieved concomitantly. In near-total amputation, re-vascularization distal to the injured digital artery is another assignment. We present a patient with avulsion injuries of the thumb and fingers and the treatment process by reducing phalangeal bones, tenorrhaphy, arteriorrhaphy, and neurorrhaphy.

## Methods

A 65-year-old male patient was injured on his left hand by an electric saw machine. Open fractures of his thumb, index, and middle fingers were noted. Furthermore, digital arteries were ruptured, showing a warm ischemia of the thumb and index finger. Adequate survival of injured digits could not be ensured, and an emergency operation was decided. On microscopic magnification, ruptured digital arteries and nerves could be observed. Considering the surgical procedure, open reduction of phalangeal bones was followed by tenorrhaphy, arteriorrhaphy, and neurorrhaphy. Postoperative wound management led to adequate healing of injured tissues. Furthermore, rehabilitation of injured digits was scheduled based on a strategic protocol.

## Results

The patient's thumb, index, and middle fingers have been recovered, and the process was uneventful. As for rehabilitation, the combination of various hand postures and controlled active exercises led to an adequate range of motion. At postoperative 3 months, pinching motion and hand grip could be achieved.

## Conclusion

Significant soft tissue injuries, including open fractures and ruptures of arteries and nerves, are difficult hurdles for a hand surgeon. These injuries should be treated using adequate strategies and procedures. Following bone alignment and tendon excursion, the revascularization of avulsed tissues is cautiously considered. Postoperative rehabilitation is another assistant for successful range of motion. Strategic exercise in avoiding injured structures can lead to step-by-step movement and advancement.



Figure 1. A 65-year-old male patient was injured on his left hand by an electric saw machine. Open fractures of his thumb, index, and middle fingers were noted. Furthermore, digital arteries were ruptured, showing a warm ischemia of the thumb and index finger.



Figure 2. Postoperative wound management led to adequate healing of injured tissues. Furthermore, rehabilitation of injured digits was scheduled based on a strategic protocol.



Figure 3. The patient's thumb, index, and middle fingers have been recovered, and the process was uneventful. At postoperative three months, pinching motion and hand grip could be achieved.

# Ultrasonographic Evaluation and Classification of Tendinous Mallet Injuries: A Novel System Highlighting Lateral Band Involvement

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Sanglim Lee<sup>1</sup>, Jihae Lee<sup>2</sup>, Ji Yeong Kim<sup>3</sup>, Suk Ha Jeon<sup>4</sup>

## Purpose

This study aimed to evaluate tendinous mallet injuries using ultrasonography and propose a classification system that highlights diverse injury patterns, including lateral band ruptures, which are often overlooked in previous classifications.

## Methods

A retrospective review was conducted on patients with acute tendinous mallet injuries of the 36 fingers. Ultrasonography was performed within two weeks post-injury and findings were classified into three types: Type 1 (elongation of the terminal tendon without rupture), Type 2 (complete rupture of the terminal tendon), and Type 3 (rupture of one slip of the lateral band). Clinical data and outcomes were collected, including extension lag, grip and pinch strength, and Quick DASH scores. Statistical comparisons were made among injury types.

## Results

Thirteen Type 1, fifteen Type 2, and eight Type 3 injuries were identified. The length of the injured tendon significantly differed among the types, with Type 1 injuries being the longest. Type 3 injuries showed a significant decrease in grip and pinch strength compared to the contralateral hand, correlating with tendon length. No significant differences were noted in pain VAS, DASH scores, or initial extension lag among the injury types. The Crawford criteria showed that Type 2 injuries were more frequently classified as "poor" compared to Type 1 and Type 3.

## Conclusion

Ultrasonography provides a comprehensive evaluation of tendinous mallet injuries, and the proposed classification system effectively captures variations in injury patterns, particularly in lateral band involvement. This system can aid in diagnosing and predicting functional outcomes in patients with mallet finger injuries.

**Keywords:** Tendinous mallet injury, lateral band rupture, ultrasonography, classification system.

# reatment of traumatic oblique and spiral metacarpal fractures with cortical screw fixation

Plast Reconstr Surg. Seoul National Univ. Bundang Hosp.

Seungjun Lee, Seokchan Eun

## Background

Metacarpal fractures are common, accounting for 40 % of all hand injuries. The use of screws for the fixation of these fractures allows early aggressive hand therapy post-operatively, reducing post-operative stiffness. We aimed to prove the results of screw fixation technique in the oblique-spiral metacarpal fractures cases.

## Methods

A total of 31 patients who were operated with a diagnosis of displaced, irreducible, unstable, rotational oblique-spiral metacarpal fracture between 2017 and 2023 were included in this study. The mean age of patients was 36.8 years (range 16-76 years; 11 females, 20 males). Two or three cortical screws were used for internal fixation of these fractures. The patients were followed up for  $6.2 \pm 2.4$  months. The patients were evaluated according to total range of motion of the finger, grasping strength and Q-DASH score.

## Results

No complications of displacement in the fracture line, implant failure, distal loss of sense due to nerve damage, malunion and rupture of the extensor tendon were observed in the postoperative follow-up of the patients. Bone union was observed in all patients in the last outpatient clinic follow-up. The time to return to work was  $28.5 \pm 3.4$  days after the intervention. The mean Quick-DASH scores were  $1.35 \pm 2.25$ .

## Conclusio

The screw fixation is very useful in patients with spiral and oblique metacarpal fractures. It allows early rehabilitation, and our patient went on to uneventful healing with excellent functional results



Fig. 1. Preoperative X-rays of a 63-year-old patient with spiral fractures in her left 3rd metacarpal bones.

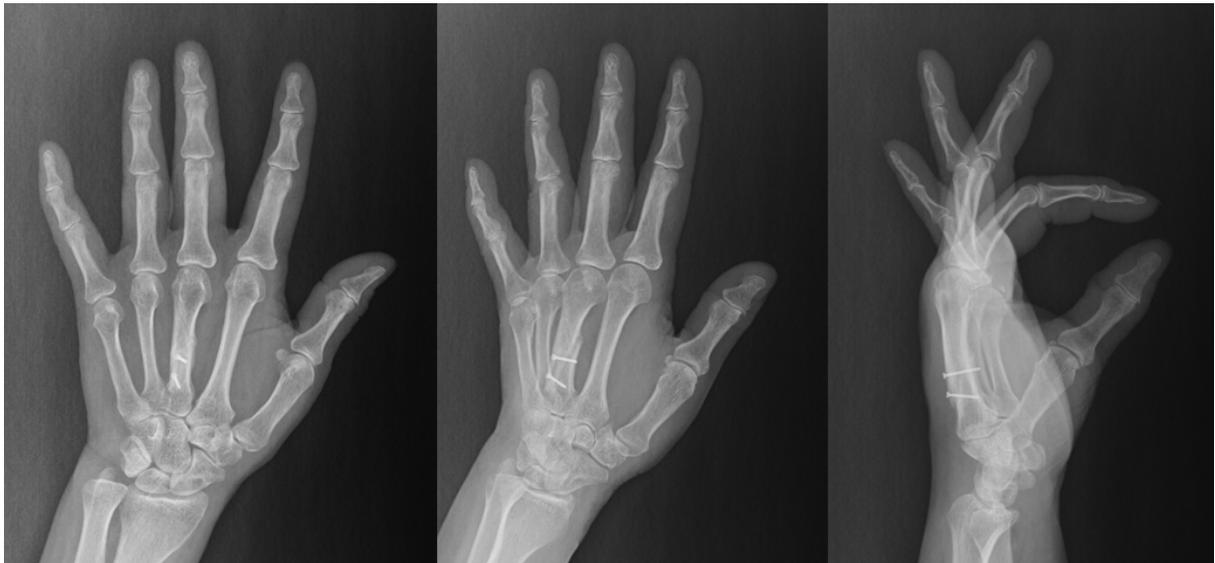


Fig. 2. The postoperative X-rays of metacarpal bone treated with two screws.

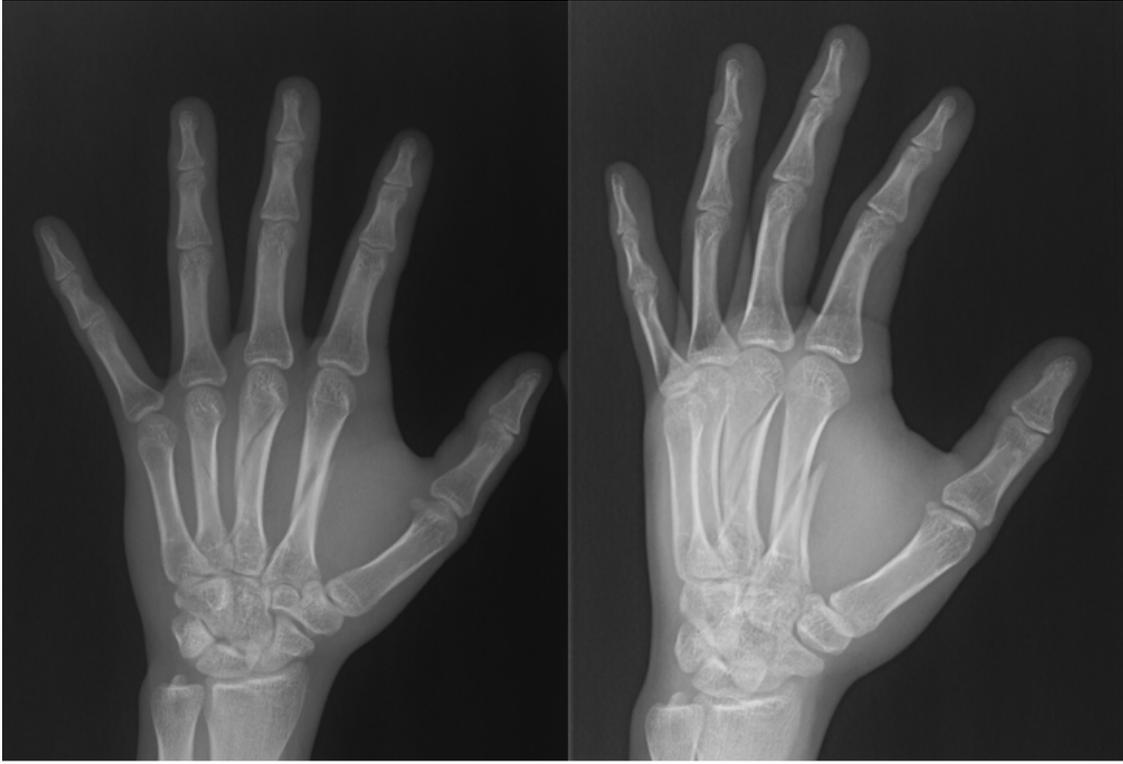


Fig. 3. Preoperative X-rays of a 24-year-old patient with spiral fractures in his left 2nd, 3rd metacarpal bones.



Fig. 4. The postoperative X-rays of metacarpal bone treated with three screws.

# Reconstruction of large traumatic skin defects of hand using various free flaps

Plast Reconstr Surg. Seoul National Univ. Bundang Hosp.

Seungjun Lee, Seokchan Eun

## Background

The reconstruction of hand defects remains a difficult problem due to the specific anatomical structures and highly sophisticated function. The particular aim must be that repairs to this functional structure are similar in texture and color and are aesthetically acceptable. Free flaps have been introduced for various kinds of reconstruction and resurfacing of traumatic defects.

## Methods

Between 2016 and 2022, the authors used free flap for eleven cases for covering hand traumatic defects. There were eight men and three woman, the mean age of the patients was 41 years, and the size of the flaps ranged from 7 x 5 cm to 17 x 9 cm. Among them, there are 5 anterolateral thigh flap, 3 lateral arm flap and 3 superficial circumflex iliac artery flap.

## Results

In the early postoperative day, the flaps showed general edema and some bullae on their surface. All flaps survived completely, and the donor site was closed directly in all. Secondary thinning surgery was performed in two cases.

## Conclusions

For smaller defects a great variety of local pedicled or island flaps can be applied. However, for larger defects with exposed tendons, nerves or other essential structures, free flaps remain as a reliable alternative.



FIG. 1. A 72-year-old man with traffic accident. Large skin defect and tendon exposure on his left hand. Elevated lateral arm flap from the ipsilateral upper arm.



FIG. 2. Immediate postoperative and 2 years after surgery. It shows good flap contour with complete flexion and extension motions.



FIG. 3. A 57-year-old woman with car accident. Large skin defect and tendon exposure on her left hand. Elevated anterolateral thigh flap from the ipsilateral thigh. Immediate postoperative view after flap transfer and full thickness skin graft.



FIG. 4. Postoperative three years view. It shows good flap contour and nice pinch motion.

# A very rare case of malignant eccrine gland tumor of the hand: a case report

Orthop Surg. Kangdong Sacred Heart Hosp.

Seungho Koo, Seung-Jin Lee

## Introduction

Tumors of sweat glands are uncommon skin tumor of the hand. Although very rare, it presents with wide and complex histological properties and clinical features.

Sweat gland tumors must be included in the differential diagnosis of benign as well as malignant lesions of the hand & upper extremity.

Marenda et. al. estimated that highly malignant sweat gland carcinomas constitute 0.005 % of all skin tumors.

We present a case of malignant eccrine gland tumor that developed on the hand and reports the result of surgical treatment and histological examination.

## Materials & Methods

A 72-year-old male patient presented with a palpable and protruding tumor of 10 years duration, on the radial aspect of second proximal phalanx of left hand. Tumor showed 2cm sized soft and round mass with bluish color.

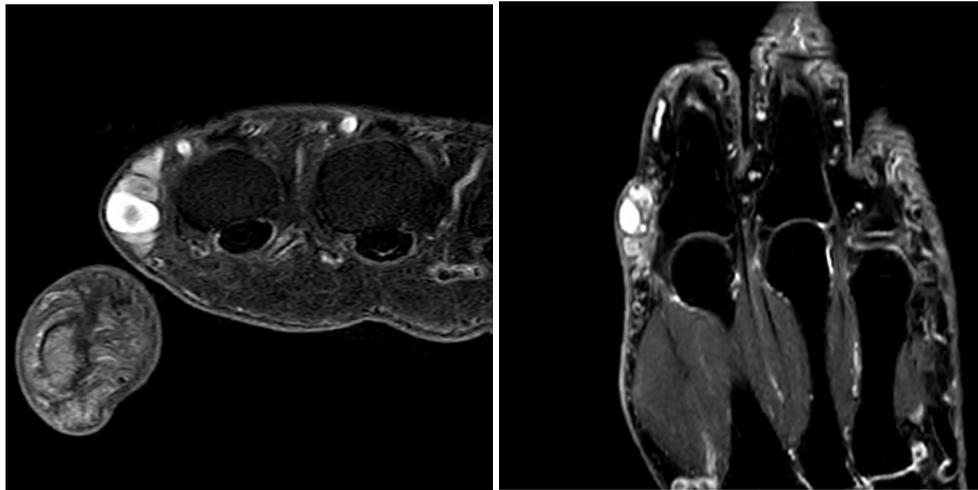
(Fig. 1, 2)



(Fig. 1, 2)

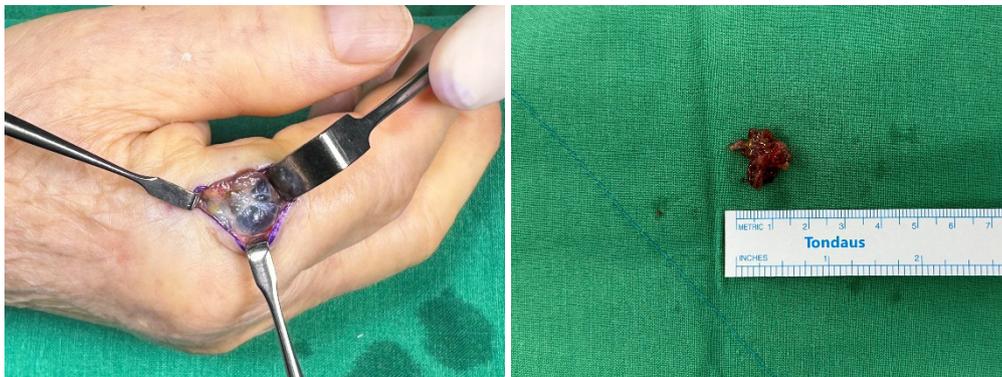
He had no pain and tenderness on tumor and any other discomfort but he wanted surgical removal of tumor because of cosmetic purpose so MRI was performed for pre-operative evaluation.

MRI findings showed 2cm sized multiloculated mass with T1 and T2 hyperintense portion, internal fluid-fluid level and phlebolith, so hemangioma was suggested. (Fig. 3, 4)



(Fig. 3, 4)

Surgery was performed under the local anesthesia. Longitudinal incision was made over the tumor and dissection was done carefully. Multiloculated bluish tumor was excised completely. (Fig. 5, 6)



(Fig. 5, 6)

## Results

: Patient showed no discomfort at surgical site clinically and cosmetically. Grossly, there were no evidence of recurrence of the tumor.

However, the biopsy results confirmed that it was a malignant eccrine gland tumor, and the patient was transferred to a higher-level hospital for further evaluation and treatment.

## Conclusion

: In this case, tumor was thought to be a hemangioma that is common tumor of the hand preoperatively. But result of histological examination showed a malignant eccrine gland tumor that requires further evaluation and treatment. Surgical excision and histological examination are needed to find potential danger of malignancy for undiagnosed tumors of the hand over long periods.

# Calcifying Aponeurotic Fibroma Inside Flexor Tendon: A Case Report

Wonju Severance Christian Hosp.

Jae Min Lee, Jin Rok Oh

Calcifying aponeurotic fibroma is a rare and benign tumor with a high recurrence rate, predominantly affecting the distal extremities of children and adolescents. To the best of our knowledge, this is the first report of a tumor in the intratendinous 4<sup>th</sup> flexor digitorum profundus. The tumor was resected using longitudinal tenotomy and excision. Considering the importance of the constructure (such as nerve, artery, and tendon), excision was performed carefully, despite the high recurrence rate of the fibroma. We recommend careful follow-up of such lesions.

**Keywords:** Calcifying aponeurotic fibroma, Surgical excision, Intratendinous

## INTRODUCTION

Calcifying aponeurotic fibroma (CAF) is a rare and benign tumor with well-characterized histopathological features.<sup>1</sup> The tumor predominantly affects the palms and fingers. However, it can also occur elsewhere, either superficially in the subcutaneous tissues or in the deeper musculofascial and parasketal tissues.<sup>2</sup> To the best of our knowledge, cases of purely intratendinous tumors have not been reported. Treatment of such tumors can be challenging because of the tumor's location since major structures, such as vessels and nerves, are densely packed in the small space.<sup>3</sup> Significant efforts should be made to preserve the function when resecting tumors from involved extremities, such as the hand, especially among children. We report the case of a 12-year-old girl with calcifying aponeurotic fibroma found inside the 4<sup>th</sup> flexor tendon of the palm.

## CASE REPORT

A 12-year-old girl with a mass on her right palm was admitted to the hospital through the outpatient department. The mass was palpable since 3–4 years ago, and the patient or her parents could not confirm whether the size had increased over the years. On physical examination, the mass was mobile during ROM exercise of the 4th digit of the left hand. On a plain radiograph (Fig. 1) and an ultrasonogram (Fig. 2), the mass was 2.3 cm long. MRI, performed for accurate analysis, confirmed a fusiform mass with dimensions of 1.2 \* 0.8 \* 2.9 cm (Fig. 3). However, the diagnosis was challenging. Therefore, the mass was surgically resected, and calcified tissue was observed in the intratendinous portion. Following resection, residual tendon repair was performed (Fig. 4), followed by a short-arm splint to restrict ROM. After the surgery, a splint was used to control ROM. Pathological examination of the intraoperative specimen revealed a calcifying aponeurotic fibroma (Fig. 6). The patient was followed up two weeks postoperatively, and right 4<sup>th</sup> finger active flexion appeared normal. The right hand showed normal ROM 6 weeks postoperatively, as shown in Figure 5.

## DISCUSSION

We often observe pediatric hand masses in the outpatient department of our hospital. The properties of these masses differ considerably, and discriminating between malignant and benign tumors is vital. The most common form of benign tumor in hand is a ganglion, followed by a giant cell tumor.<sup>4</sup> Calcified aponeurotic fibroma (CAF) is a very rare form of a benign tumor, with the first case reported in 1953 by Keasby.<sup>5</sup> Since then, around 100 cases have been reported in the literature. CAF generally affects the distal portion of extremities. Among younger individuals, the fingers and palms of the hand are mostly affected. The mass appears as slow-growing and as an ill-defined lesion related to tendon, tendon sheath, and aponeurosis in the body.<sup>6</sup> Since CAF is a clinically rare tumor, its diagnosis can often be challenging. It is diagnosed based on the medical history of the patients and clinical tests such as MRI and ultrasounds. Plain radiography for such tumors usually shows negative results.<sup>4</sup> Moreover, distinguishing giant cell tumors from CAF can be challenging. The clinical features of these tumors are similar; both tumors commonly affect the fingers, are attached to the tendon sheath, and show a similar signal intensity and gross feature on MRI (grayish-white, hard, and well-encapsulated mass). However, the histopathological features of these tumors are different.<sup>4</sup> CAF can be of two types based on histological findings. One type typically affects young patients, is more infiltrative and, lacks calcification, and characteristically shows a high recurrence rate.<sup>7,8</sup> The second type is more nodular in structure, typically contains speckled calcification, and affects older patients.<sup>9,10</sup> The recommended treatment of CAF is conservative local excision. However, some cases of CAF with metastatic fibrosarcoma of the lungs and the bones have also been reported,<sup>11</sup> necessitating radical excision. However, radical excision for such cases is highly debatable as noted in several different studies.<sup>12,13</sup> Considering the benign natural course of CAF, radical excision may be considered too invasive. Second, CAF predominantly affects the hand, which is densely populated by nerves, vessels, and tendons. To preserve hand function, local excision should be preferred in such cases. Considering

the recurrence rate of such tumors and the need for local excision, the benign characteristics and the rare metastasis in such patients before intervention.

In conclusion, CAF generally has benign features and is less likely to metastasize. Since it is generally known to affect the hand, the mass should be resected carefully so as not to affect hand function. Among children, hand masses should be carefully evaluated with proper tools and be treated, while also considering the tumor's natural course and its location.

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# Case Report: Bilateral Atypical Ulnar Fractures Treated with Different Osteosynthesis Techniques

National Health Insurance Ilsan Hospital

Jun-Ku Lee

Atypical ulnar fractures (AUFs) are rare complications of long-term bisphosphonate use in osteoporosis management. We report a case of bilateral AUFs in an 81-year-old woman treated with osteosynthesis using autologous iliac bone grafts. Surgical techniques varied between forearms, with a tricortical bone graft on the right and a cancellous bone graft on the left after resecting sclerotic margins. Both ulna were fixed with a 9 or 10 hole 3.5mm profile locking plate and a 6 or 7 hole 2.0mm profile locking plate. Postoperatively, variations were observed in the bone-grafted gaps, leading to subsequent differences in ulnar variances in the wrists. Serial follow-ups revealed complete union without complications at the same postoperative 20-week mark. Our approach, which included resection of sclerotic margins, bone grafting of cortical or cancellous tissue, and rigid fixation, resulted in favorable outcomes for both patients with ulnar fractures.

**Key words:** Atypical ulnar fracture, bisphosphonate, osteosynthesis, bone graft

# Dorsal wrist ganglion originating at the volar scaphotrapeziotrapezoidal joint: A case report

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## Introduction

Ganglion cysts are common, benign, soft-tissue tumors found in the hand and wrist. Ganglion cysts originating from the dorsal wrist joint are usually found in the dorsal side, and those originating from the volar wrist joint are usually found in the volar side. Herein, a rare case is presented of a large dorsal ganglion cyst originating from the volar scaphotrapeziotrapezoidal (STT) joint that pierced the first dorsal interosseous muscle, bulging dorsally.

## Case report

A 40-year-old woman presented with a progressively growing mass over the dorsal aspect of her left wrist and mild pain with wrist flexion/extension. The patient had no underlying disease or traumatic injury. The mass had been evident for six months and was palpable on the radial side of the dorsal wrist, with no tenderness. On ultrasound, a well-defined hypoechoic lesion was revealed. MRI(magnetic resonance imaging) indicated a multilocular cystic mass, measuring 28 x 12 mm, which appeared as a ganglion cyst. The cyst extended to the volar STT joint, lying much deeper than the flexor pollicis longus (FPL) and flexor carpi radialis (FCR) of the volar wrist. The cyst was attached to the radial artery at the position where the deep palmar arch is formed from the terminal part of the radial artery (Fig 1). The ganglion cyst was identified as originating from the volar side of the STT joint, where it bulged dorsally, passing through the position between the superficial head and deep head of the first dorsal interosseous muscle with radial artery. It was decided to surgically remove the cyst. Two incisions were made at the first dorsal web space and volar side of the STT joint. Since the cyst was adherent to the radial artery, it was meticulously dissected so as not to damage the radial artery. After it had been checked, the stalk arising from the STT joint was removed (Fig 2). Pathological examination confirmed the

diagnosis of a ganglion cyst. The patient had no loss of function in the hand, and no symptoms of recurrence were observed one year after surgery.

## Discussion

Dorsal wrist ganglion cysts that originate from the scapholunate ligament or scapholunate joint are the most common ganglion cysts (70%). Volar wrist ganglia (20%) occur in the radiocarpal or STT joint. When the ganglion originates from the volar joint surface of the STT joint, it is mostly likely to be seen as a volar side lump. In previous case reports, most ganglion cysts originating from wrist joint volar surfaces were viewed as lumps on the volar side (volar wrist, thenar area, and palm). However, no cases of volar wrist ganglia appearing on the dorsal wrist have been reported. Hence, a rare case in which a ganglion cyst originated from the volar STT joint to appear on the dorsal wrist is presented here.

There are two theories explaining the development of rare ganglion cysts. First, ganglion cysts originating from the STT do not directly pierce the volar side, owing to the FCR sheath. So, most cases, they grow proximal or distal to the FCR sheath. Second, the radial artery that runs to the deep palmar arch lies between the deep head and superficial head of the first dorsal interosseous muscle, and this part is much looser relative to the surrounding tissue. Consequently, ganglion cysts originating from the STT joint bulge distally due to the FCR sheath and grow dorsally via a loose space where the radial artery progresses to the deep palmar arch.

Several studies have suggested that finding the exact origin of a ganglion cyst for removal reduces recurrence. A mass in the distal radial dorsal wrist area can be thought to a ganglion cyst originating from the dorsal CMC joint, or a protrusion resulting from an extended ganglion cyst originating from the dorsal S-L ligament. However, since this mass may originate from the volar STT joint or volar CMC joint, as was the case with the patient presented in this report, pre-operative MRI may accurately reveal its origin, thereby facilitating surgery to reduce recurrence.

Similarly, also to the patient under discussion, in many cases, ganglion cysts originating from the volar STT joint are close to the radial artery. Pre-operative MRI may be helpful in determining a locational relationship between the radial artery and ganglion cyst, thereby assisting the surgeon to avoid damaging the radial artery. Moreover, if the radial artery is attached to the ganglion cyst, as in this case, there is a high likelihood that the radial artery may be damaged. Therefore, Allen's test must be conducted before surgery to confirm whether ulnar artery blood flow is adequate.

In conclusion, since ganglion cysts occurring in the dorsal wrist may originate from the volar midcarpal joint, a pre-operative MRI must be conducted to decrease the recurrence and to perform surgery with minimal complications. If a pre-operative MRI reveals a ganglion cyst originating from the volar midcarpal area and close to the radial artery, an effort should be made to remove the cyst within the area of origin while minimizing injury to the radial artery.

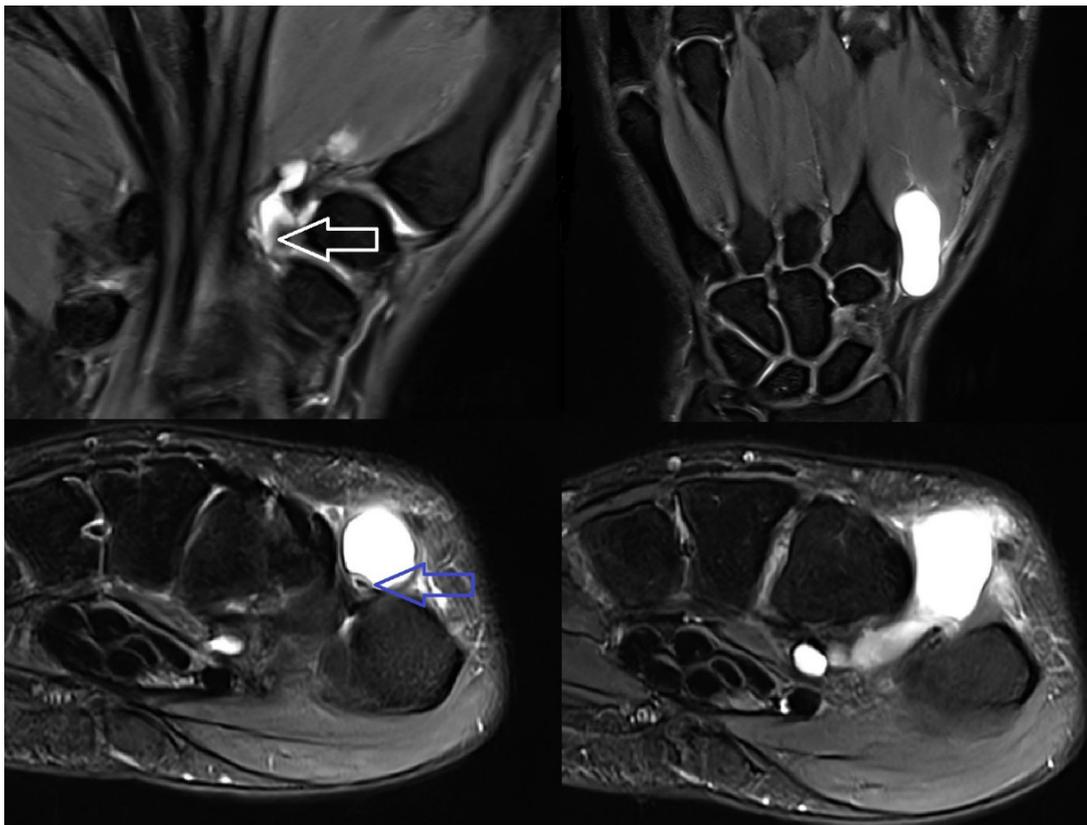


Fig. 1. MRI findings of ganglion cyst. A bulge of dorsal ganglion cyst originating from the STT joint (white arrow). The ganglion cyst is adherent to the radial artery (blue arrow).



Fig. 2. Clinical presentation observed during surgery. (A) A lump of ganglion cyst on the dorsum of the wrist. (B) After excision. Preservation of the radial artery (black arrow). (C) Appearance of a part of the volar STT joint. Stalk of ganglion cyst from the volar STT joint (red arrow).

# Neglected very large ancient schwannoma of the distal wrist: A case report and literature review

Plast Reconstr Surg. Saeson Hosp.

Hyun Rok Lee, Jae Hoon Kang

## Introduction

Ancient schwannoma is a variant of schwannoma characterized by slow progression, degenerative changes, and more frequent occurrence in the elderly. There have been two prior reported cases of ancient schwannoma arising from the distal ulnar nerve at the wrist level, but neither were long standing or very large. We report an ancient schwannoma found in the ulnar nerve of the distal forearm that was found to be clinically meaningful in size.

## Case report

A 61-year-old man presented with complaints of tingling sensation of the 4th and 5th fingers and bulging of the ulnar side of the wrist. He said that the mass in his wrist grew very slowly, starting about 10 years ago, and that he had started experiencing a tingling sensation in his 4th and 5th fingers about 3 years prior, which had become worse in the past year. On physical examination, a 5-cm-sized mass was observed on the ulnar side of the wrist, showing a slight Tinel sign with no pain or tenderness. There was no evidence of ulnar or median nerve palsy in the hand.

Several preoperative imaging tests were performed; radiologic examination was unremarkable, while ultrasonography showed a 5.5x4x3 cm sized, well-defined mass containing internal hypoechoic areas. An ovoid heterogeneous mass measuring 5.5x4.5x3cm was observed on MRI. T1 weighted imaging (T1WI) showed an overall low signal intensity, T2 weighted imaging (T2WI) showed a mix of high and low signal intensity, and there were areas inside that showed low signal intensity on both T1WI and T2WI. Contrast enhanced imaging revealed enhancement throughout the mass, except for some regions in the middle (Fig. 1). The tumor compressed the muscles and tendons, causing the ulnar sided structures to be deviated the radial side, but there was no invasion

of the muscle or bone.

Based on the results of the preoperative examination, a benign nerve sheath tumor was suspected. As it was thought that the possibility of malignancy was not high, we elected to perform a marginal excision and permanent biopsy with no frozen biopsy or wide excision. The surgical findings indicated a well-defined mass measuring 5x4x3 cm, which appeared to be eccentric with the nerves. Nerve fascicles were partially attached to the surface of the mass, and no fascicles were seen within the mass. The mass could be removed meticulously without causing any nerve injury (Fig. 2.). Histologically, the encapsulated mass revealed nodular cellularity with streaming fascicles of spindle shaped Schwann cells (Antoni A area) in the background of the myxomatous stroma (Antoni B area). Focally, a fibrinodgenerative paucicellular area and irregular vascular channels with hemosiderin laden macrophages indicating chronic process, consistent with ancient schwannoma, were observed (Fig. 3).

The patient still had a slight tingling sensation in the immediate postoperative period, but no other neurologic findings were noted. At his last visit 3 years after surgery, he reported no recurrence and that he felt better than before surgery, but some tingling sensations remained.

## Discussion

Ancient schwannoma is a variant of schwannoma characterized by slow progression and more frequent occurrence in the elderly. Schwannomas have no specific symptoms when small, but as they grow, they can cause symptoms such as Tinel sign, pain, and paralysis. However, motor deficits, which occur mostly in malignant nerve tumors, are less likely to occur because the slow progression gives time for adaptation.

Ancient schwannoma have several characteristics which can aid in diagnosis. Antoni A area (dense hypercellular area with spindle cells) and Antoni B area (loose hypocellular area with myxoid tissue) appearing in an alternating pattern is a characteristic of conventional schwannoma. Ancient schwannoma also shows an alternating pattern of Antoni A and B areas, but with relatively less Antoni A areas and a greater proportion of Antoni B areas. In addition, slow growth and slow degenerative changes (cystic formation, calcification, hemorrhage, and perivascular hyalinization) may appear inside the mass. MRI findings reflect the histologic features of schwannoma. Antoni A areas show a lower signal intensity on T1 and T2 weighted images, while Antoni B areas show lower signal intensity on T1WI and high signal intensity on T2WI.

Ancient schwannoma can be mistaken for malignant tumors on preoperative examination. The key to preoperative differential diagnosis is performing imaging studies that reflect the patient's age, time of presentation, presence or absence of neurologic symptoms, and the histologic features of the ancient schwannoma mentioned above.

At the time of surgical treatment, ancient schwannoma is often in enlarged state; however, even enlarged tumors are not prone to complications such as motor deficits, which commonly occur in malignant tumors, because of ancient schwannoma's slow progression. Furthermore, even if the tumor itself is large, as was observed in this

case, because most ancient schwannoma grow eccentrically, it is not difficult to excise without inflicting any nerve injury.

Thus far, there have been two reported cases of ancient schwannoma of the ulnar nerve in the distal wrist, one of which was 1 cm in diameter and globular in shape, which the other was 2 x 3 cm and oval in shape, and both were less than 3 years old. However, the two cases above were relatively small and quickly detected to cause mass effects or post-operative complications. Since the distal wrist had no free space and the mass was discovered and removed relatively quickly, it could not have grown large enough to cause degenerative changes for a long enough period of time as with an ancient schwannoma in a different region such as the proximal extremity. For this reason, cases of ancient schwannoma in the distal wrist that are sufficiently large and old to cause problems are rare, and have not yet been reported. As opposed to the previous cases, the patient in this case report was neglected and underwent medical treatment relatively late despite the location in the distal wrist.

As in the case of small ancient schwannoma in the distal wrist, most cases of large ancient schwannoma do not cause severe neurological symptoms and can be treated without special complications with a good preoperative diagnosis. Therefore, if a mass suspected to be an ancient schwannoma is found in the distal wrist, even if it is large and old, it is expected to respond well to surgical treatment and prompt surgical removal is recommended.

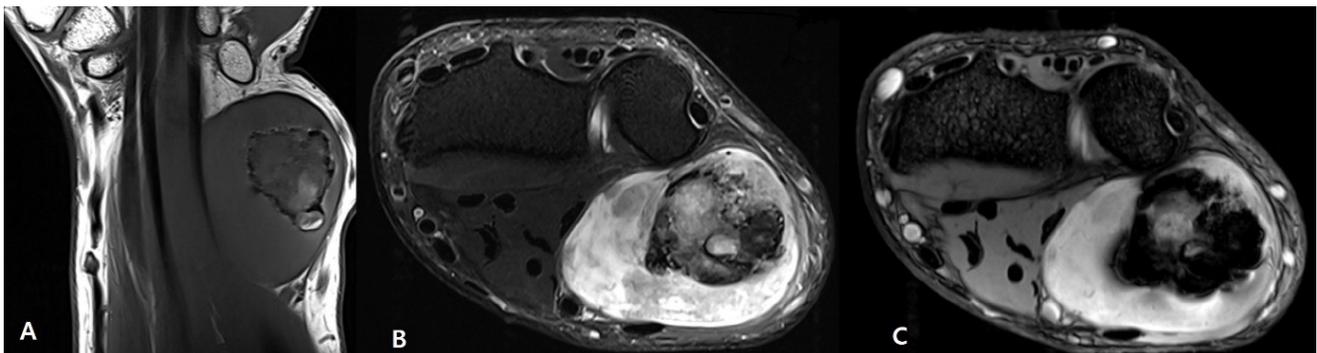


Fig. 1. Results of MRI.

T1 weighted image (T1WI) showing overall low signal intensity (A), and the T2 weighted image (T2WI) showing a mix of high and low signal intensity (B). There were several areas inside the mass that showed low signal intensity (degenerative areas) on both T1WI and T2WI (C).



Fig. 2. The mass was located in the ulnar nerve in an eccentric fashion, and was removed with minimal damage to the nerve.

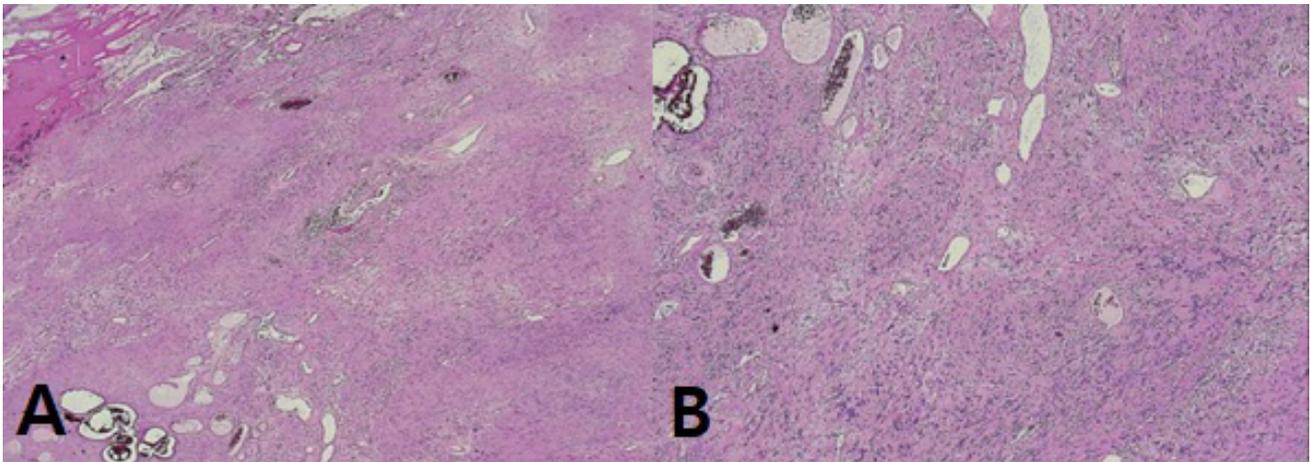


Fig. 3. The tissue showing nodular cellularity with irregular vascular channels and fibrinodgenerative area. (H-E, X40) (A), Prominent streaming fascicles of spindle cells (Antoni A tissue) are noted. (H-E, X100) (B).

# Fibroma of the Flexor Tendon at Carpal Tunnel causing Trigger Wrist in Young Child - Case Report -

Cheongju TOP Hosp.

Hyung Joon Lee

Triggering phenomenon of the flexor tendon at the wrist is a rare and occurs mainly in adults. The triggering can be caused by many different conditions, including soft tissue tumor, rheumatoid disease, anomalous muscle, synovitis. The authors diagnosed the trigger phenomenon caused by fibroma of flexor tendon at the right carpal tunnel in an 11-year-old girl. So we would like to report this with a literature review.

**Key Words :** Wrist, Carpal tunnel, Triggering, Fibroma

# Comparison of outcomes between primary total elbow arthroplasty and plate osteosynthesis in distal humerus fractures with concomitant osteoporosis

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## Introduction

Distal humerus fractures (DHF) account for approximately 1-2% of all fractures and represent about 5% of osteoporotic fractures in individuals aged 60 and older. Treatment options for DHFs typically include open reduction and internal fixation (ORIF) or primary total elbow arthroplasty (TEA), depending on the fracture pattern and the bone quality. Several studies suggest that primary TEA can be a viable option for patients with DHFs accompanied by osteoporosis, as it may facilitate a quicker return to daily activities and result in relatively favorable functional outcomes. However, other study also indicates that the complication rates associated with primary TEA can be significantly high, highlighting the need for caution in this approach. To our best knowledge, while numerous studies have compared TEA and ORIF in patients with DHFs, there is a lack of study focused on functional and radiographic outcomes specifically in patients diagnosed with osteoporosis. The aim of our study is to compare the functional and radiographic outcomes of patients with DHFs accompanied by osteoporosis who have been followed for more than three years.

## Materials and methods

We conducted a retrospective analysis of 150 patients diagnosed with DHF who underwent surgical intervention between January 2005 and December 2019. Among these, we included patients who were followed for more than three years and had a DEXA score of  $-2.5$  or lower at the time of diagnosis. Patients with nonunion or those requiring revision surgery were excluded from the study. Ultimately, our study included a total of 46 patients (46 elbows), comprising 33 patients in the ORIF group (33 elbows) and 13 patients in the primary TEA group (13 elbows). We analyzed functional outcomes, radiographic outcomes, and other complications, including ulnar nerve symptoms. Functional outcomes were assessed by evaluating elbow extension, flexion,

pronation, supination, and the total arc of motion. We also measured the Mayo Elbow Performance Score (MEPS), the Disabilities of the Arm, Shoulder, and Hand (DASH) score, and pain using the visual analog scale (VAS). Radiographic outcomes assessed included periprosthetic fractures, implant loosening, and infections.

## Results

Among the patients followed for more than three years, the pain VAS scores were significantly lower in the ORIF group compared to the primary TEA group. Similarly, in the pain subgroup of the MEPS, the ORIF group demonstrated a statistically significant reduction in pain levels. However, there were no statistically significant differences in the elbow functional outcomes as represented by the MEPS and the DASH scores between the two groups. Notably, in the motion subgroup of the MEPS, the TEA group exhibited a statistically significant higher score, but no differences were observed in the range of motion (ROM) parameters between the two groups.

In the radiographic assessment, aseptic loosening was observed in 30.8% of the primary TEA group, while no cases were reported in the ORIF group, marking the only significant difference among the various assessment criteria. Regarding ulnar nerve symptoms, 30.8% of patients in the TEA group and 24.2% in the ORIF group experienced symptoms, with no significant difference between the two groups. All patients presented with paresthesia symptoms, which were deemed manageable through observation.

## Conclusion

There was no significant difference between the primary TEA group and the ORIF group in patients with DHFs accompanied by osteoporosis. However, during a minimum follow-up period of three years, the radiographic outcomes in the primary TEA group were poor, with aseptic loosening being a notable issue. For this reason, caution is advised when considering primary TEA as the first option for patients with DFHs associated with osteoporosis.

# Hemi metacarpal head replacement using osteochondral graft for metacarpal head fracture

Duson Hosp.

SangWoo Kim, Yong Hwan Kim, Hyunsik Park, Jong Ick Whang

## Introduction

Metacarpal head fractures present a significant challenge for hand surgeons. In cases of split-type fractures, if the fragment is large, it can be fixed with screws. However, when the fracture is comminuted or cannot be stabilized with screws, reconstructing the articular surface becomes impossible. The collapse of the articular surface may result in limited range of motion of the metacarpophalangeal joint and persistent pain.

On the other hand, various studies have demonstrated the efficacy of using costal cartilage or knee cartilage grafts to restore the articular cartilage surface of the metacarpal head in cases of avascular necrosis. Inspired by this approach, we propose a surgical technique for reconstructing the articular surface of the metacarpal head in cases where the fracture fragments are large but comminuted, making osteochondral grafting unfeasible. This technique involves grafting structured bone from the knee osteochondral area to reconstruct the articular surface of the metacarpal head.

## Case report

A 38-year-old male patient, transfer our clinic with fracture fourth metacarpal head distal articular type due to a fall down the stairs. He underwent open reduction and internal fixation with a 2.0 half-threaded cancellous screw other clinic. On the fifth postoperative day, the fixation failed to maintain stability, resulting in a subluxation of the metacarpophalangeal (MCP) joint.

. At our initial examination, tenderness was found on palpation around the MCP joint. Joint was dislocated dorsally. CT revealed that the remaining bone fragment was small and severely comminuted, making standard open reduction and internal fixation challenging. Therefore, We decided to reconstruct the joint surface by transplanting osteochondral grafts.

The index MP joint was approached via a dorsal curvilinear incision using previous operation.

The dorsal capsule was excised and the MCP joint was examined. The metacarpal head was found to have around lower position half size defect 4<sup>th</sup> metacarpal head. With flexion of the metacarpophalangeal joint, the surgeon can gain good exposure to the metacarpal head lesion through this approach. There were, small, comminuted osteochondral fragments free in the MCP joint, which we removed. We measure the defect size. This patient required a graft measuring 1.5 cm in width, 1.0 cm in length, and 1.0 cm in height. We then prepare to harvest an osteochondral strut bone graft from the knee.

After deflating the tourniquet on the hand, we inflate the tourniquet on the lower extremity and use a standard lateral parapatellar approach to access the lateral femoral condyle. The donor strut bone is harvested from the non-weight bearing portion of the knee, specifically between the sulcus terminalis and the physis. Using an osteotome, we harvest the graft from the previously measured area in the non-weight bearing portion of the knee. The donor site is then repaired with bone wax. After inserting a drain and suturing the skin of the knee, we deflate the tourniquet on the lower extremity. Next, we reapply the tourniquet to the upper extremity. The harvested osteochondral strut graft is then shaped to fit the actual fracture defect. With the metacarpophalangeal (MP) joint flexed, we align the chondral lesion of the graft to face the base of the proximal phalanx and temporarily fix it with a K-wire. Using two 2.0 headless screws, we fix the graft from dorsal to volar. Using a C-arm, we verify the appropriate screw length, the congruency of the joint surface, and check for joint instability during range of motion.

Finally, we tightly repair the capsule and surrounding tissues, carefully suture the skin around the extensor, and apply a protective short arm splint in the intrinsic position. Range of motion exercises begin the day after surgery.

## Result

Six months post-surgery, both X-ray and CT scans show signs of bone union progression. The patient also achieved full extension and full flexion range of motion.

## Conclusion

In cases of severely comminuted fractures of the metacarpal head, reconstructing the metacarpal head using osteochondral grafts harvested from the knee, which has a similar joint surface shape, can be a viable treatment option.

# Novel technique TFCC repair without bone tunnel

Duson Hosp.

SangWoo Kim, Yong Whan Kim, Hyunsik Park, Jong Ick Whang

## Introduction

Various surgical methods have been proposed for TFCC (Triangular Fibrocartilage Complex) repair. This paper aims to describe the outside-in technique using a 21-gauge needle, without employing a bone tunnel.

## Surgical method

In recent years, the method of attaching the TFCC peripheral tear to the fovea using a bone tunnel has been widely used. However, when performing surgery with a bone tunnel, a guide is necessary, and there is the inconvenience of having to view the C-arm along with the arthroscope. Therefore, we introduce a method that attaches to the fovea, known for its anatomical reduction position, without using a bone tunnel.

Prepare with the standard wrist scope, and pass a 2-0 fiber wire through an 18-gauge needle from the volar side of the ECU, twisting it to make a loop. Pass the needle at an appropriate distance from the edge of the TFCC tear and remove it through the 6R portal. Without completely removing the needle, pull it back slightly and pass it again at an appropriate distance, then remove the fiber wire through the 6U portal.

Next, use a shaver to enter the TFCC tear site and perform debridement of the ulna head area to aid healing after TFCC repair.

Then, make an incision about 4 cm below the ulna head, carefully avoiding the ulna BR. Use a mosquito clamp to pull the threads from the 6R and 6U portals as close to the bone as possible. Finally, fixate the ulna using a mini-pushlock.

## Conclusion

In a group of three patients who underwent surgery using this method, improvements were observed in DASH scores and VAS scores at the 1-year follow-up.

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## 2024 대한수부외과학회 추계학술대회

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