On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

Co-Chairs: Mark E. Baratz, MD and Christina M. Ward, MD

Program Syllabus

76TH ANNUAL MEETING OF THE ASSH
SEPTEMBER 30 – OCTOBER 2, 2021

822 West Washington Blvd
Chicago, IL 60607
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LEARNING OBJECTIVES
At the conclusion of this program, the attendee will:

- Evaluate and categorize TFCC tears and understand relationship between TFCC tear type and operative approach, including approaches to ulnar abutment.
- Identify underlying causes of DRUJ instability and plan operative approach for treatment.
- Understand utility and limitations of different surgical approaches to DRUJ arthritis.
- Recognize less common causes of ulnar sided wrist pain including pisotriquetral arthritis and hook of hamate pathology.

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The American Society for Surgery of the Hand gratefully acknowledges those who have generously volunteered considerable time and effort to plan, organize and present this CME course. The ASSH appreciates the faculty's dedication to teaching, their support of the ASSH mission, and their significant contribution to the educational success of this program.
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● Commed: Consultant

Geneva Vicenta Tranchida, MD
No relevant conflicts of interest to disclose

Christina M. Ward, MD
No relevant conflicts of interest to disclose

Clara W. Wong, FRCS
No relevant conflicts of interest to disclose

On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

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Program

Session Chair(s)
Mark E. Baratz, MD | Christina M. Ward, MD

10 Minutes
Introduction
Mark E. Baratz, MD | Christina M. Ward, MD

10 Minutes
Making the Diagnosis: History, Exam, Anatomy, and Imaging
Nicole Strauss Schroeder, MD

15 Minutes
Surgical Approach to TFCC
David S. Ruch, MD

10 Minutes
Making the Diagnosis: History, Exam, Anatomy, and Imaging
Felicity Fishman, MD

10 Minutes
Surg Approach: Scope vs. Open Wafer
Clara W. Wong, FRCS

15 Minutes
Surg Approach: Ulnar Shortening Osteotomy
Mark E. Baratz, MD

15 Minutes
Making the Diagnosis: History, Exam, Anatomy, and Imaging
Sanjeev Kakar, MD, FAOA

10 Minutes
Acute DRUJ Instability
Jacqueline Geissler, MD

10 Minutes
Chronic DRUJ Instability
Christina M. Ward, MD

15 Minutes
Surg Approach: Resection Arthroplasty
Jesse B. Jupiter, MD

15 Minutes
Biologic Implant Arthroplasty (Including HOS)
Dean G. Sotereanos, MD

15 Minutes
Unconstrained Implant Arthroplasty
Brian D. Adams, MD

15 Minutes
Constrained Implant Arthroplasty
Douglas P. Hanel, MD

15 Minutes
ECU Pathology
Michelle G. Carlson, MD

30 Minutes
Rapid Fire Cases: Pisotriquetral Arthritis
Maureen A. O'Shaughnessy, MD

30 Minutes
Rapid Fire Cases: Guyons Canal
Geneva Vicenta Tranchida, MD

30 Minutes
Rapid Fire Cases: Hook of Hamate
Hannah H. Lee, MD, PhD

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10 Minutes

Making the Diagnosis: History, Exam, Anatomy, and Imaging

Nicole Strauss Schroeder, MD
● Aiviva Pharmaceuticals: Consultant

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15 Minutes

Surgical Approach to TFCC

David S. Ruch, MD

- Acumed: Consultant
- Acumed: Speaker
- Field Orthopaedics: Consultant

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Speaker has not provided a handout for this presentation.

Session Handouts

OnDemand

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10 Minutes

Making the Diagnosis: History, Exam, Anatomy, and Imaging

Felicity Fishman, MD
No relevant conflicts of interest to disclose

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Ulnar Impaction Syndrome: History, Exam, Anatomy and Imaging

Felicity Fishman, MD
Associate Professor
Loyola Stritch School of Medicine
Shriners Hospital for Children- Chicago

1

Ulnar Impaction Syndrome

- Ulnar impaction syndrome, ulnocarpal abutment, ulnocarpal impaction
- Degenerative condition with painful overloading of the ulnocarpal articulation
- Frequently associated with ulnar positive variance but can be ulnar neutral or static ulnar negative
- Leads to degenerative changes in TFCC→ chondromalacia of ulnar lunate, triquetrum and distal ulnar head → instability of LT joint and eventually arthrosis of ulnocarpal joint and DRUJ

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Presentation

- Complaints of ulnar sided wrist pain
- Insidious onset and progressive discomfort
- No discrete trauma
- Pain improves with rest
- Worsens with activities that require grip, rotation, or ulnar deviation

Cerezal, Magn Reson Imaging Clin N Am, 2004

3

Etiology

- Typically associated with ulnar positive variance
- Any condition that leads to increase in relative length of ulna
  - Distal radius malunion
  - Radial head excision
  - Congenital ulnar positive variance
  - Ulnar overgrowth with premature physeal closure of radius
  - Madelungs

4

UIS Biomechanics

- Radius rotates around ulna
- Ulnar neutral wrist → 82% of axial load transmitted across radius, 18% transmitted across ulna
- Ulnar lengthening of 2.5mm lead to increase in force to 42%

Palmer & Werner, CORR, 1984

5

Ulnar Wrist Anatomy

Sam, Indian J of Orthop, 2021

- Important Players in UIS:
  - TFCC
  - Ulnar Head
  - Ulnar proximal lunate
  - Proximal triquetrum
  - Lunotriquetral ligament

6

Classification

- Class II lesions are degenerative (Not acute)

Table 1
The Palmer classification of TFCC degenerative conditions (Class II lesions)

Classification	Description
IIA	TFCC wear
IIB	TFCC wear + chondromalacia
IIC	TFCC perforation + chondromalacia
IID	TFCC perforation + chondromalacia + LTIL perforation
IIE	TFCC perforation + chondromalacia + LTIL perforation + arthritis

Sammer & Rizzo, Hand Clin 2010

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Physical Examination

- TTP just distal to head of ulna, TTP volar to styloid
- May be tender over LT interval

Sachar, JHS 2012

8

Physical Examination

- **Nakamura ulnar carpal stress test**
  - Wrist in max ulnar deviation, axial load via wrist, passively rotate from supination to pronation
  - Sensitive for UIS but not specific
    - LTIL injury, TFCC injury, isolated arthritis

Sammer & Rizzo, Hand Clin 2010

9

Imaging: Radiographs

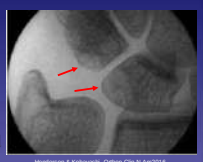
- Begin with standard neutral PA & lateral
- Radiographs of contralateral side
- Evaluate for pathology that could contribute to ulnar positive variance

Sammer & Rizzo, Hand Clin 2010

10

Imaging: Radiographs

- Subchondral sclerosis or cystic changes of dome of ulna, proximal ulna corner of lunate, and/or proximal radial corner of triquetrum
- Can progress in severe cases to degenerative arthritis of ulnocarpal and DRUJ articulations



Henderson & Kobayashi, Orthop Clin N Am2016

11

Imaging: Radiographs

- Ulnar variance differs based on position of arm
- Forearm pronation and grip lead to increase in ulnar length
- Neutral Position:
  - Elbow at 90° flexion, shoulder abducted, forearm neutral

Yeh, JHS 2001

12

Imaging: Radiographs

- Dynamic grip view
  - Forearm in pronation with grip changes ulnar variance

Acott & Greenberg, Orthop Clin N Am, 2020

13

Measuring Ulnar Variance

- Method of perpendiculars
  - Line through distal ulnar aspect of radius perpendicular to longitudinal axis
  - Distal cortical rim of ulna marked
  - Distance between rim and perpendicular line is ulnar variance

Ozturk, Acta Orthop Traumatol Turc 2021

14

Measuring Ulnar Variance

- Concentric Circle technique of Palmer et al
  - Distal sclerotic line of radius
  - Distance from a circle that approximates the subchondral distal radius to the distal the ulnar head is measured

Ozturk, Acta Orthop Traumatol Turc 2021

15

Imaging: MRI

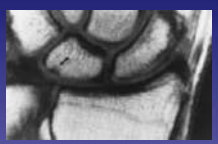
- Can detect early changes prior to cystic changes
- May show ulnar impaction in ulnar negative variance

Cerezal et al, Magn Reson Imaging Clin N Am, 2004

16

Imaging: MRI

- Early fibrillation & chondromalacia of cartilage
- Can detect early subtle subchondral sclerosis
- Bone hyperemia or edema in ulnocarpal region



Tomaino, JHS 2000

- Can evaluate integrity of TFCC and LTIL

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Summary

- UIS is most common in ulnar positive wrist but can occur in ulnar negative or dynamic ulnar positive wrists
- Physical examination will typically demonstrate pain over distal ulna and LT interval, pain with ulnar carpal stress test
- Imaging should include PA and lateral in neutral, dynamic grip view in pronation
- MRI helpful to show other pathology and early UIS

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Thank you!
LOYOLA
MEDICINE
Department of Orthopaedic Surgery and Rehabilitation

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10 Minutes

Surg Approach: Scope vs. Open Wafer

Clara W. Wong, FRCS

No relevant conflicts of interest to disclose

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knowledge commitment compassion

ULNAR IMPACTION SYNDROME - SCOPE / OPEN WAFER

Clara Wong Wing-yee

Clinical Professional Consultant, Department of Orthopaedics and Traumatology, the Chinese University of Hong Kong

Associate Professor of Practice, the Chinese University of Hong Kong

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ULNAR IMPACTION SYNDROME

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ULNAR IMPACTION SYNDROME

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Operative Treatment

- Ulnar Shortening Osteotomy
- Wafer Procedure

Wafer Procedure

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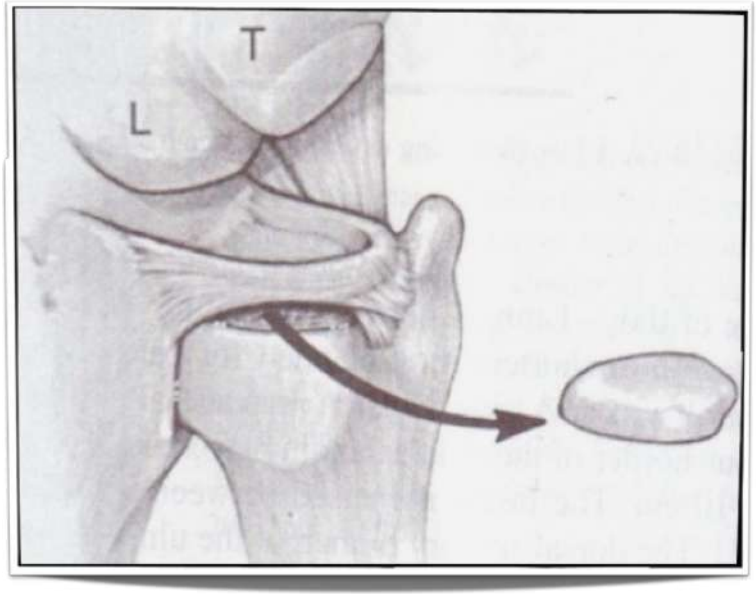
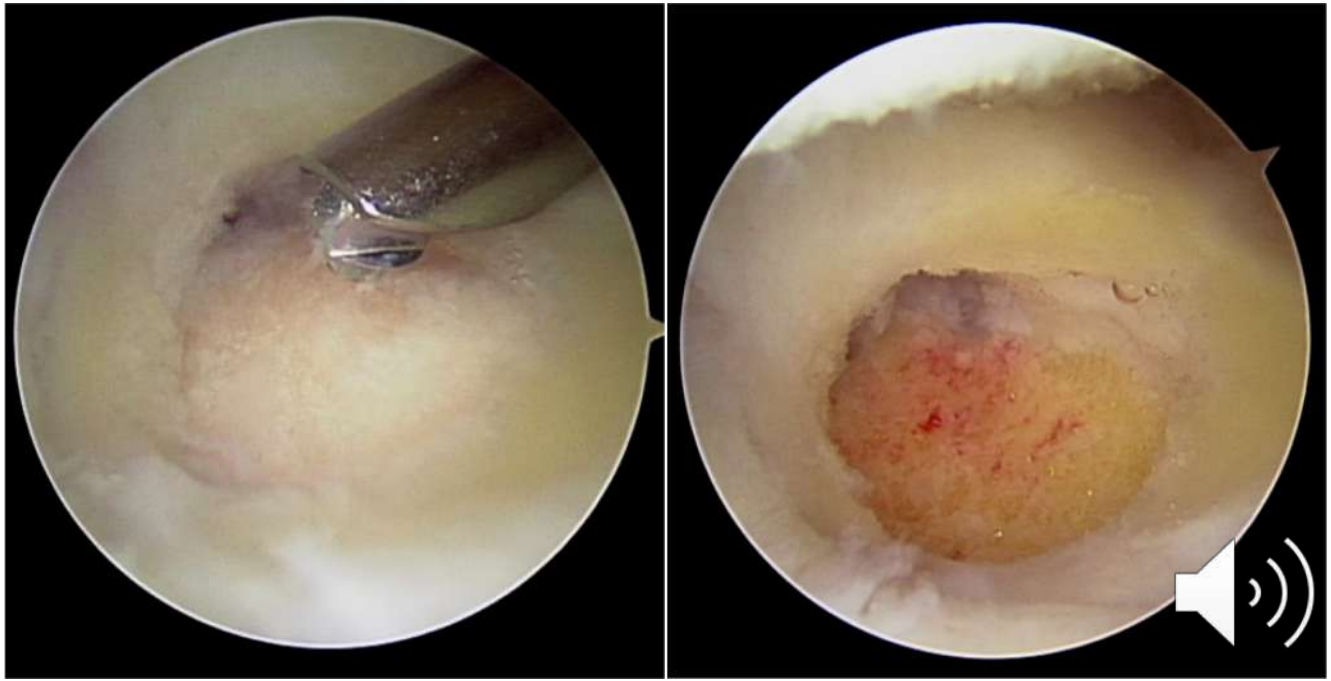
1989 Scientific Exhibit in ASSH, San Antonio, Texas
Feldon P, Terrono AL, Belsky MR. The “wafer” procedure. Partial distal ulnar resection. Clin Orthop Relat Res. 1992;275:124e129.

Open **2-4 mm**



1990 Osterman AL, Bora FW, Maitin E. Arthroscopic debridement of the triangular librocartilage complex tears. *Arthroscopy 1990;6:120-4.*

Arthroscopic **1-2 mm**



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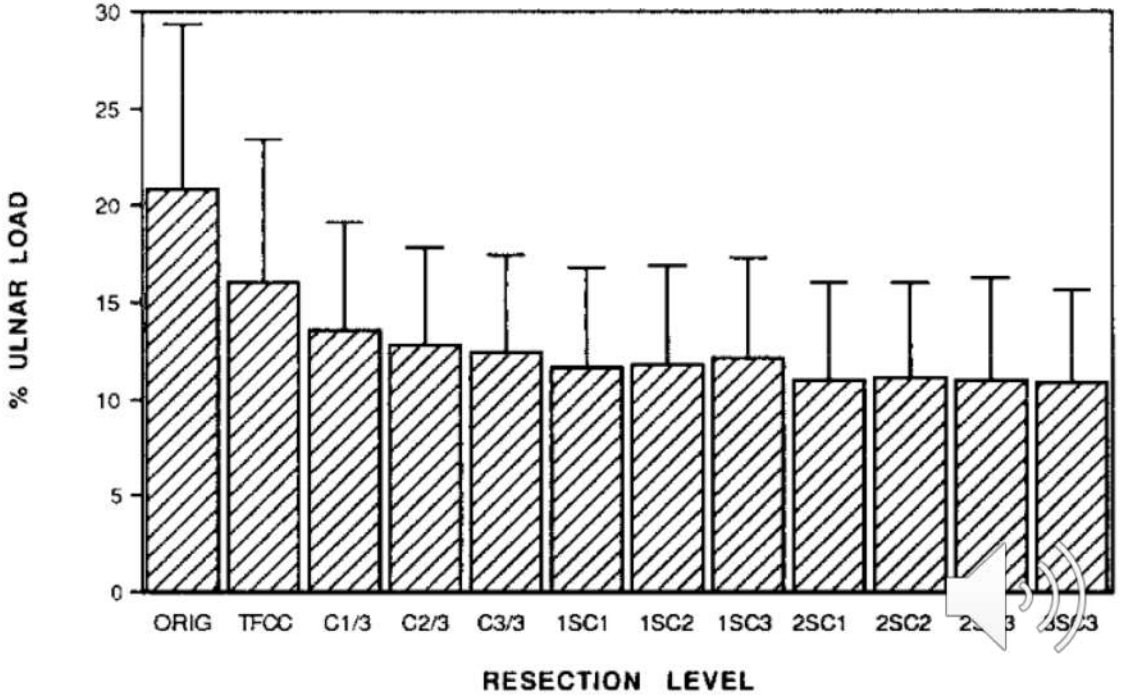
1992 Wnorowski DC, Palmer AK, Werner FW, Fortino MD. Anatomic and biomechanical analysis of the arthroscopic wafer procedure. Arthroscopy. 1992;8(2):204e212.

Arthroscopic **-2 mm**

FRIST LINE SURGICAL TREATMENT IN ULNAR IMPACTION SYNDROME WITH PEFORATED TFCC



Surgical procedure

Open Wafer Procedure

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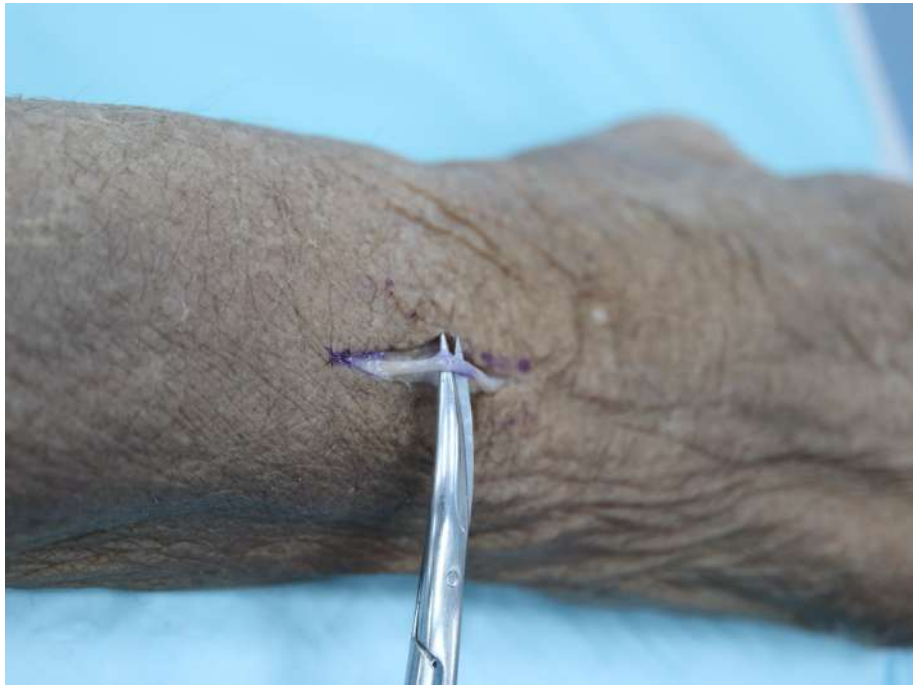
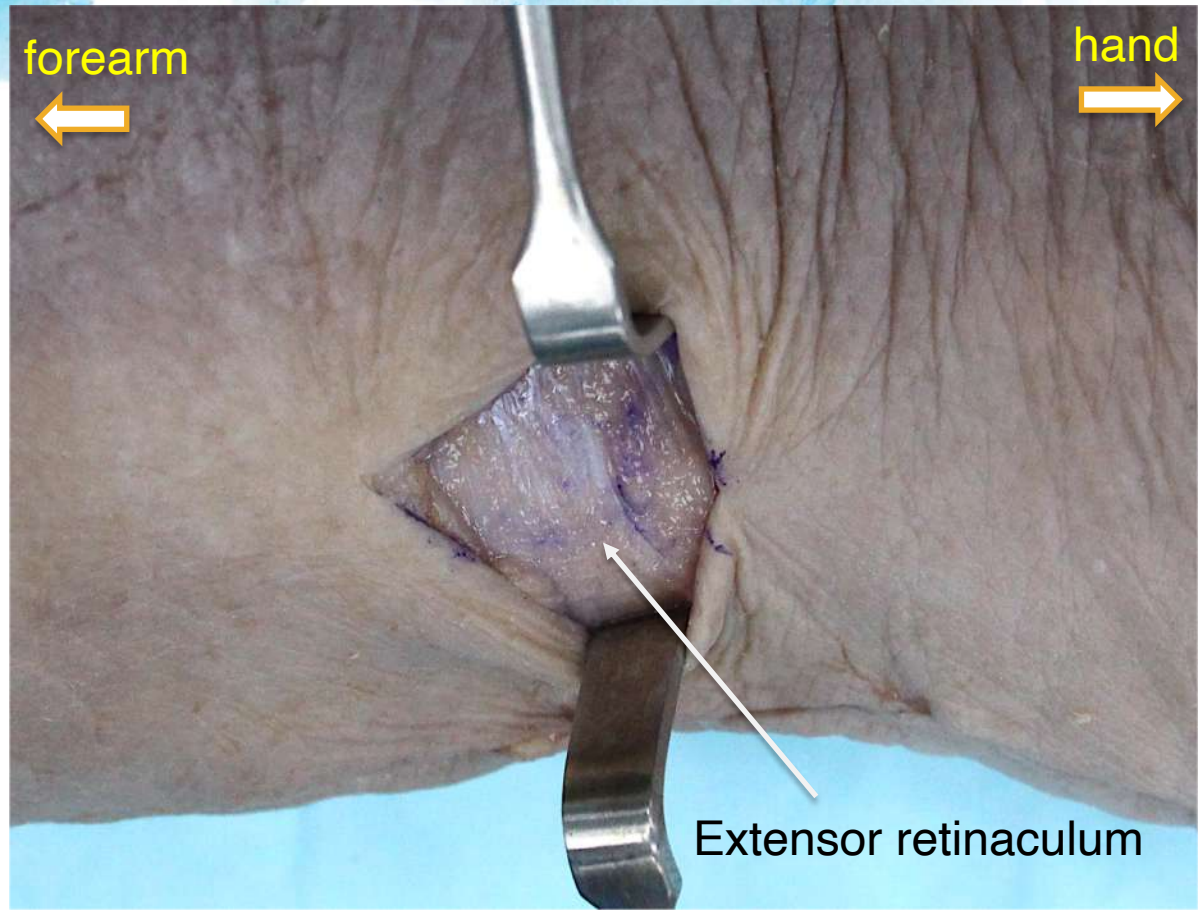
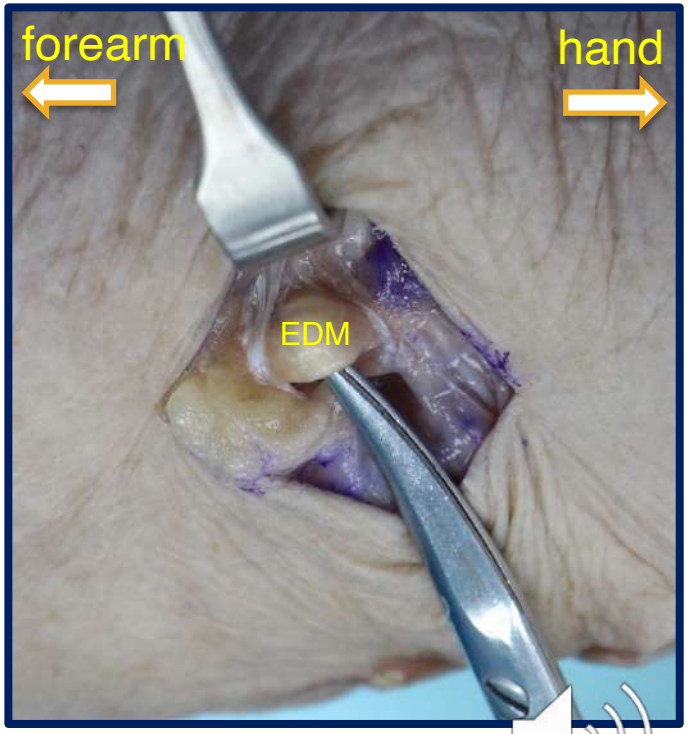


Dorsal cutaneous branch of ulnar nerve

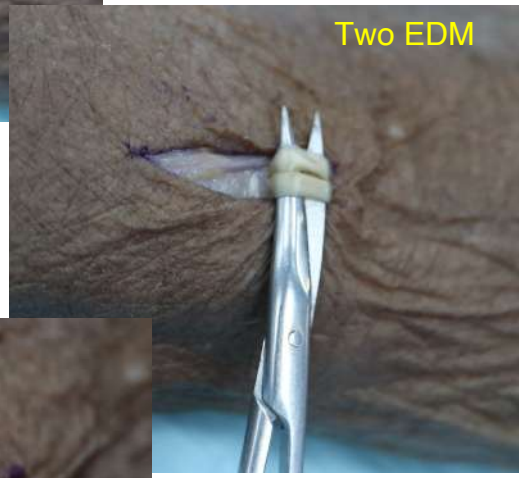

forearm
hand
Extensor retinaculum

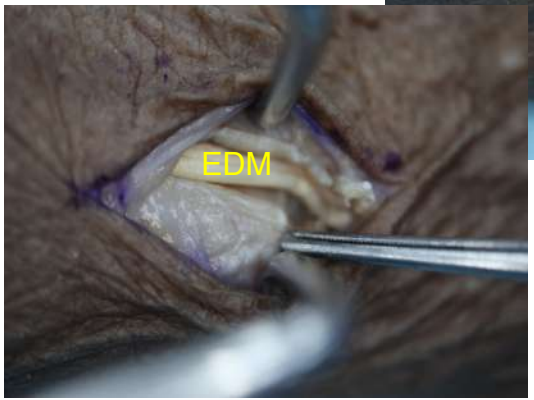

forearm
hand
EDM

Open EDM retinaculum

- One or two EDM tendons
- Retract them radially

Footage courtesy of Prof Mark Baratz





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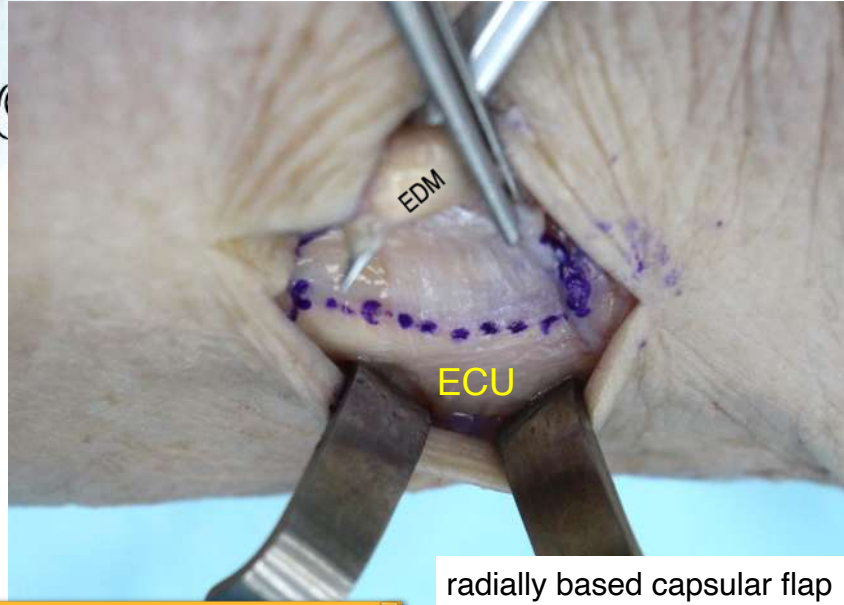
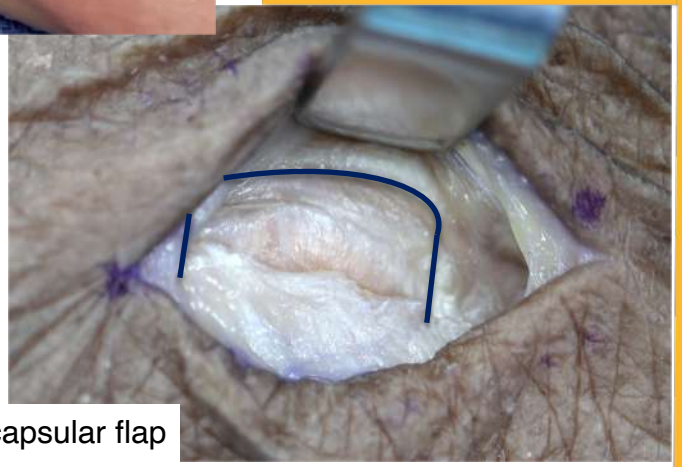
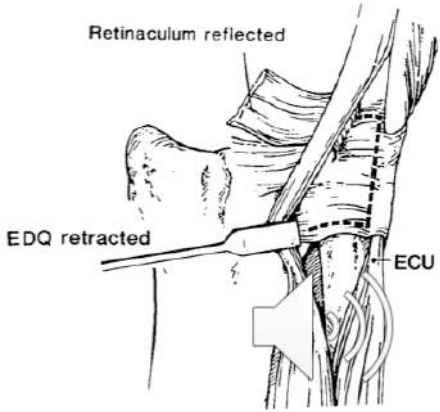


radially based capsular flap



ulnarly based capsular flap

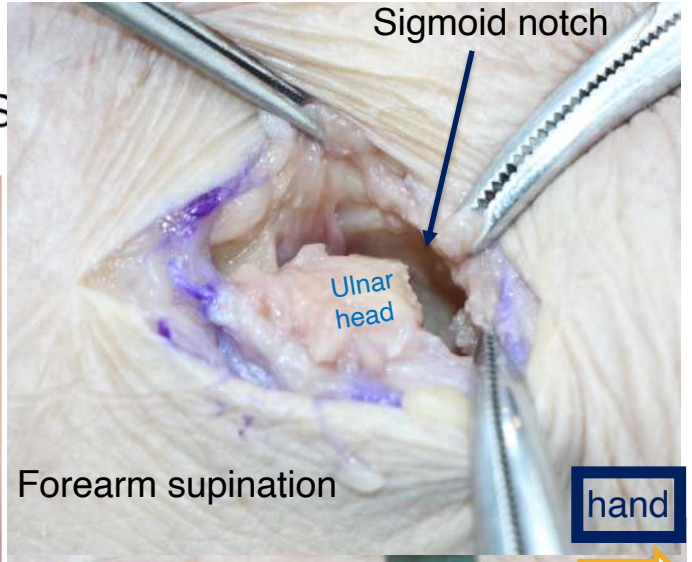


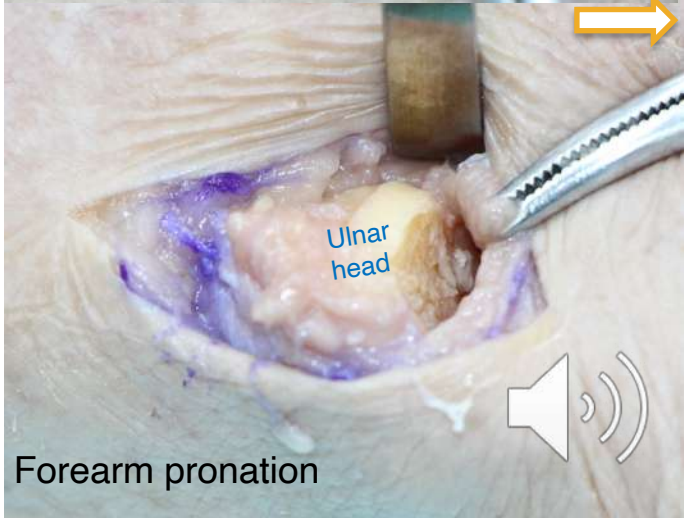
Feldon P et al. CORR 1992;275:124-9

Footage courtesy of Prof Mark Baratz

2mm –ve ulnar variance

Footage courtesy of Prof Mark Baratz

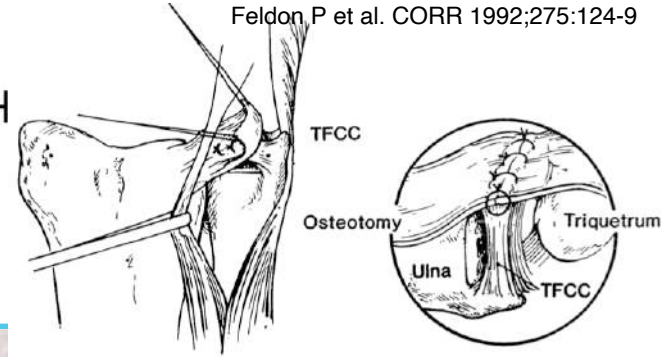


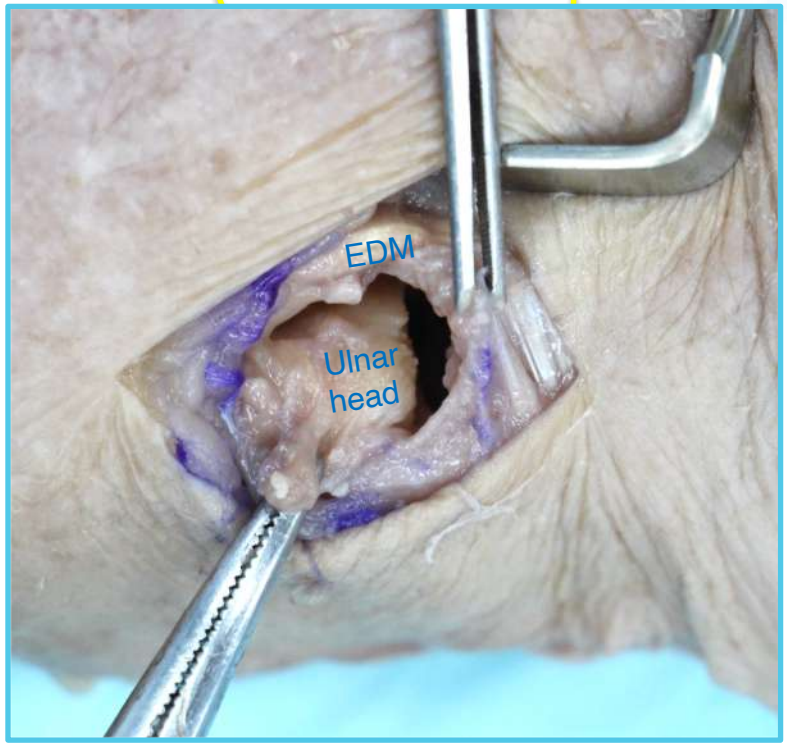


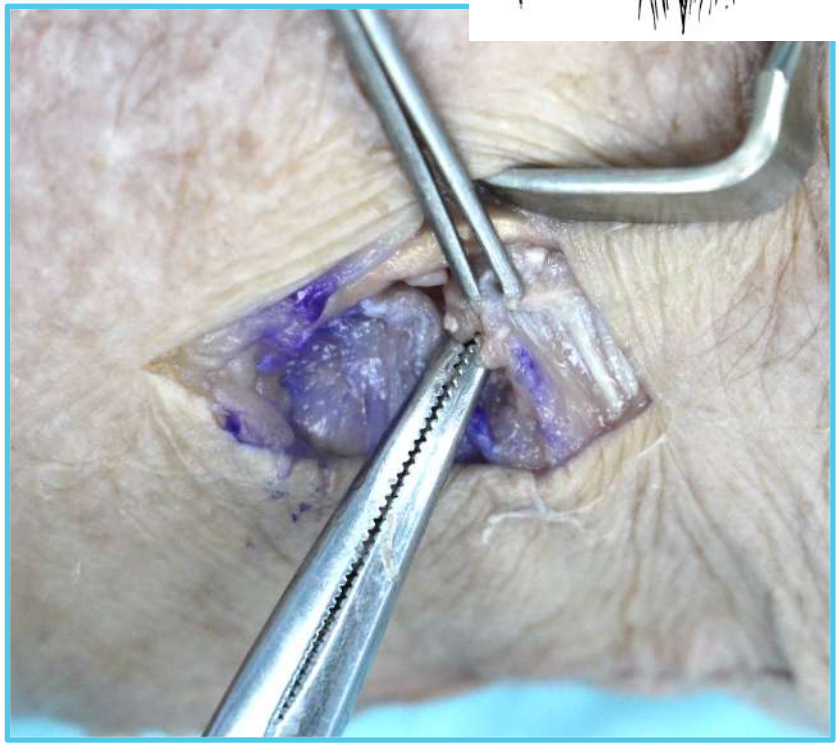
Dorsal capsule

Dorsal aspect of TFCC

Feldon P et al. CORR 1992;275:124-9







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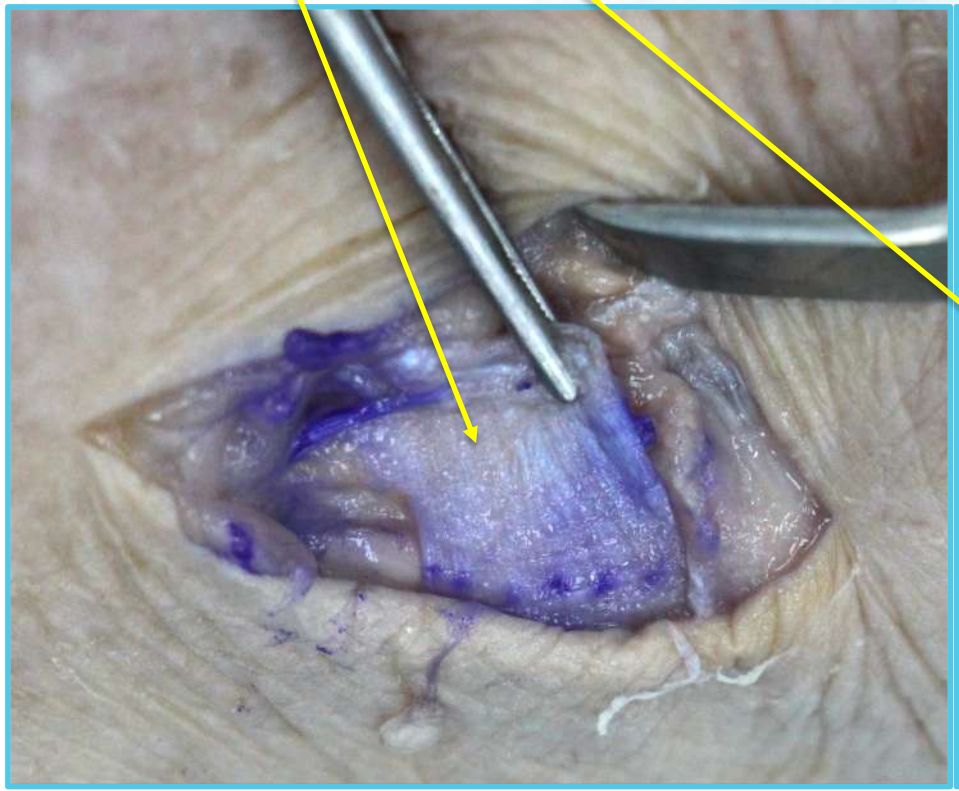
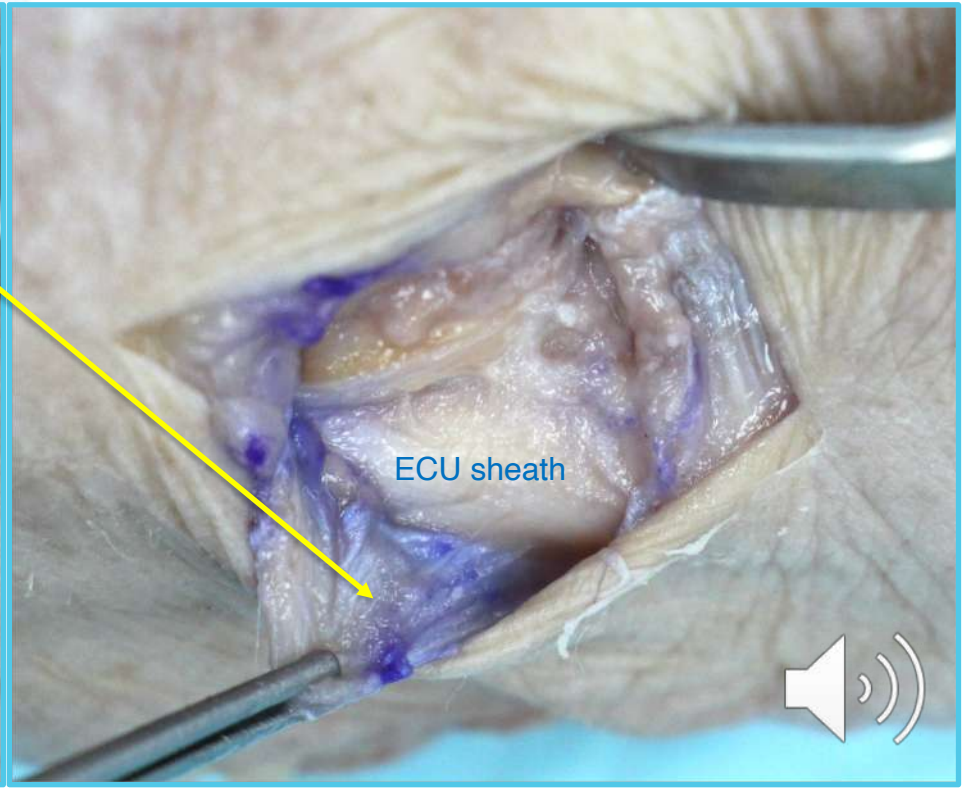
Extensor retinaculum

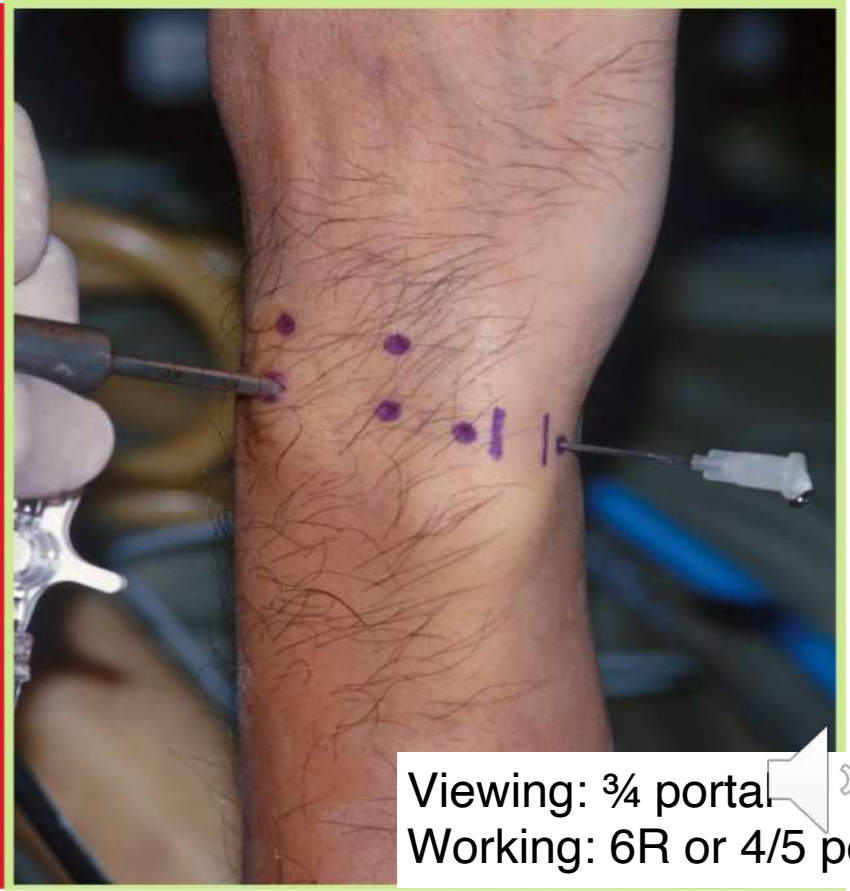




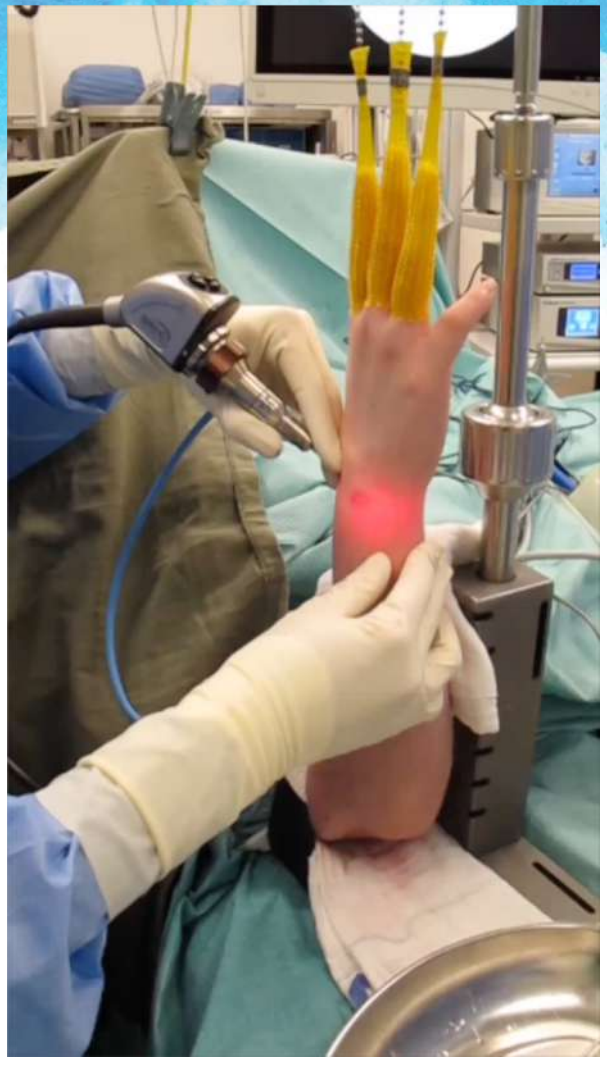
Surgical procedure

Arthroscopic Wafer Procedure

PSLA



Viewing: ¾ portal
Working: 6R or 4/5 portal



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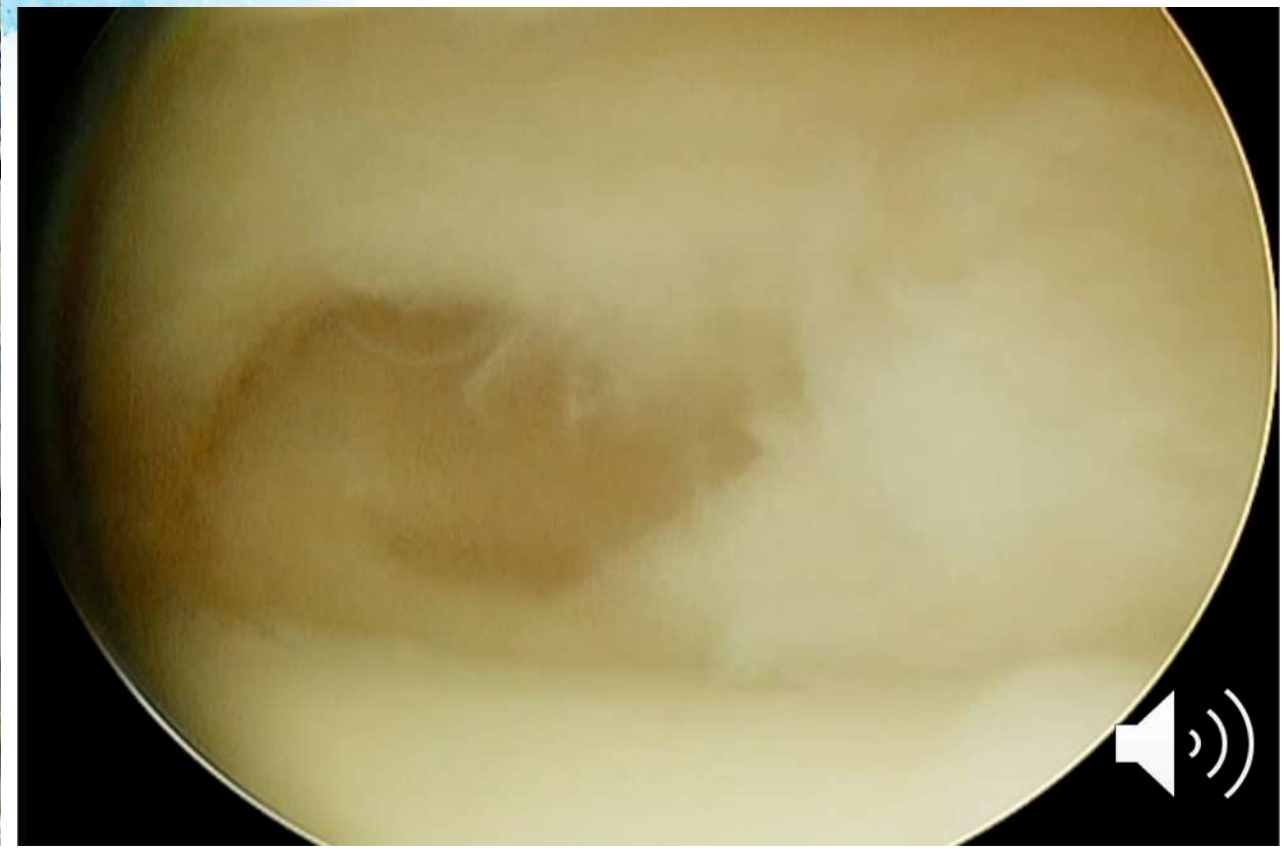
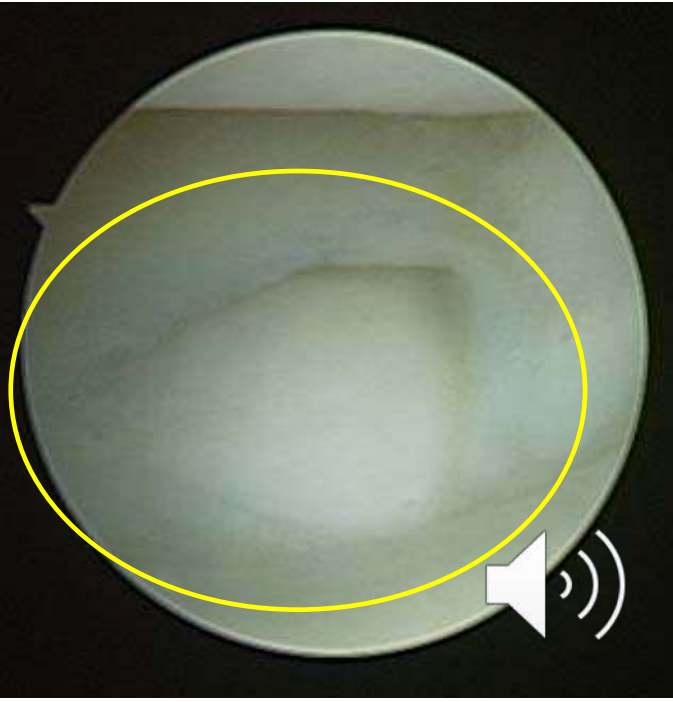
Rotation forearm to assess the whole ulnar head



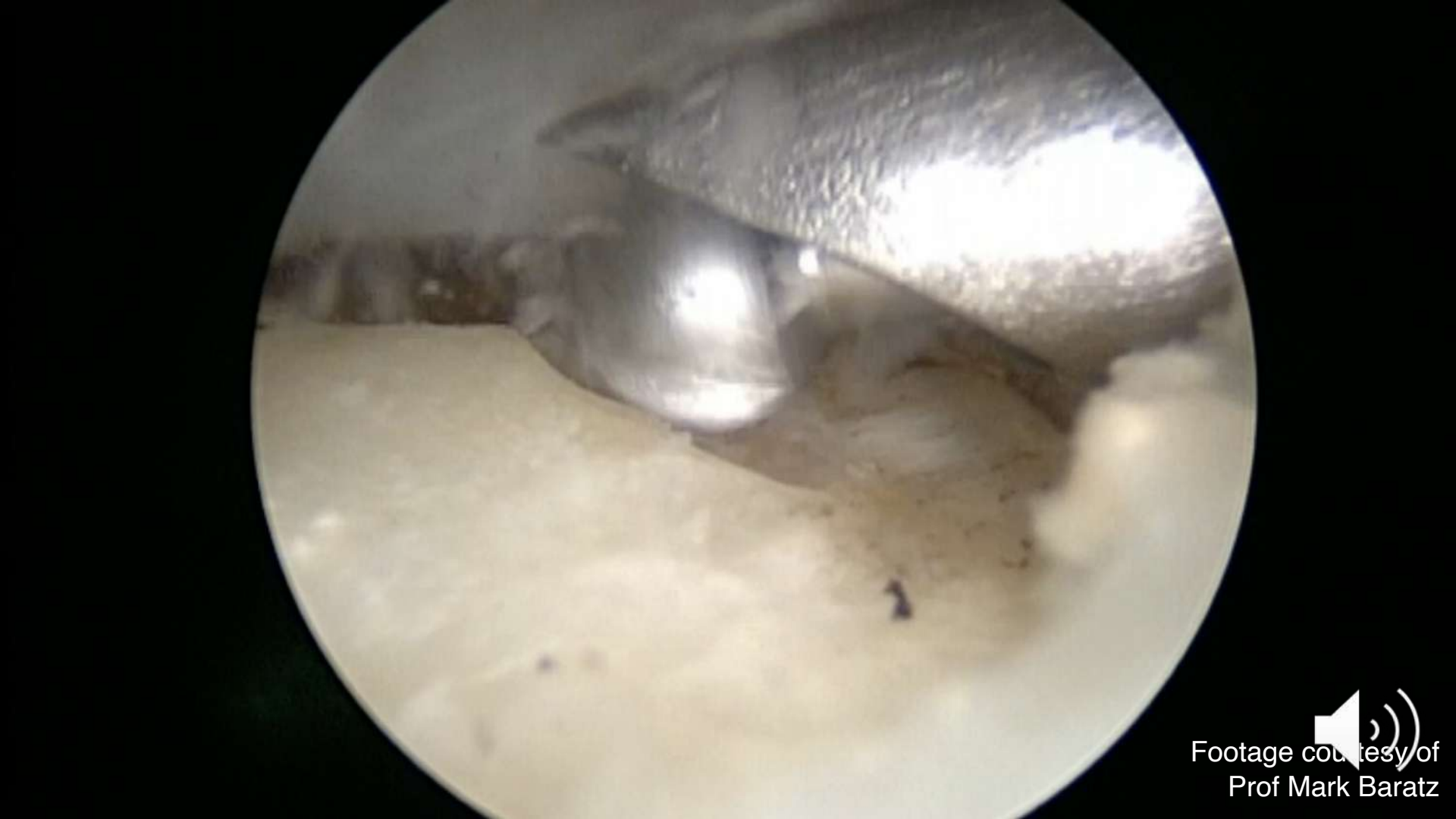
TFCC debridement, synovectomy

H knowledge commitment compassion

Not to damage the radioulnar ligaments



TFCC cauterization

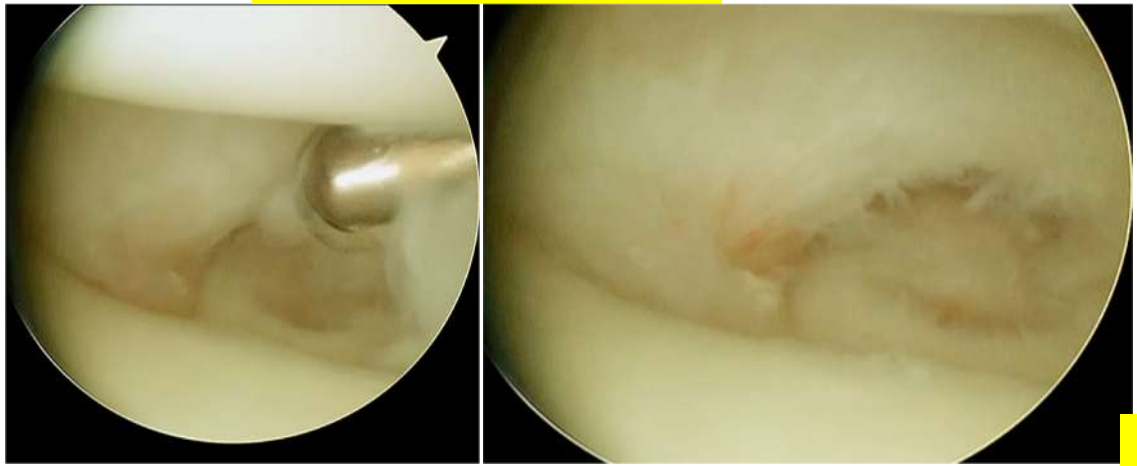

Footage courtesy of
Prof Mark Baratz

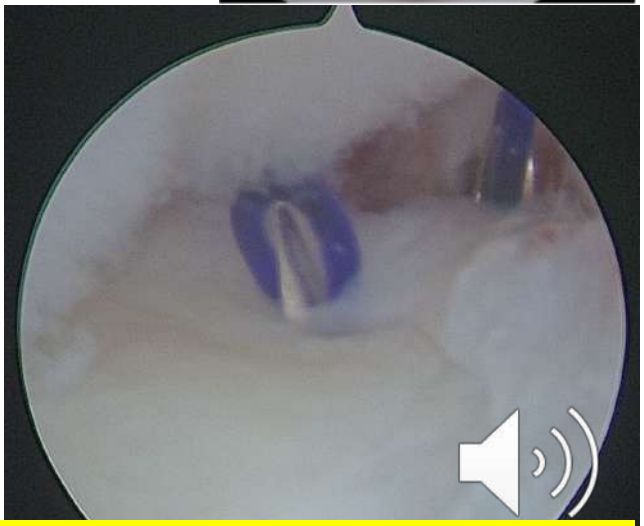
Arthroscopic Wafer Procedure

Advantages

- Minimal invasiveness
- Shorter rehabilitation, early postoperative mobility
- Good results were reported
- Avoid problems seen with USO, including immobilization, nonunion, need of removal of implants, and not burn the bridge of salvage with USO
- Simultaneously addressing TFCC or other pathologies

Debridement of TFCC





TFCC repair if peripheral or foveal tear & repairable

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Abrasion chondroplasty of carpal bones

Microfracture chondroplasty of carpal bones

Disadvantages

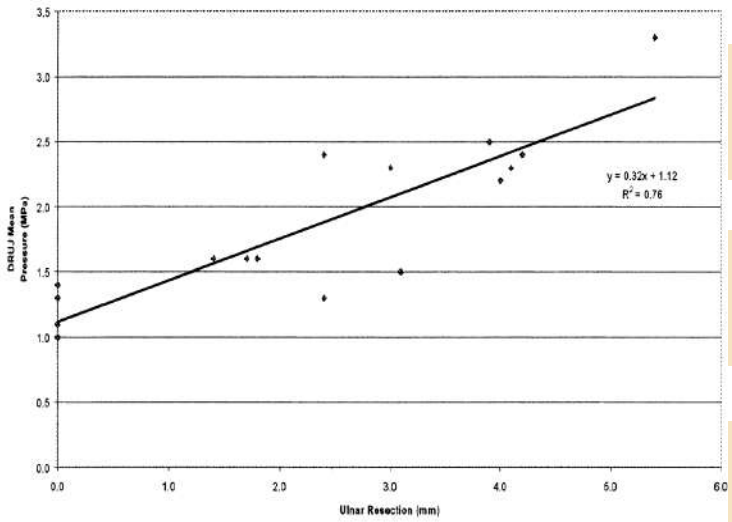

Figure 2. Mean DRUJ pressure versus distal ulnar resection.

Increase of pressure on sigmoid notch after resection

1mm : 29%

2mm: 57%

3mm: 86%

- **Extensor carpi ulnaris tendon irritation**

林家麟, 張志鵬, 陳宏明, and 曾俊雄. "Wafer Distal Resection for Ulnar Impaction Syndrome." 北市醫學雜誌 2.11 (2005): 1071-075. Web.

Slutsky DJ, Osterman A, The wafer procedure, Fractures and Injuries of the Distal Radius and Carpus, 1st ed., Elsevier, Philadelphia, pp. 343350, 2009.

- **Persistent ulnar wrist pain which needs later ulnar shortening**

Boulas HJ, Milek MA. Ulnar shortening for tears of the triangular fibrocartilaginous complex. ***J** Hand Surgery* 1990;15A:41.5-20.

Loftus, John B. "Arthroscopic Wafer for Ulnar Impaction Syndrome." Techniques in Hand & Upper Extremity Surgery 4.3 (2000): 182-88. Web.

- **Prolonged pain and weak grip strength**

Meftah, Morteza, Eric P Keefer, Georgia Panagopoulos, and S. Steven Yang. "ARTHROSCOPIC WAFER RESECTION FOR ULNAR IMPACTION SYNDROME: PREDICTION OF OUTCOMES." Hand Surgery 15.2 (2010): 89-93. Web.

Loftus, John B. "Arthroscopic Wafer for Ulnar Impaction Syndrome." Techniques in Hand & Upper Extremity Surgery 4.3 (2000): 182-88. Web.

Oh, Won-Taek, Ho-Jung Kang, Yong-Min Chun, Il-Hyun Koh, Hae-Mo-Su An, and Yun-Rak Choi. "Arthroscopic Wafer Procedure Versus Ulnar Shortening Osteotomy as a Surgical Treatment for Idiopathic Ulnar Impaction Syndrome." Arthroscopy: The Journal of Arthroscopic and Related Surgery 34.2 (2018): 421-30. Web.

- **Destabilization & increase pressure of DRUJ from over-resection**

林家麟, 張志鵬, 陳宏明, and 曾俊雄. "Wafer Distal Resection for Ulnar Impaction Syndrome." 北市醫學雜誌 2.11 (2005): 1071-075. Web.

Feldon P etal. CORR 1992;275:124-9

Lapner P et al. JHS Am 2004; 29:80-4.

- **Subsequent ulnar styloid impaction**

QUESTIONS

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1. Can an intact TFCC be resected in performing an arthroscopic wafer ?

Resection of TFCC to perform arthroscopic wafer

TFCC resection not recommended, further study and review needed before becoming an accepted technique

Adham MN, Seradge H, Parker WL. *Arthroscopic Treatment of Ulnar Impaction Syndrome.* Presented at ASPRS 67th Annual Meeting, Oct. 3-7, Boston, 1998.

Loftus, John B. "Arthroscopic Wafer for Ulnar Impaction Syndrome." Techniques in Hand & Upper Extremity Surgery 4.3 (2000): 182-88. Web.

How many mm of ulnar head can be maximally resected ?

Feasible with greater than 4mm variance so long as prominent ulnar styloid process not provide ongoing abutment

Tomaino, Matthew M. "Editorial Commentary: Wrist Ulnar Impaction Syndrome: When I Use the Wafer Procedure and When I Do Not." Arthroscopy: The Journal of Arthroscopic and Related Surgery 34.2 (2018): 431-32. Web.

Commonly accepted to avoid shortening in ulnar +ve variance of >3mm

Colantoni, Julie, Christopher Chadderdon, and R. Glenn Gaston. "Arthroscopic Wafer Procedure for Ulnar Impaction Syndrome." Arthroscopy Techniques 3.1 (2014): E123-125. Web.

AVOID WAFER

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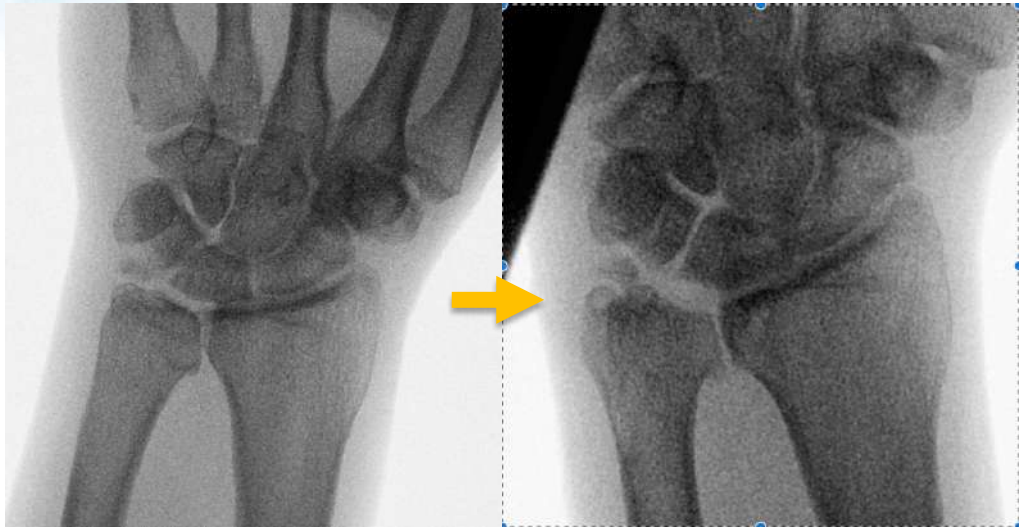
Success in correctly selected patients, avoided in wrist/ DRUJ instability

Loftus, John B. "Arthroscopic Wafer for Ulnar Impaction Syndrome." Techniques in Hand & Upper Extremity Surgery 4.3 (2000): 182-88. Web.



ECU tendonitis

林家麟, 張志鵬, 陳宏明, and 曾俊雄. "Wafer Distal Resection for Ulnar Impaction Syndrome." 北市醫學雜誌 2.11 (2005): 1071-075. Web.

Ulnar +ve variance more than 3mm

Colantoni, Julie, Christopher Chadderdon, and R. Glenn Gaston. "Arthroscopic Wafer Procedure for Ulnar Impaction Syndrome." Arthroscopy Techniques 3.1 (2014): E123-125. Web.

Ulnar head too prominent that there is no space between the ulnar head & the carpus

Tomaino, Matthew M. "Editorial Commentary: Wrist Ulnar Impaction Syndrome: When I Use the Wafer Procedure and When I Do Not." Arthroscopy: The Journal of Arthroscopic and Related Surgery 34.2 (2018): 431-32. Web.

AVOID WAFER

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Prominent ulnar styloid process risk of ongoing abutment after wafer

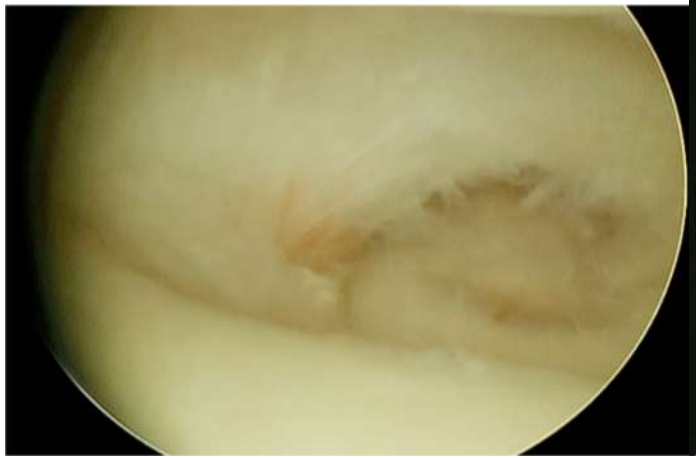
林家麟, 張志鵬, 陳宏明, and 曾俊雄. "Wafer Distal Resection for Ulnar Impaction Syndrome." 北市醫學雜誌 2.11 (2005): 1071-075. Web.

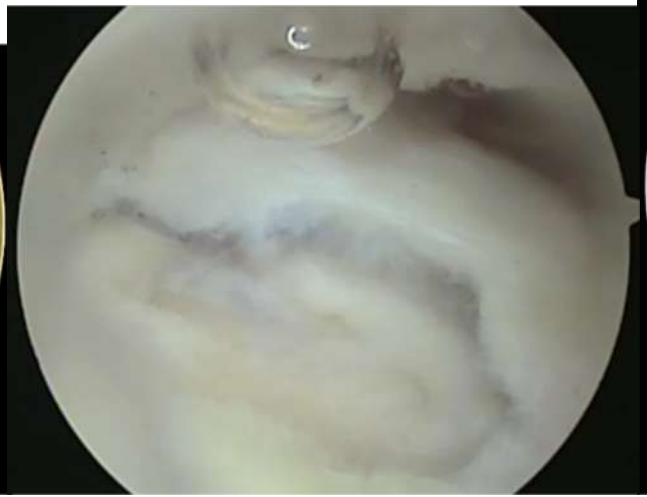
Tomaino, Matthew M. "Editorial Commentary: Wrist Ulnar Impaction Syndrome: When I Use the Wafer Procedure and When I Do Not." Arthroscopy: The Journal of Arthroscopic and Related Surgery 34.2 (2018): 431-32. Web.

TFCC centrally intact

Ulnar head cartilage intact

Wafer when cartilage is bad





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THANK YOU

San Francisco, CA SEPTEMBER 30 – OCTOBER 2, 2021

On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

15 Minutes

Surg Approach: Ulnar Shortening Osteotomy

Mark E. Baratz, MD

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Speaker has not provided a handout for this presentation.

Session Handouts

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On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

15 Minutes

Making the Diagnosis: History, Exam, Anatomy, and Imaging

Sanjeev Kakar, MD, FAOA

- Arthrex: Consultant
- Restor3d: Consultant
- BJJ, JBJS: Reviewer and Editor
- ASSH: Hand Editor

76TH ANNUAL MEETING OF THE ASSH
SEPTEMBER 30 - OCTOBER 2, 2021

Diagnosis of DRUJ Instability

A Case Based Approach

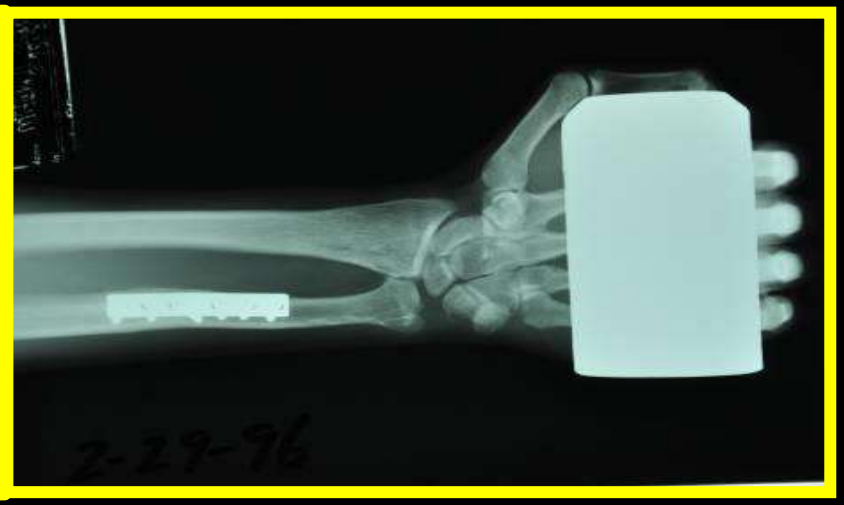
Sanj Kakar MD, FAOA
Professor of Orthopaedic Surgery
Mayo Clinic
Rochester, MN USA

Three Key Take Aways

- **Clinical exam is key**
- **Learn to read your own MRIs**
- **DRUJ arthroscopy**

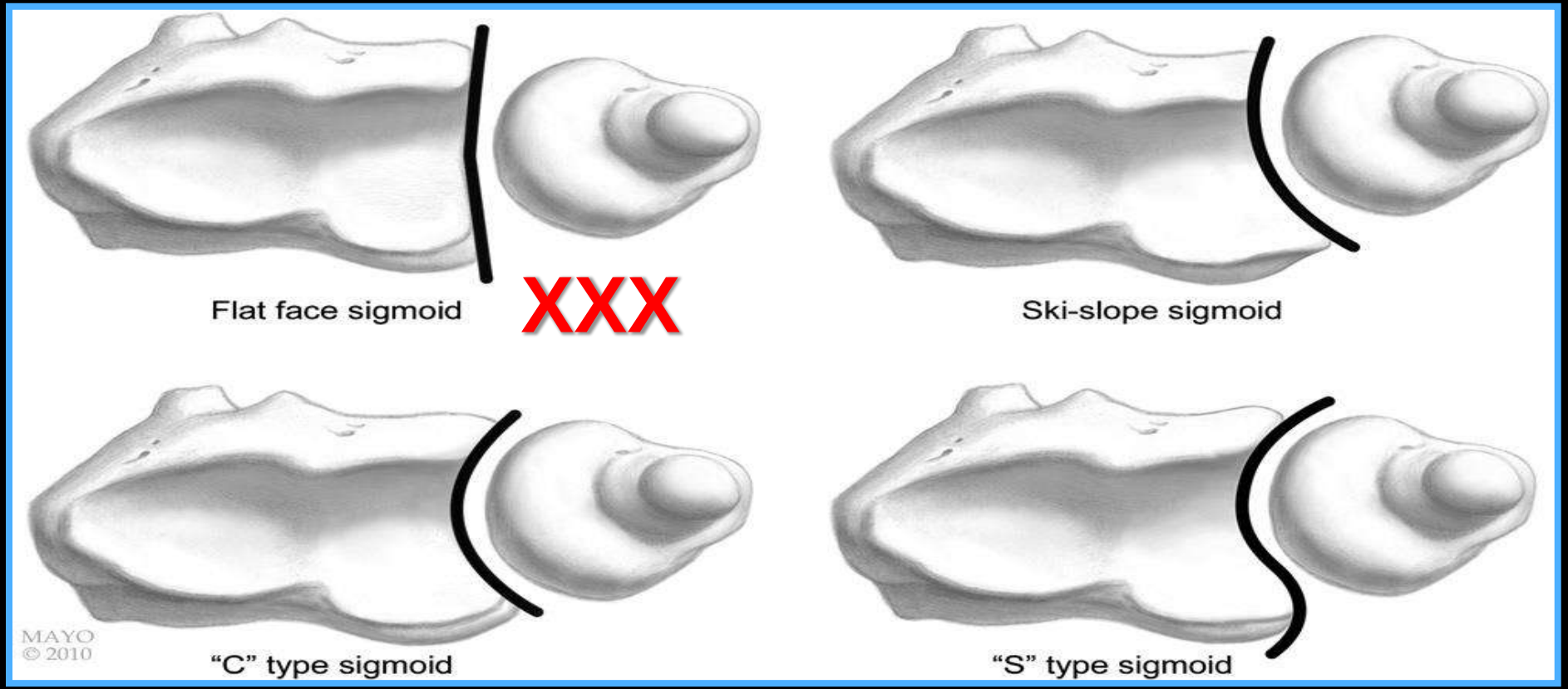
In managing pathology of the DRUJ

“the ulna head should be preserved whenever possible as it is critical for both weight bearing and forearm motion” Dick Berger



Bony Anatomy

Failure Rate



Soft Tissue Anatomy

- ✓ Triangular fibrocartilage
- ✓ Ulnocarpal ligaments
- ✓ Radioulnar membrane
- ✓ ECU tendon and sheath
- ✓ Pronator quadratus muscle

- ✓ RUPERT
  - ✓ (R=sigmoid notch radius)

Three Key Questions To Ask Yourself When Managing Ulnar Wrist Pain?

Categorization Of Ulnar Wrist Pain

- **Pain**
- **Pain with instability**
- **Pain with arthritis**

How Useful Is A MRI?

- MRI
  - 80+% sensitive for central tears
  - Peripheral tear sensitivity less but increased w/ arthrogram
    - Negative MRI does not rule out tear

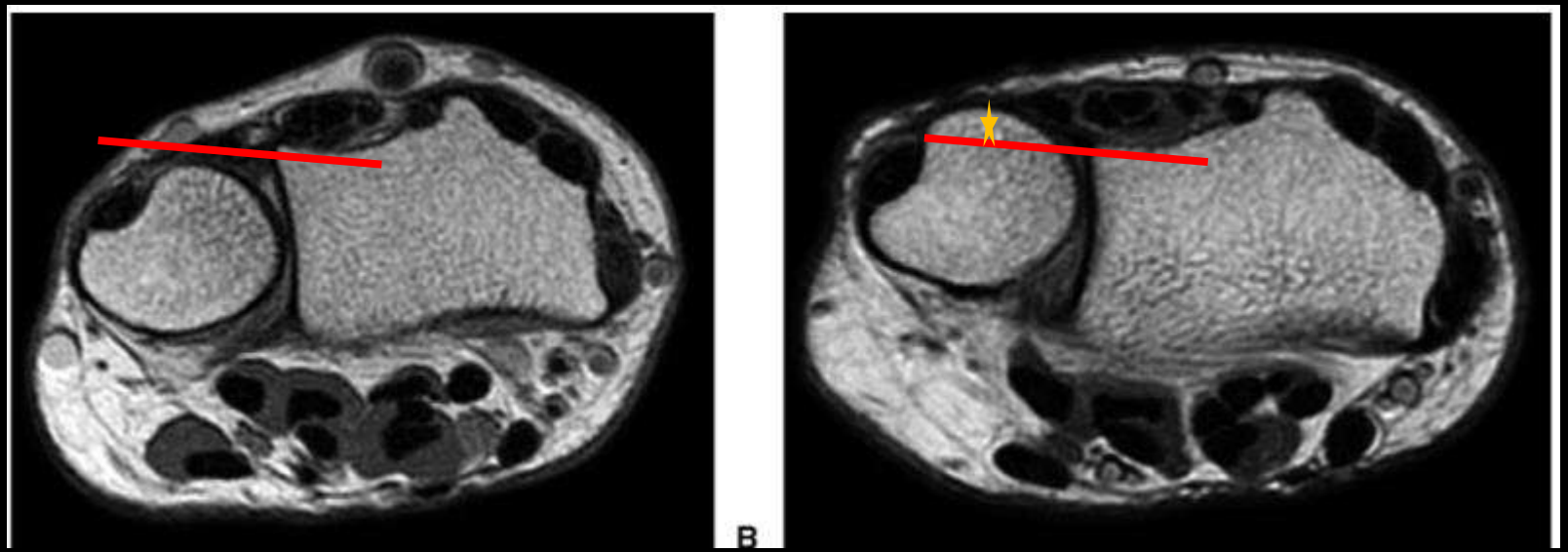
Diagnostic Comparison of 1.5 Tesla and 3.0 Tesla Preoperative MRI of the Wrist in Patients With Ulnar-Sided Wrist Pain

Meredith L. Anderson, MD, John A. Skinner, MD, Joel P. Felmlee, PhD, Richard A. Berger, MD, PhD, Kimberly K. Amrami, MD

Conclusions The sensitivity, specificity, and accuracy of 3.0T wrist MRI for the TFCC is consistently higher compared with those of 1.5T wrist MRI. The trend suggests that 3.0T wrist MRI provides improved capability for detection of TFCC injuries. Given the available sample size, however, the confidence intervals around the point estimates are wide and overlapping. Further studies are needed to confirm or refute our results of the estimated sensitivity, specificity, and accuracy parameters. (*J Hand Surg 2008;33A:1153–1159. Copyright © 2008 by the American Society for Surgery of the Hand. All rights reserved.*)

Subluxation of the Distal Radioulnar Joint as a Predictor of Foveal Triangular Fibrocartilage Complex Tears

Eric C. Ehman, MD, Meredith L. Hayes, MD, Richard A. Berger, MD, PhD, Joel P. Felmlee, PhD, Kimberly K. Amrami, MD



The "Four-Leaf Clover" Treatment Algorithm: A Practical Approach to Manage Disorders of the Distal Radioulnar Joint

Sanjeev Kakar, MD,* Marc Garcia-Elias, MD, PhD*†

CME Continuing Medical Education

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Planners

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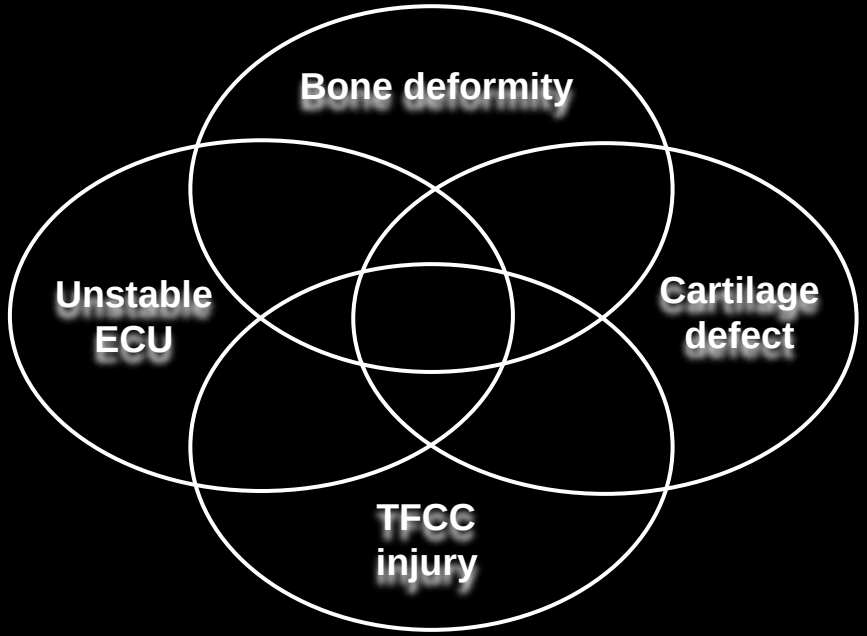
Learning Objectives

Upon completion of this CME activity, the learner should achieve an understanding of:

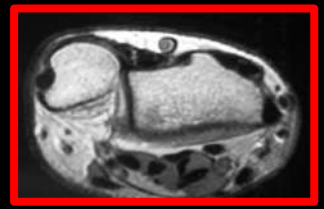
- Osseous constraints of the distal radio-ulnar joint (DRUJ)
- Soft tissue restraints of the DRUJ
- Interrelated multiple causes of disorders of the DRUJ
- Treatment algorithm for disorders of the DRUJ

Deadline: Each examination purchased in 2016 must be completed by January 31, 2017, to be eligible for CME. A certificate will be issued upon completion of the activity. Estimated time to complete each JHS CME activity is up to one hour.

Four Important Questions To Ask



- ✓ Bone deformity ? YES / NO
- ✓ Cartilage damage ? YES / NO
- ✓ TFCC injury ? YES / NO
- ✓ Unstable ECU YES / NO



Forget About The Acuity Of The Injury When Deciding Upon Repair Or Reconstruction

Is The Quality Of The Tissue Able To Withstand The Repair?

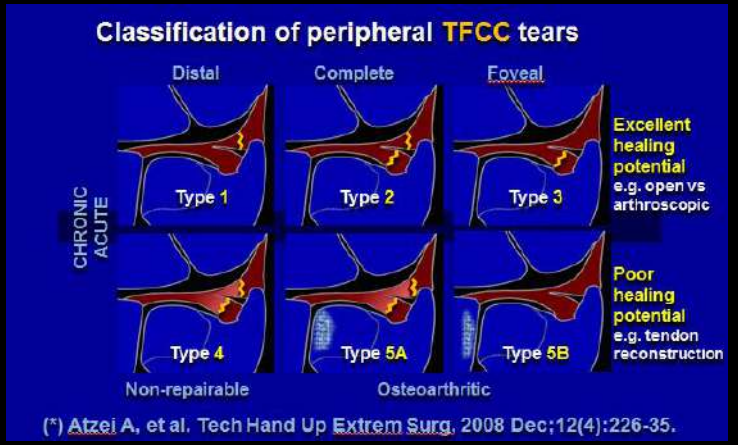
How Do You Test Foveal Attachment?

- **Arthroscopic assessment**
  - **Hook test** Ruch et al.
  - **Trampoline test** Hermansdorfer & Kleinman
  - **DRUJ arthroscopy** Nakamura
  - **Suction test** Kakar & Greene

Summary

Forget About The Acuity

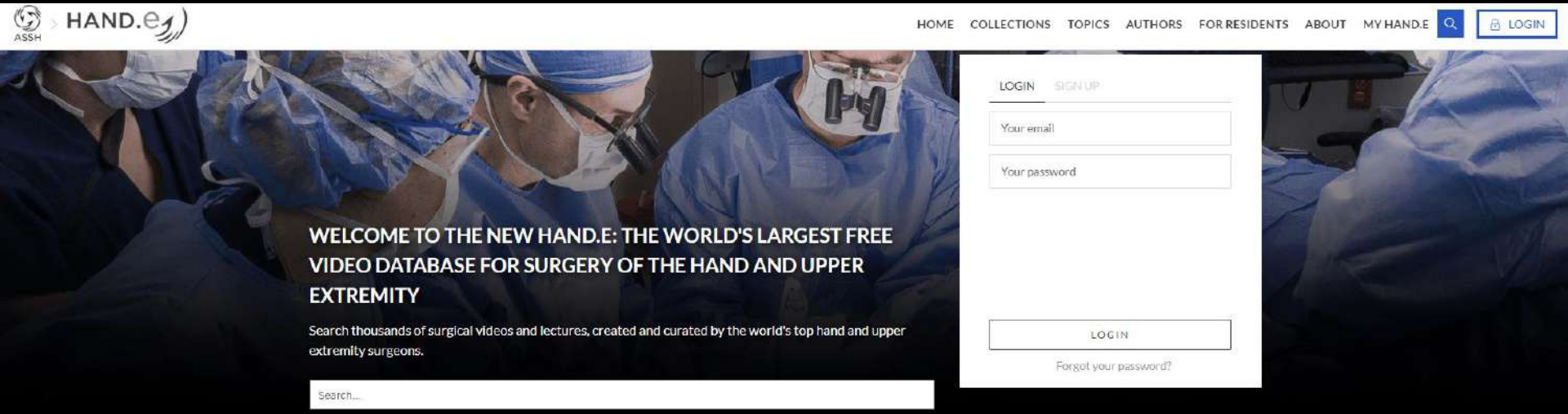
It's The Quality Of The Tissue That Determines Repair Versus Reconstruction?



Three Key Take Aways

- **Clinical exam is key**
- **Learn to read your own MRIs**
- **DRUJ arthroscopy**

Thank You For The Privilege Of Your Time



Email: Kakar.sanjeev@mayo.edu

On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

10 Minutes

Acute DRUJ Instability

Jacqueline Geissler, MD

No relevant conflicts of interest to disclose

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Acute DRUJ Instability: Practical tips

Jacqueline Geissler, MD
Hennepin Healthcare, Minneapolis, MN
Assistant professor University of MN
Jacqueline.Geissler@hcmed.org

San Francisco, CA SEPTEMBER 30 - OCTOBER 2, 2021

1

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Most Important: Evaluate & Diagnose

- Acute DRUJ management >>> Chronic DRUJ Management
- Associated after distal radius/shaft > isolated
- Presumes restoration of radius anatomy
- Predictors of instability: suggestive, but unreliable → Look
- Clinical Evaluation
- Dr. Sanjeev Kakar

2

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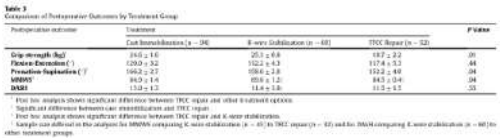
Moving Target

- 2021 meta-analysis & systematic review looking at cast, pins, TFCC repair



A.X. Xiao et al. / Journal of Hand Surgery Global Online 3 (2021) 133e138134

3

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Clinical evaluation of the DRUJ

- Stable
- Unstable
- Gray area
- Tip: Evaluate contralateral wrist
- Tip: Stabilize the Radial column during exam
- Tip: evaluate in semi-pronation and semi-supination

4

Practical Intraoperative Algorithm

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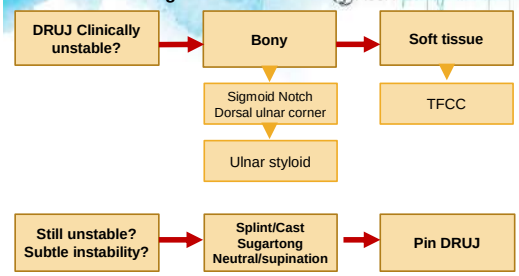

5

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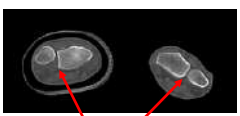
Bone

- Sigmoid Notch
- Ulnar Styloid



6

Practical Intraoperative Algorithm

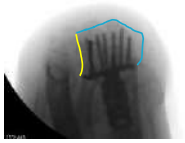
DRUJ Clinically unstable?
Bony
Soft tissue
Sigmoid Notch Dorsal ulnar corner
TFCC
Ulnar styloid
Still unstable? Subtle instability?
Splint/Cast Sugartong Neutral/supination
Pin DRUJ

7

Bone: Sigmoid Notch

- Sigmoid Notch

Preop Planning: CT scan



Tangential View

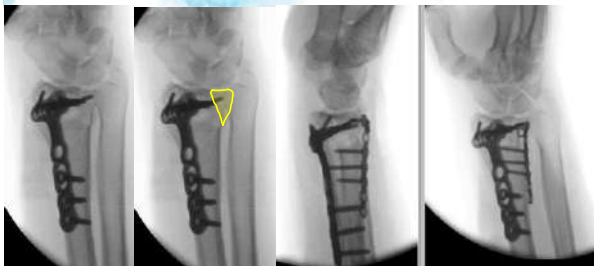
Semi-supinated & semi pronated oblique views

8

Sigmoid Notch Congruency: Dorsal Ulnar Corner Fixation

9

Imaging of Dorsal Ulnar Corner



10

Practical Intraoperative Algorithm

DRUJ Clinically unstable?
Bony
Soft tissue
Sigmoid Notch Dorsal ulnar corner
TFCC
Ulnar styloid
Still unstable? Subtle instability?
Splint/Cast Sugartong Neutral/supination
Pin DRUJ

11

Bone: Ulnar Styloid

AP

PA

12

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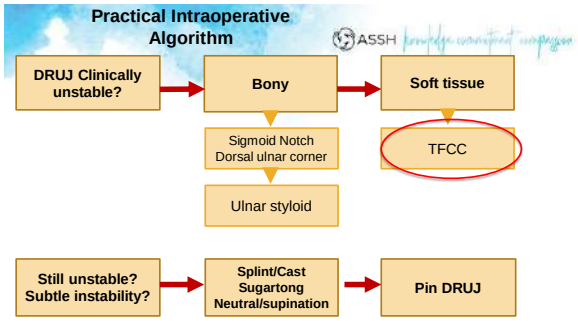

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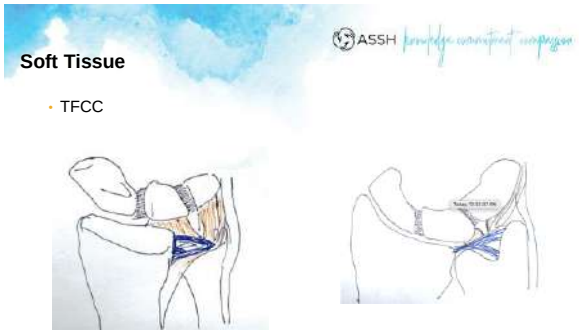

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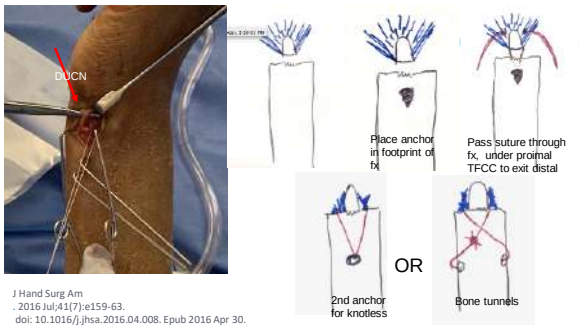

J Hand Surg Am
. 2016 Jul;41(7):e159-63.
doi: 10.1016/j.jhsa.2016.04.008. Epub 2016 Apr 30.

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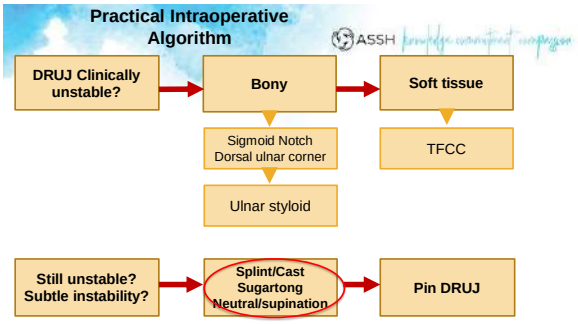

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Splint

- When subtle instability even after fixation, but not enough to want to pin
- Sugartong in OR→Muenster cast in clinic
  - Duration based on findings: 2-6 weeks
    - Intraop: degree of instability intraop
    - Follow up: Clinical exam (stiff or unstable), radiographs
- Usually neutral rotation, but if need rotation/supination
- Tip: apply sugartong, then twist into preferred position before dries.

Park et al., J Hand Surg Am. 2012 Mar;37(3):528-31.

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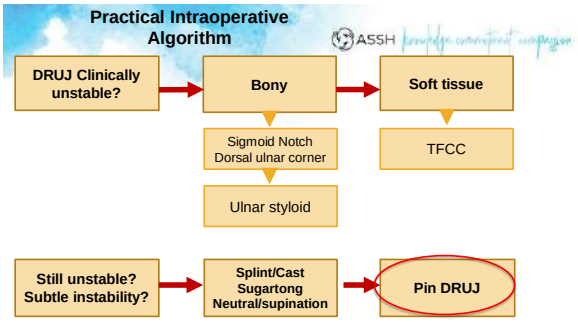

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Pin the DRUJ?

- When (still) unstable
- When fractures are not amenable to specific fixation
- Need to ensure alignment
- Not Hand surgery trained

- Tip: Ulna-->Radius (smaller bone to bigger bone, easier), 0.062 K wires
- Tip: hold DRUJ reduced in neutral: flex elbow 90 degrees and confirm neutral rotation
- Tip: 4 cortices so can retrieve if break

Handchir Mikrochir Plast Chir . 2001 Jul;33(4):252-7. doi: 10.1055/s-2001-16587.

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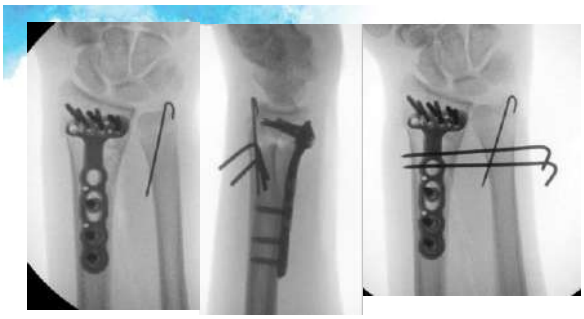

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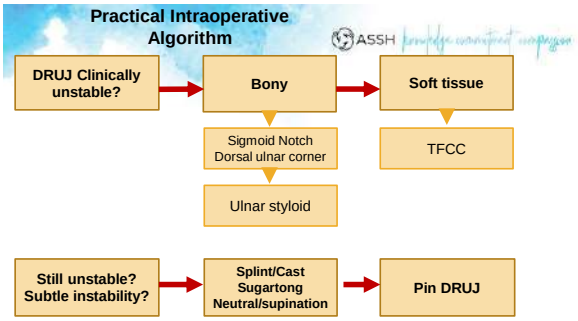
Sigmoid Notch Congruency, Poor Fixation Options →pinning

26

Practical Intraoperative Algorithm



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Thank you

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Assistant professor University of MN
Jacqueline.Geissler@hcmed.org

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On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

10 Minutes

Chronic DRUJ Instability

Christina M. Ward, MD

No relevant conflicts of interest to disclose

76TH ANNUAL MEETING OF THE ASSH
SEPTEMBER 30 - OCTOBER 2, 2021

Chronic DRUJ Instability

Christina M. Ward, MD

September 2021

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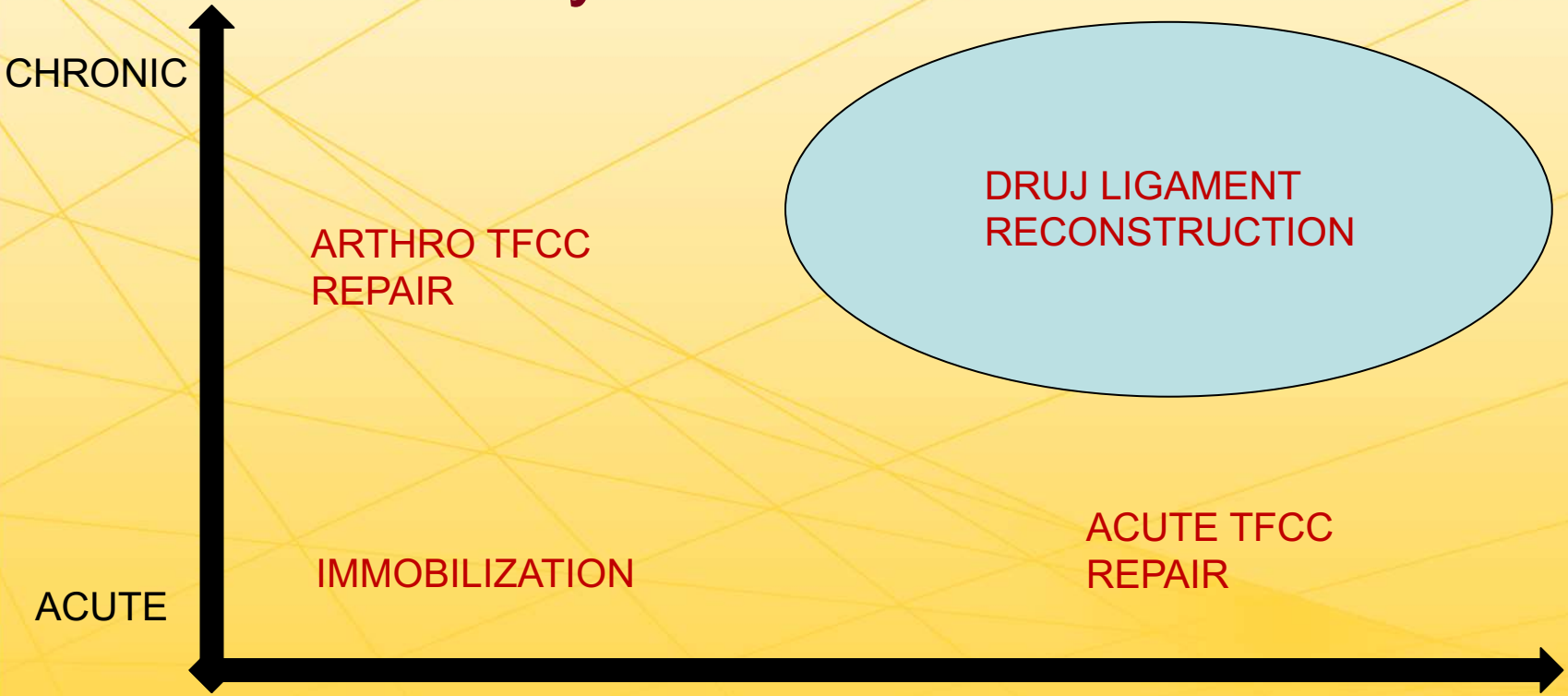
Disclosure

- Neither I, Christina M. Ward, nor any family members, have any relevant financial relationships to be discussed, directly, or indirectly, referred to or illustrated with or without recognition within the presentation

DRUJ instability



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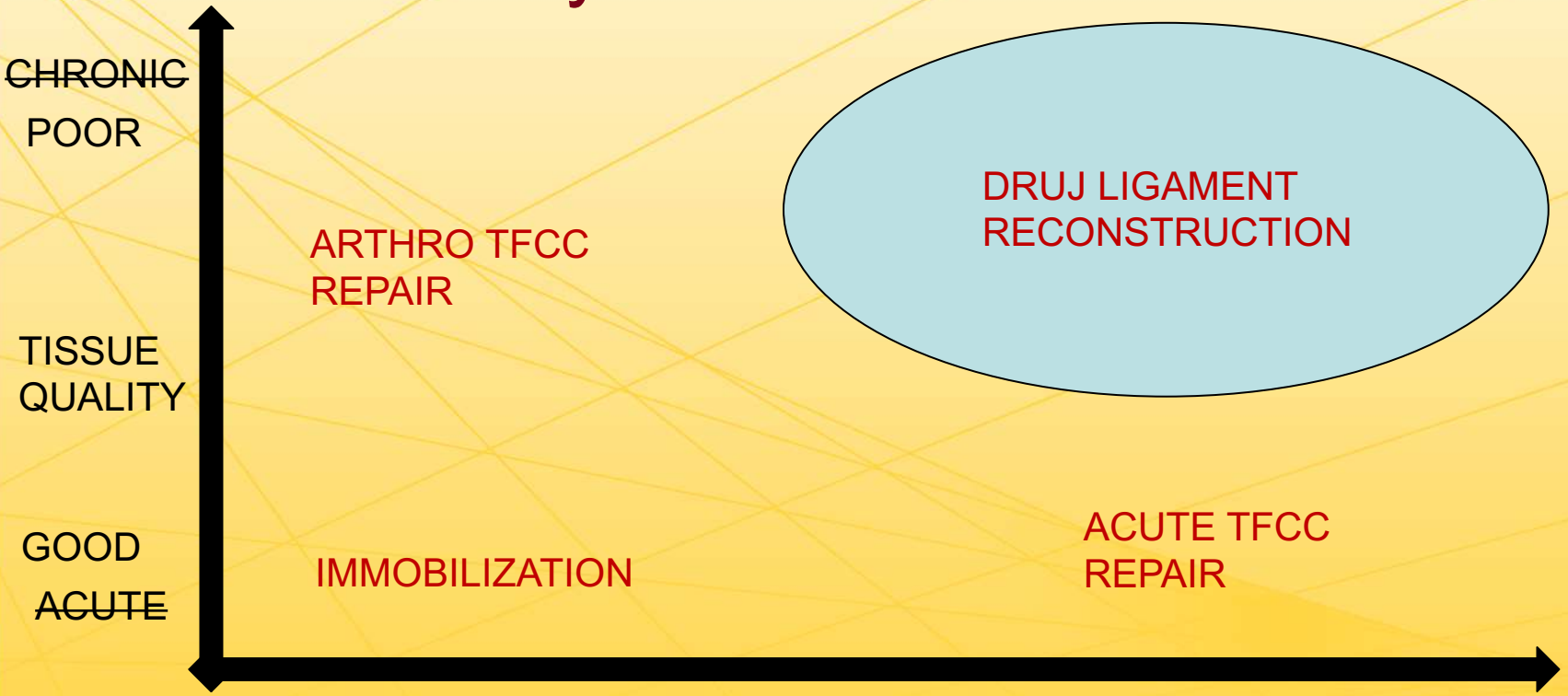
DRUJ instability



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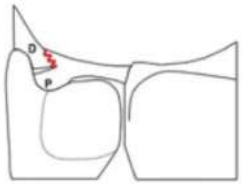
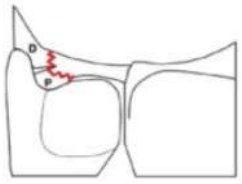
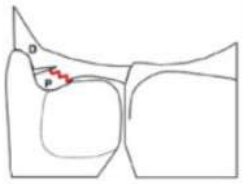
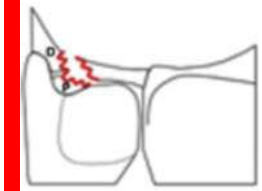
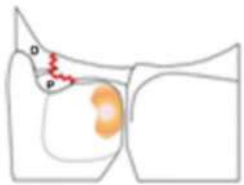
	Class 1: reparable distal tear	Class 2: reparable complete tear	Class 3: reparable proximal tear	Class 4: nonreparable tear	Class 5: arthritic DRUJ
					
Clinical DRUJ instability	None/slight	Mild/Severe		Severe	Mild/severe
Appearance of TFCC distal component (RC arthroscopy)	Torn	Torn	Intact	Torn	Variable
Status of TFCC proximal component (Hook test/ DRUJ arthroscopy)	Intact	Torn	Torn	Torn	
Healing potential of TFCC tear's margins	Good	Good	Good	Poor	
Status of DRUJ cartilage (DRUJ arthroscopy)	Good	Good	Good	Good	Poor
Treatment	REPAIR Suture (Ligament-to-capsule)	REPAIR Foveal refixation		RECONSTRUCTION Tendon graft	SALVAGE Arthroplasty or joint replacement

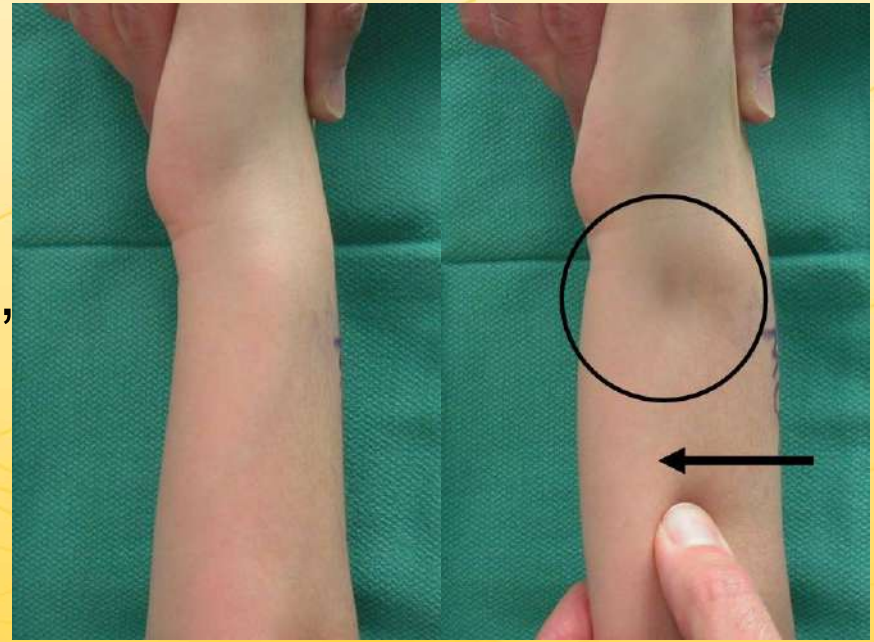
Atzei and Luchetti, Foveal TFCC tear classification and treatment. Hand Clinics 2011; 27: 263-272.

Making the diagnosis…

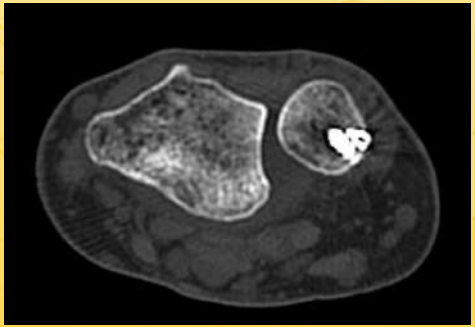
- Sometimes history of specific trauma
- Often have had previous surgery
- Vague description of symptoms
  - Pain, aching, fatigue, limited lifting or carrying
  - “can’t trust the arm”, “gives out”
  - Clunking or clicking with rotation

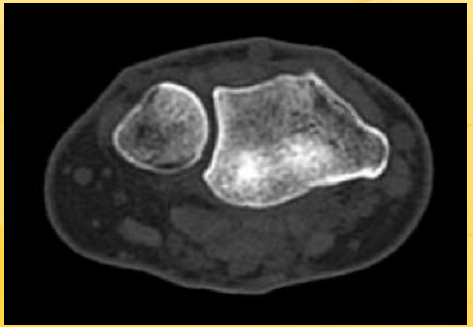
Clinical exam

- Pain or apprehension with forearm rotation, limitation of active rotation
- Often tender at DRUJ and fovea, +/- ECU
- Apprehensive with DRUJ shuck /piano key



- Improved ROM, decreased pain with reduction





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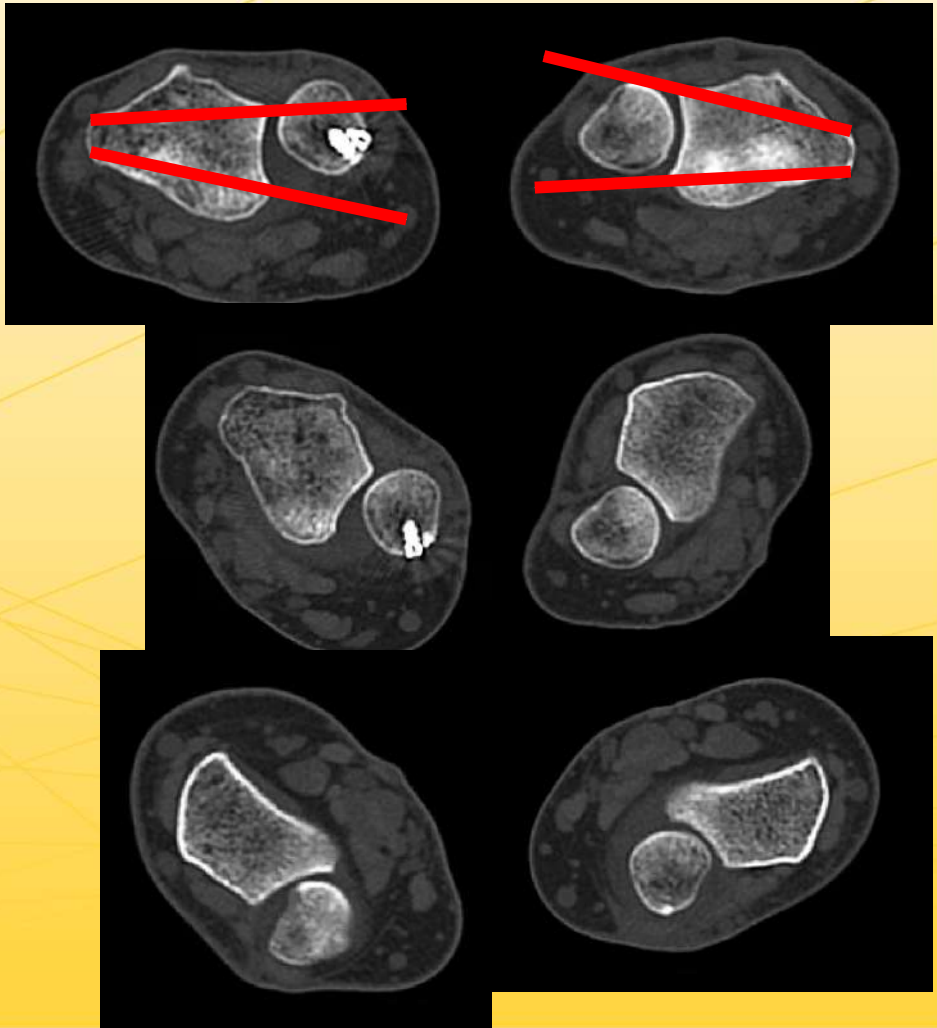
Imaging

- MRI helpful in the setting of an acute injury
- CT of both wrists in pronation, neutral, and supination
  - Evaluation of bony congruity and sigmoid notch
  - Evaluate for DRUJ arthritis



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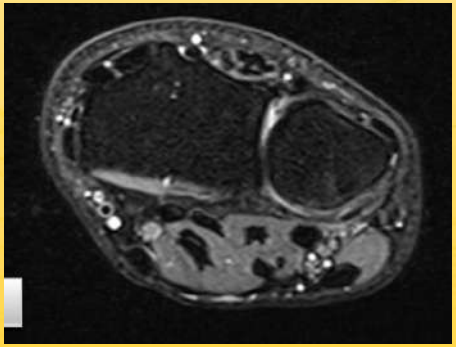
Indications for reconstruction

- Chronic instability
  - Acute instability → direct repair
- Inadequate tissue for primary repair
  - Mild instability, foveal tear on MRI → arthroscopy
- Bony congruence
  - CT to evaluate sigmoid notch
  - Consider concomitant sigmoid notchplasty
  - Malunion of the radius? Elbow pathology?
- Absence of DRUJ arthritis
  - No radiographic arthritis
  - Physical exam → compression with rotation

- 30s F felt pop and pain in wrist after doing cartwheel 6 weeks ago
- Tender at fovea
- ECU stable
- Normal radiographs
- 6 weeks of immobilization with no improvement



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	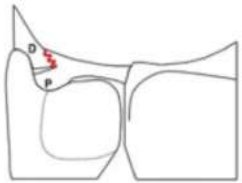	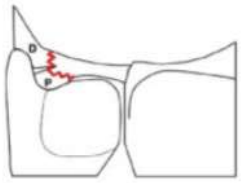	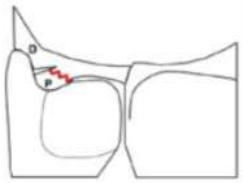	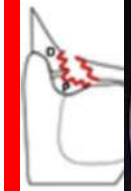
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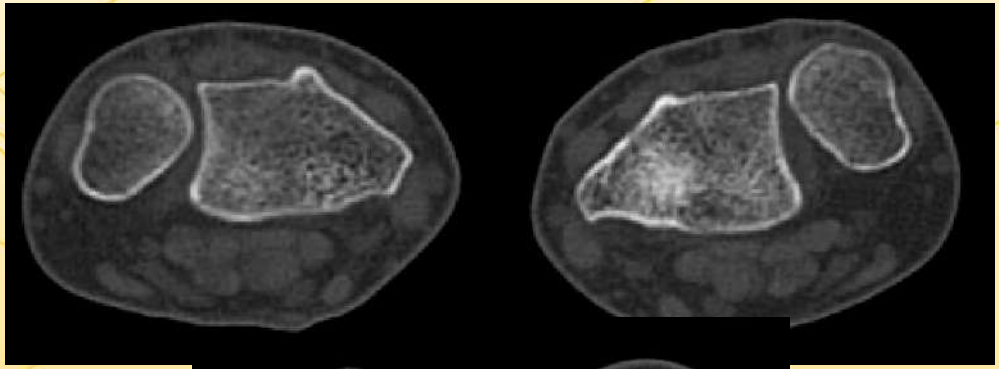

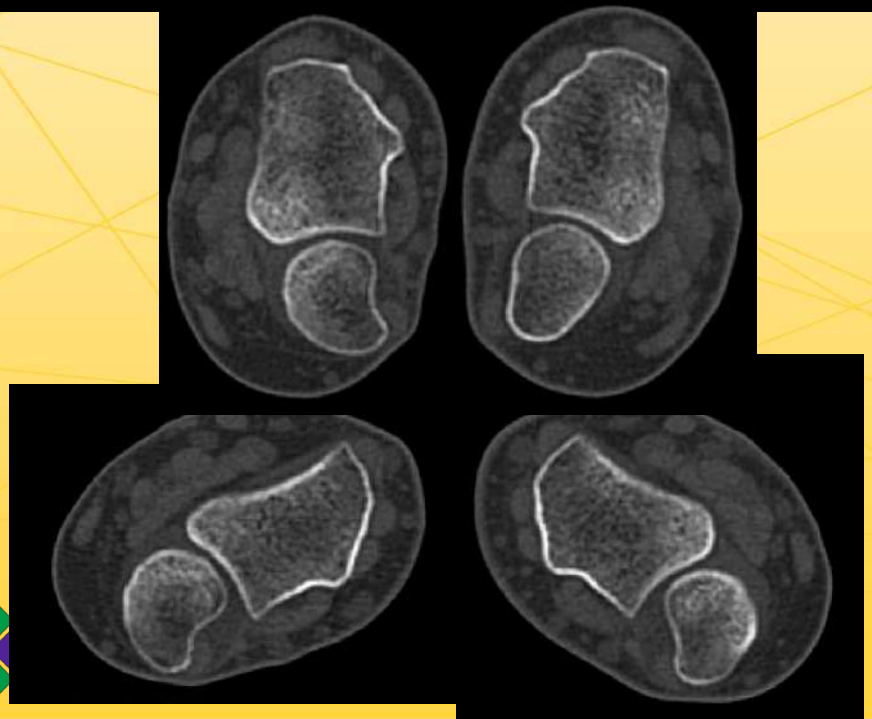

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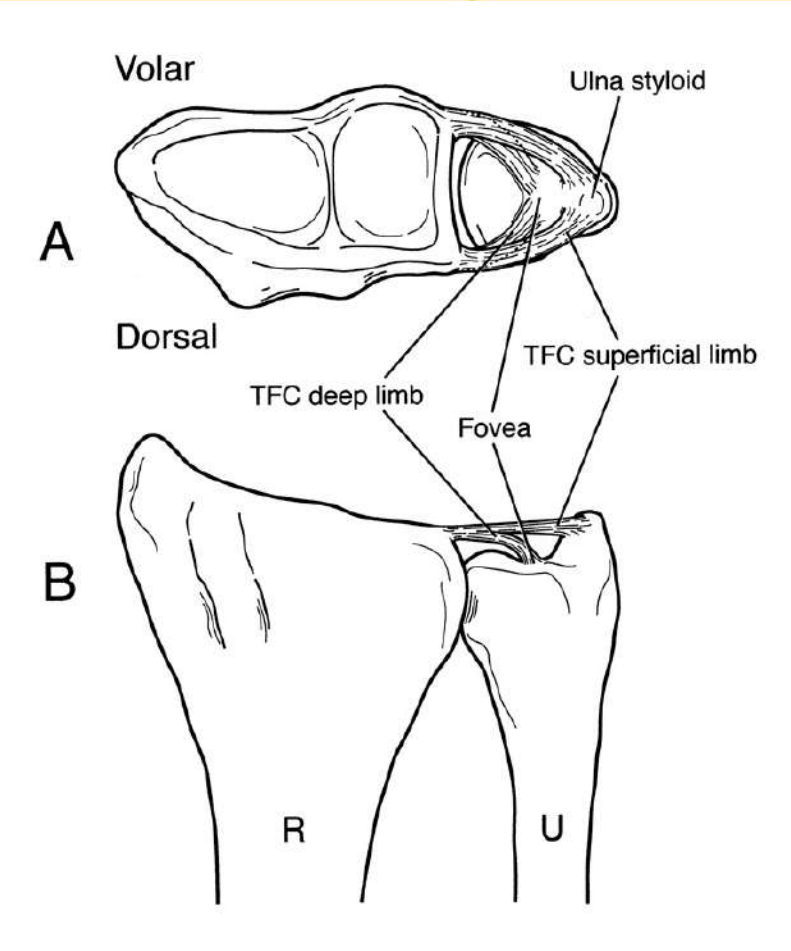
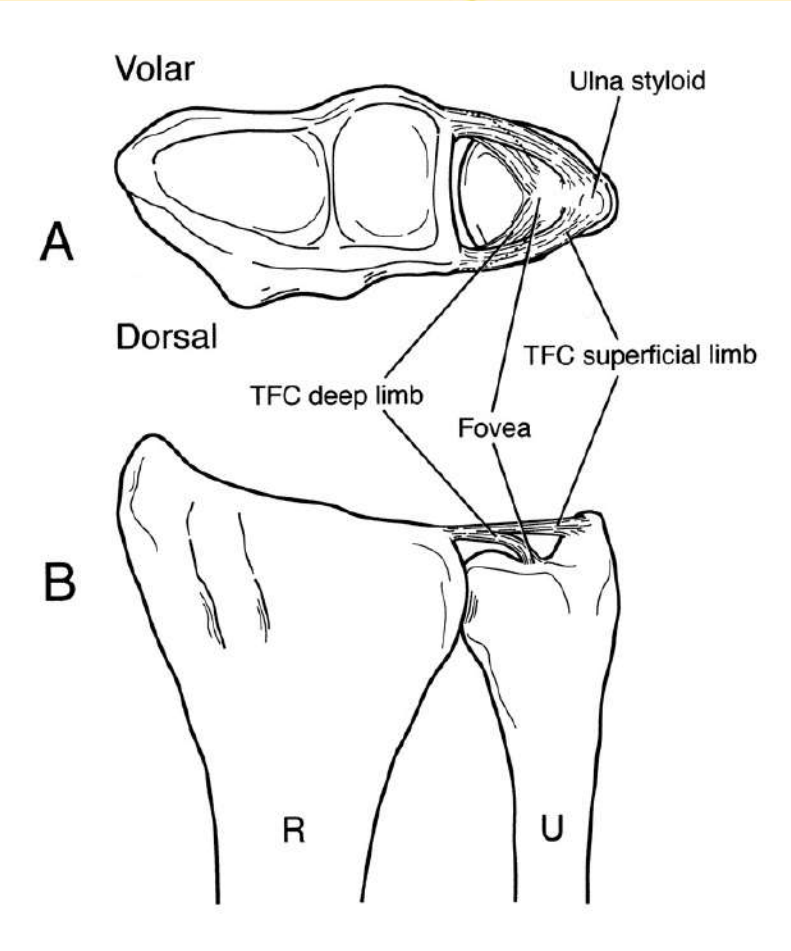


DRUJ stability

- TFCC
  - Volar and dorsal radioulnar ligaments
    - Superficial and deep fibers
  - Triangular fibrocartilage disc
  - ECU tendon subsheath
  - Ulnocarpal ligaments
- DRUJ capsule
- Distal interosseous membrane
  - Distal oblique bundle
- Dynamic stabilizers
  - Pronator quadratus, ECU



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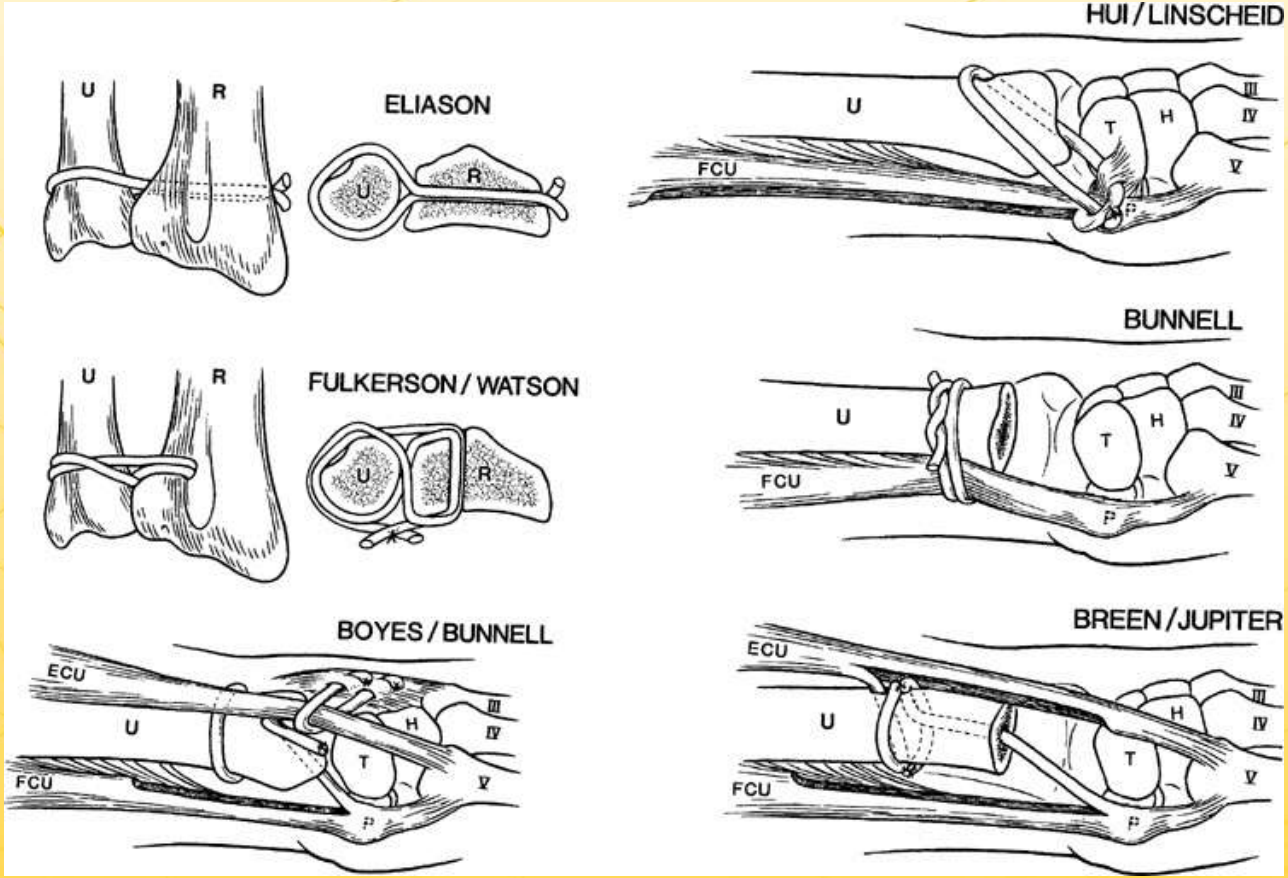

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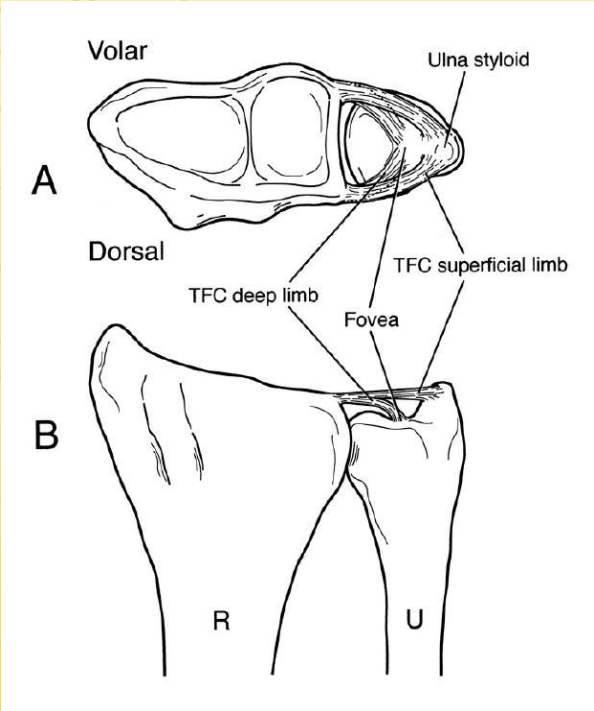

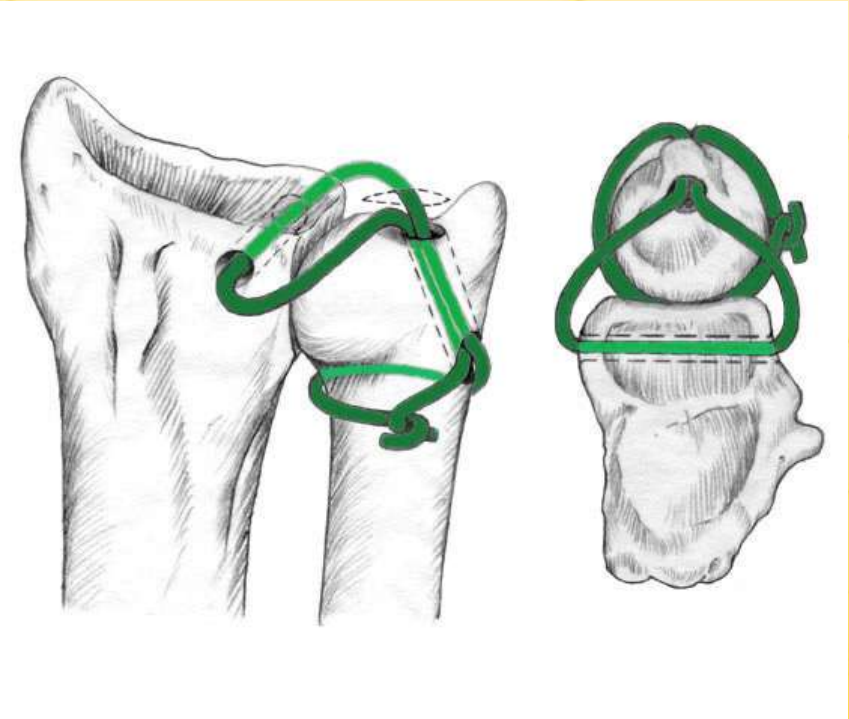

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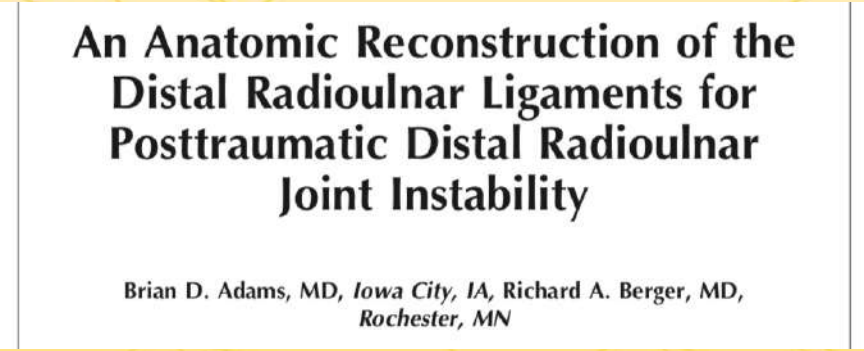
Adams-Berger DRUJ ligament reconstruction



An Anatomic Reconstruction of the Distal Radioulnar Ligaments for Posttraumatic Distal Radioulnar Joint Instability

Brian D. Adams, MD, *Iowa City, IA,* Richard A. Berger, MD, *Rochester, MN*

J Hand Surg Am 2002; 27: 243-51.

- 14 patients, ages 16-45
  - f/u 1-4 years
- 12 of 14 stable DRUJ
  - 9 of 14 pain free
  - 5 of 14 mild pain

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Gillis JA, Soreide E, Khouri JS, Kadar A, Berger RA, Moran SL. Outcomes of the Adams-Berger Ligament Reconstruction for Distal Radioulnar Joint Instability in 95 Consecutive Cases. J Wrist Surg 2019; 8: 268-275.

- 95 wrists
  - Mean age 37 years, f/u 28-190 months
  - 91% stable DRUJ
  - 76% no or mild pain
  - 12 with revision surgery (4 for symptomatic DRUJ arthritis)

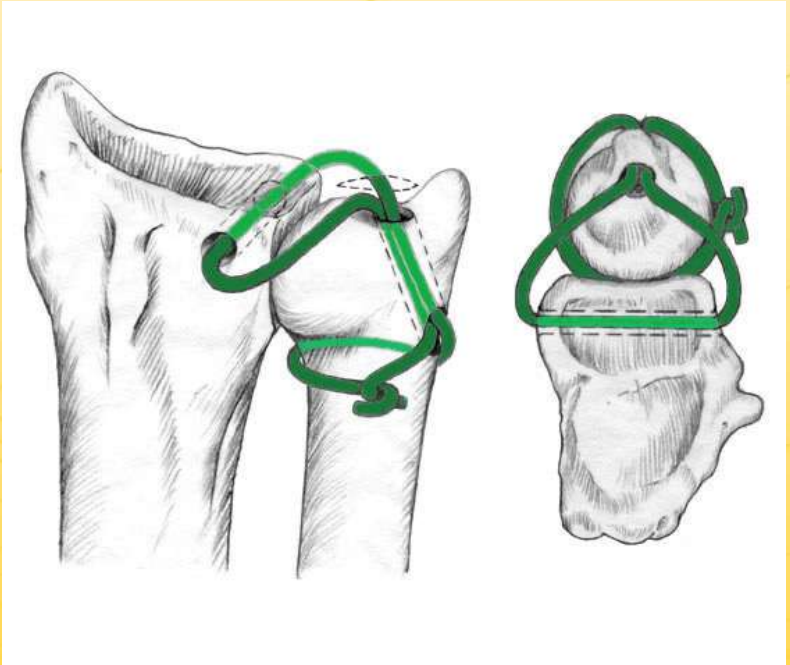
21 patients had undergone previous TFCC repair

No correlation between failure and

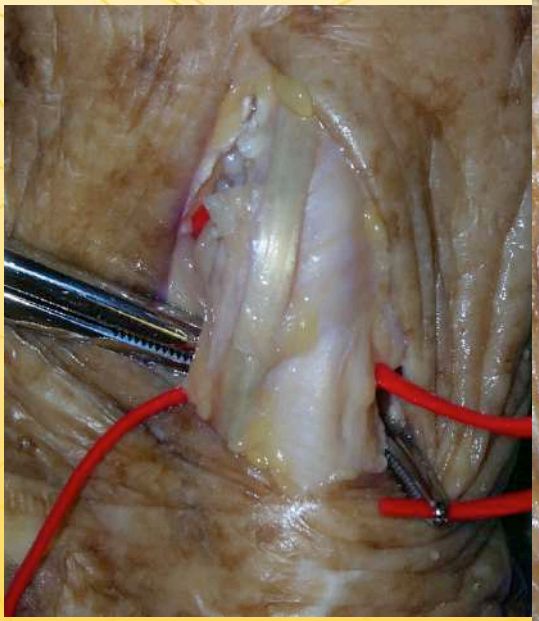
- Patient age
- Sigmoid notch anatomy
- Timing of surgery

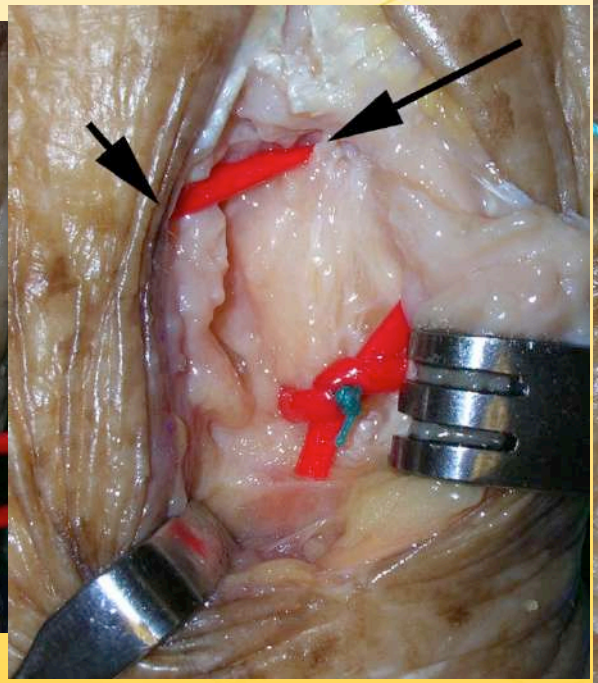
Adams-Berger reconstruction results

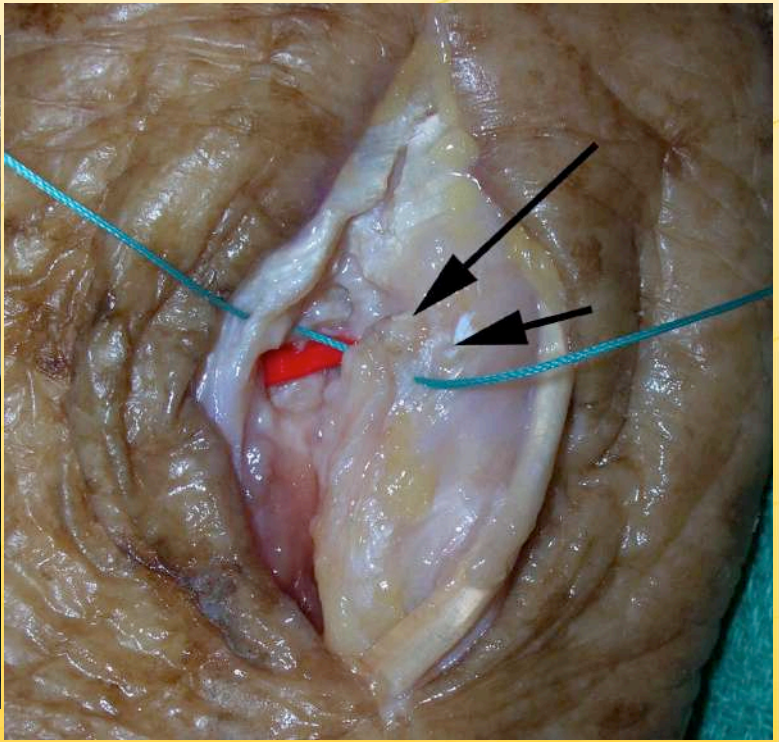
- Some correlation between ulnar graft fixation and successful restoration of stability
  - 1 year revision free
    - 94% with standard (loop) fixation in 83 wrists
    - 75% with with suture anchor fixation in 8 wrists
    - 67% with interference screw in 4 wrists



Graft tensioning







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Conclusion

- Ligament reconstruction can restore DRUJ stability in many (but not all) patients in the setting of a reducible DRUJ
- Must have bony congruency to be successful
- Not perfect…
  - Adams and Berger: 65% pain free
  - Gillis and Moran: 28% pain free, 48% mild pain

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- Multiple techniques for foveal repair

- Effective for DRUJ stabilization when
  - Normal bony anatomy (ulnar neutral to ulnar negative)
  - Adequate soft tissue (consider timing from injury to surgery)
  - Mild to moderate instability
  - No DRUJ arthritis

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On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

15 Minutes

Surg Approach: Resection Arthroplasty

Jesse B. Jupiter, MD

- DePuySynthes: Speaker
- RevBio: Consultant
- Accumed: Speaker
- OHK: Royalties -Royalties

76TH ANNUAL MEETING OF THE ASSH
SEPTEMBER 30 - OCTOBER 2, 2021

76TH ANNUAL MEETING OF THE ASSH

knowledge commitment compassion

Distal Radioulnar Joint Resection Arthroplasty

Jesse B Jupiter MD

Bernard CH, Huelle C. 1857

San Francisco, CA SEPTEMBER 30 - OCTOBER 2, 2021

1

RESECTION ARTHROPLASTY

Total ulnar head resection (Darrach procedure)

Severe degenerative changes in the elderly

Technical details: **sub-capital osteotomy (at neck level), and re-center(dorsalize) the sheath of ECU (dynamic stabilizer)**

2

RESECTION ARTHROPLASTY

Partial ulnar head resection (Bowers, Watson)

INDICATIONS:

LOW FUNCTIONAL WRIST DEMAND

Elderly patients, non-dominant hand, light manual activities
Rheumatoid arthritis; rotational contracture

PRE-REQUISITES: **neutral ulnar variance, otherwise ulnar shortening necessary to prevent stylo-carpal impingement**

To avoid late radio-ulnar impingement a voluminous soft tissue interposition is mandatory: ***ECU anchovy and pronator quadratus!!***

3

- **Severinus 1644**
- **Rognetta 1834**
- **Dupuytren 1839**
- **Malgagni. 1855**
- **Darrrach 1912**

4

My own feeling is that whatever their fallibility, eponyms illustrate the lineage of surgery and bring to it the color of old times, distinguished features, ancient sieges and pestilences, and continually remind us of the international nature of science

M. Ravitch, MD

5

DRUJ

Three basic conditions:

Incongruency, impaction and instability.

(these findings may present *isolated* or *combined*!!)

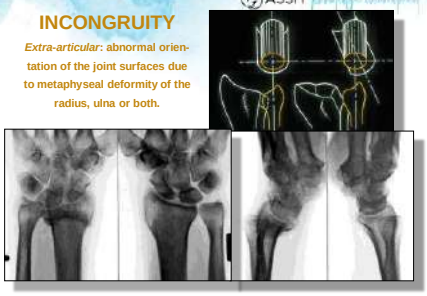
Less frequent problems

1) **Painful non-union of the ulnar styloid (*no instability*)**
2) **Capsular retraction (*pronatory contracture*)**
3) **Radio-ulnar impingement (*following resection of the ulnar head or unstable Sauve-Kapandji stumps)***

6

INCONGRUITY

***Extra-articular*: abnormal orientation of the joint surfaces due to metaphyseal deformity of the radius, ulna or both.**



7

INCONGRUITY

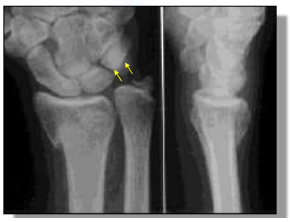
***Intra-articular*: following fractures entering the sigmoid notch, ulnar head or both.**

Ulnocarpal arthritis secondary to chronic *ulnar impaction*. (post-traumatic radial shortening)

8

IMPACTION

***Abnormal contact of two bony surfaces* due to radial shortening (*synonyms:* ulnocarpal abutment or impingement syndrome**



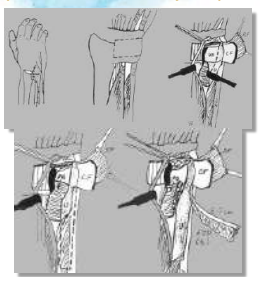
9

INSTABILITY

***Loss of ligament support*: rupture or avulsion of the TFC, capsular ligaments, secondary stabilizers (ECU sheath, pronator quadratus, interosseous membrane).**

10

modified Bowers procedure with ECU "anchovy" and pronator quadratus interposition



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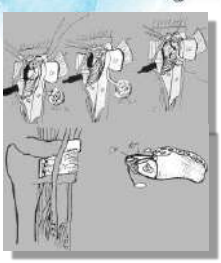

trans-osseous fixation of the capsulo-retinacular flap to the dorsal ridge of sigmoid notch

12

13

14

Complications

- **Ulnocarpal impingement**
- **Restricted forearm rotation**
- **Painful instability**

15

RESECTION ARTHROPLASTY

Total ulnar head resection (Darrach procedure)

Decompression of painful ulnocarpal joint
Elimination of painful DRUJ
Restoration or maintenance of forearm rotation

16

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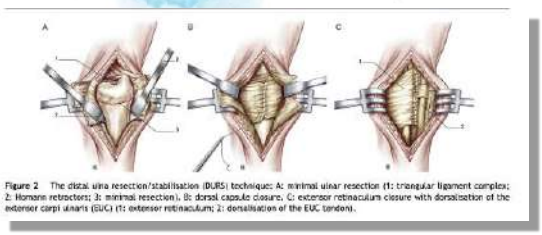


Figure 2 The distal ulna resection/stabilisation (DURS) technique: A: minimal ulnar resection (1: triangular ligament complex; 2: Homane retractors); B: minimal resection); B: dorsal capsule closure. C: extensor retinaculum closure with dorsalisation of the extensor carpi ulnaris (ECU) (1: extensor retinaculum; 2: dorsalisation of the ECU tendon).

19

Outcomes reveal 30-40% rate of complications

- **Dorsopalmar forearm instability**
- **Mechanical clicking, catching, locking**
- **Pain, weakness**
- **Distal radius-carpus-hand subluxation**
- **Progressive medial carpal translocation**

Rana and Taylor JBJS Br 1973
Hartz and Beckenbaugh J Trauma 1979
Field J et al JBJS Br 1993

20

"?? Oversimplified approach to a rather complex mechanical problem"

William Kleinman MD
Am J Orthop 2009

21

The Unstable Darrach

"the radius and the hand as well as what is resting in the hand—are resting on the ulnar head
Which is the keystone of the DRUJ and forearm as a whole

Karl Hagert M.D CORR 1992

22

painful ulnar stump after excessive distal ulnar resection in a patient with a malunited Colles fracture.

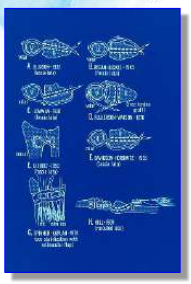
Lees and Scheker X-rays demonstrating radio-ulnar impingement.

23

Surgical Options for Failed Darrach

- **Tenodesis of the ulnar stump**
- **Lengthening osteotomy of the ulna**
- **Ulnar head prosthesis**

24



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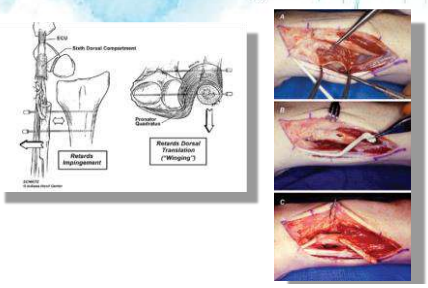

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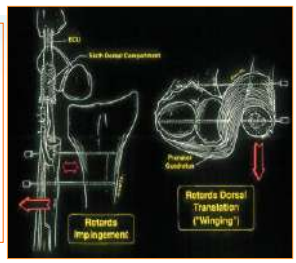
Ulnar Stump Tenodesis

PROBLEM

Most "tenodesis" procedures stretch over time



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Lengthening Osteotomy

- **Technique developed by H.K. Watson**

PROBLEM

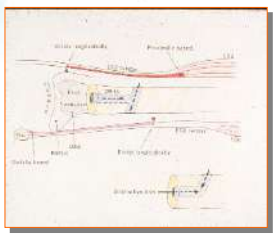
- **Late outcome by other investigators lacking**

28

Combined Tether Procedure

- **Developed by Ergodan Atasoy**
- **Adapted by Breen and Jupiter**

Breen TF, Jupiter J.Extensor carpi ulnaris And flexor carpi ulnaris tenodesis for the Unstable distal ulna. J Hand Surg 1989; 14A: 612-617.



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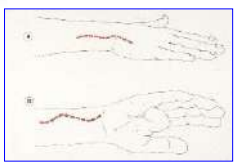
Tactics – Dorsal Approach

- Skin incision
- Extensor retinaculum incision
- ECU preparation – proximally based
- Distal ulna preparation



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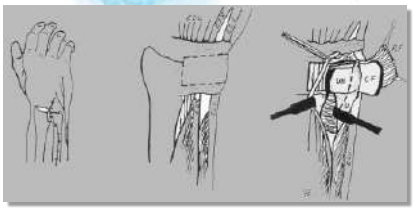

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Tactics – Dorsal Approach

- ECU preparation – proximally based

32

Tactics – Dorsal Approach

- Distal ulna preparation

33

Tactics – Palmar Approach

- Skin incision
- Isolate ulnar nerve/artery
- FCU preparation – distally based
- Tendon passed dorsally (extraarticular)

34

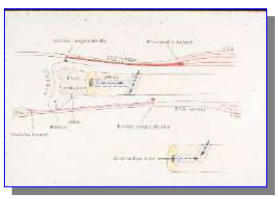
Tactics – Palmar Approach

- Skin incision
- – Isolate ulnar nerve/artery

35

Tactics – Palmar Approach

- FCU preparation – distally based



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Combined

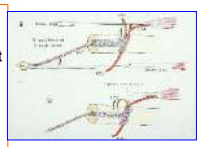
Tactics – Palmar Approach

- Skin incision
- Isolate ulnar nerve/artery
- FCU preparation – distally based
- **Tendon passed dorsally (extraarticular)**

37

Tactics – Tendon Stabilization

- **Each strip passed into ulna**
- **4-0 sutures placed, not tied**
- **Forearm supinated and sutures tied**
- **Tendon ends passed around ulna and sutured**



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Tactics – Tendon Stabilization

- Each strip passed into ulna
- **4-0 sutures placed, not tied**
- Forearm supinated and sutures tied
- Tendon ends passed around ulna and sutured

40

Tactics – Tendon Stabilization

- Each strip passed into ulna
- 4-0 sutures placed, not tied
- **Forearm supinated and sutures tied**
- Tendon ends passed around ulna and sutured

41

Tactics – Tendon Stabilization

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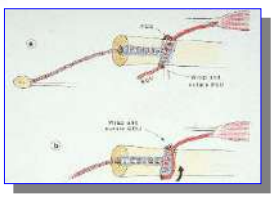

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Tactics – Closure

- Imbrication of capsule
- Retinaculum sling for ECU
- Suction drainage
- Long arm splint – forearm supination

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Combined ECU/FCU Tether of the Unstable Distal Ulna Long-Term Follow-Up

Thomas Breen, MD
Erdogan Atasoy, MD
Jesse B. Jupiter, MD

Breen T, Jupiter J J. Hand Surg 1989

44

- 10 patients
- Age
- Dominant limb
- Occupation

- 6 female
  4 male
- 32.9 years
  (range 19-46 yrs)
- 4
- 6 white collar
  4 laborers

45

Original Problem

Post traumatic	9
Rheumatoid arthritis	1
Previous Darrach	6
Previous hemiresection	2

46

DRUJ pain	5 severe 5 moderate
	6 severe
DRUJ instability	4 multidirectional

47

	Average
Forearm	
Pronation	39°
Supination	41°
Wrist	
Extension	38°
Flexion	29°
Grip Strength	25 lbs

48

Average 82.7 Months (60-125 mos)

- **Personal evaluation**
- **Radiographs**
- **BTE evaluation (2 patients)**

49

Radiographs

- **No dorsal ulnar subluxation**
- **No heterotopic bone**

50

Subjective

Pain	**1 moderate (WCA)**
Instability	**None**

51

Motion	Forearm	Average
	Pronation	41° → 78.5
	Supination	38° → 62.5
	Wrist	
	Extension	39° → 45.0
	Flexion	29° → 45.0
	Grip Strength	*25 lbs → 54 lbs

52

53

Functional Status

Return to job	**5**
Out of work	**3**
Retired	**1**
Job modification	**1**

54

Conclusions

ECU/FCU Tether

- Long term stability
- Limited complications
- Controls multiplanar instability

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THANK YOU

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Massachusetts General Hospital
Department of Orthopaedics
Boston, Massachusetts

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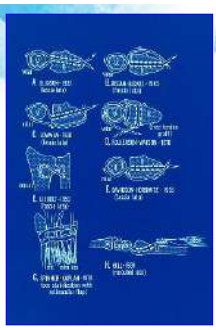

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On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

15 Minutes

Biologic Implant Arthroplasty (Including HOS)

Dean G. Sotereanos, MD

- AxogenInc: Consultant
- Commed: Consultant

ASSH
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76TH ANNUAL MEETING OF THE ASSH
SEPTEMBER 30 - OCTOBER 2, 2021

Precourse 14:

Biologic Implant Arthroplasty (Including HOS)

(Achilles Tendon Allograft Interposition)

Dean G. Sotereanos, MD
Clinical Professor of Orthopaedic Surgery, University of Pittsburgh School of Medicine,
Orthopaedic Specialists - UPMC, Pittsburgh, PA

Distal Radio-ulnar interposition arthroplasty using an Achilles tendon allograft

- Is indicated for failed distal ulnar resection due to impingement
- Especially for young, active patients
- Mechanical interposition
- Prevents distal radio-ulnar convergence

Technique Notes

- Previous surgical incisions are incorporated into the approach
- Dorsal approach through the fifth dorsal compartment
- Subperiosteal exposure of distal ulna, 4-6 cm proximal to distal stump
- Exposure of medial cortex of radius
- 3-4 micro suture anchors are placed into the medial cortex of radius (3-4 cm length), proximal to the sigmoid notch, at site of the impingement
- 3-4 drill holes are made in the distal ulna

- The allograft is sutured between the radius and ulna with the sutures from the anchors passed through the graft and drill holes

Pearls & Pitfalls

- For sufficient size of allograft bulk, obtain as much as necessary –increase allograft size if crepitus is palpated
- Use micro suture anchors for graft fixation to avoid radial shaft fracture
- Immobilize in long-arm splint in neutral position for 10 days and convert to cast for 6 weeks
- Physical therapy can be started after 6 weeks to advance motion and strength

Key words: Achilles allograft, failed Darrach, impingement, interposition arthroplasty, ulnar head resection

REFERENCES

- Sotereanos DG, Papatheodorou LK, Williams BG. Tendon allograft interposition for failed distal ulnar resection: 2-14 year follow-up. J Hand Surg Am. 2014;39(3):443-448.
- Papatheodorou L, Rubright J, Kokkalis Z, Sotereanos D. Resection Interposition Arthroplasty for Failed Distal Ulna Resections. Journal of Wrist Surgery 2013;02(01):13-18.
- Greenberg JA, Sotereanos D. Achilles allograft interposition for failed Darrach distal ulna resections. Tech Hand Up Extrem Surg. 2008;12(2):121-125.
- Sotereanos DG, Gobel F, Vardakas DG, Sarris I. An allograft salvage technique for failure of the Darrach procedure: a report of four cases. J Hand Surg Br. 2002;27(4):317-321.

On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

15 Minutes

Unconstrained Implant Arthroplasty

Brian D. Adams, MD

- Smith and Nephew: Consultant and Royalties
- Extremity Medical: Royalties
- Stryker: Consultant

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SEPTEMBER 30 - OCTOBER 2, 2021

DRUJ Hemiarthroplasty
Unconstrained Implant Arthroplasty
PreCourse 14 AM21

Brian D. Adams, MD
Professor of Orthopedic Surgery
Baylor College of Medicine
Houston, Texas

Role of Prosthetic Replacment

It is not new – Silicone implants were introduced in 1970's

Premise
Complete and partial distal ulna resections impair DRUJ function and forearm stability
Ulnar head replacement improves DRUJ kinematics to near normal in lab studies

Implant designs currently available

- Complete ulnar head replacement - Head only or head with extended collar / neck
- Unlinked total joint replacement - Sigmoid notch and complete ulnar head
- Linked total joint replacement - Constrained total joint
- Partial ulnar head replacement - Replaces only the articular surfaces
- Pyrocarbon head was used in Europe for a period of time

Indications for Implant Arthroplasty

- Failed resectional arthroplasty
- Primary osteoarthritis
- Post-traumatic arthritis
- Acute comminuted distal ulna fractures
- Quiescent inflammatory arthritis
- Tumor reconstruction
- Traumatic loss of distal ulna

Anatomic Considerations Joint Stability

- Soft tissue stabilizers - Joint capsule, TFCC, tendons, muscles
- Sigmoid notch - Shape, integrity of rims, & surface regularity
- Current reduction of joint - Dislocated, subluxated, or reduced
- Primary disease activity - Active, controlled, in remission

Anatomic Considerations: Integrity of the Distal Ulna

- Shape, size & length of head / neck
- Slope and surface of head articular surface
- Condition of ulnar styloid – e.g., basilar fracture

Anatomic Considerations: Radioulnar Variance

- Acquired positive variance - e.g., distal radius fracture deformity
- Developmental negative variance - normal variant
- Madelung's deformity - developmental positive ulnar variance

Specific Pearls and Pitfalls for Rheumatoid Arthritis

- Must be quiescent disease
- Must not be subluxated joint
- Sigmoid notch must be minimally eroded
- Probably not indicated for previous distal ulna resections

Non-constrained Implant Arthroplasty for the Distal Radioulnar Joint
B. D. Adams and J. L. Gaffey. Journal of Hand Surgery (E) 2017 42(4):416-421

Abstract

A variety of surgical techniques are used to treat the arthritic distal radioulnar joint, which is influenced by aetiology and previous procedures. Four types of ulnar head arthroplasty exist: total ulnar head, partial ulnar head, unlinked total distal radioulnar joint, and linked distal radioulnar joint. Although long-term outcome studies are sparse, short-term clinical and biomechanical studies have shown encouraging results, leading to expanded indications. Based on our experience and a literature review, patients are advised that pain is improved but minor pain is common after strenuous activity. Ulnar neck resorption is common, however, implant loosening is rare. Sigmoid notch erosion is concerning, but appears to stabilize and not affect outcome. A partial ulnar head replacement that retains bony architecture and soft tissue restraints may have benefit over a total ulnar head in appropriate patients. If appropriate selection criteria are met, ulnar head replacement typically produces reliable results, with low revision.

Introduction

A variety of surgical techniques are used to treat arthritis of the distal radioulnar (DRU) joint, which is influenced by whether the cause is post-traumatic, inflammatory, osteoarthritic, or chronic instability,and if previous procedures have been performed. Differentiating between DRU arthritis and ulnocarpal impaction syndrome is important because if both
are present then both may require treatment to alleviate symptoms. If articular surface damage is localized, then nonablative procedures that realign the joint, such as ulnar shortening that shifts the proximal margin of the ulnar head out of the sigmoid notch, or resection of the arthritic proximal one-third of the articular surface of the ulnar head can be attempted. For more severe arthritis, surgical treatments can be divided into three categories: partial or complete distal ulna resection with or without a soft tissue interposition, joint fusion combined with an ulnar neck pseudarthrosis (Sauvé–Kapandji procedure), and partial or complete joint replacement, however, only implant arthroplasty provides the potential to restore normal function (Douglas et al., 2014; Gordon et al., 2003; Sauerbier et al., 2002).

Implant designs

Normal stability and motion of the forearm requires an intact ulnar head, which provides a load-bearing surface and maintains a near normal axis of forearm rotation, making implant

arthroplasty an attractive concept for the treatment of ulnar head deficiencies and arthritis. A successful ulnar head implant arthroplasty also avoids the risk of radioulnar impingement and stump instability that may occur with resectional arthroplasty techniques. Although a silicone implant combined with soft tissue reconstruction temporarily relieves symptoms and restores stability, inevitable implant breakage, and frequent silicone synovitis lead to silicone implants being abandoned (Swanson, 1973).

Various metal implant designs have become available and can be divided into four categories: total ulnar head replacement with or without an extended collar, partial ulnar head replacement, unlinked total DRU joint replacement, and linked DRU joint replacement. Although long-term clinical outcome studies are sparse, short-term clinical and biomechanical laboratory studies have shown encouraging results. The use of ulnar head implant arthroplasty has expanded beyond the treatment of failed resectional arthroplasty to include primary treatment ofarthritis and other conditions.

Several modular ulnar head replacement systems with variable head sizes, stem diameters, and lengths of collar extensions for ulnar neck deficiencies are available. These modular systems offer versatility and have been used for acute ulnar head fractures, post-traumatic DRU arthritis, rheumatoid arthritis, osteoarthritis, and failed previous partial or completeresections of the distal ulna. The implant head typically has a site for suture attachment of the triangular fibrocartilage complex, extensor carpi ulnaris (ECU) sheath, and ulnocarpal ligaments to help stabilize the DRU joint. Cement fixation of the stem is not usually necessary. Because complete ulnar head resection removes all direct soft tissue restraints between the carpus and head and between the sigmoid notch and head, instability is a substantial risk. Thus, preoperative dislocation or substantial instability of either anulnar head or ulnar neck stump is usually a contraindication, including post-traumatic and inflammatory arthritis conditions. Fortunately, some patients with a previous Darrach procedure have developed strong scar encapsulation with a stable and aligned stump and the implant may be stable after implantation. One system has the option to also replace the sigmoid notch with a metal-backed polyethylene component, which is intended to avoid sigmoid notch erosion, reduce pain caused by metal contact against bone, and possibly improve joint stability (Stryker Medical, Kalamazoo, USA), however very little clinical outcome information is available for this system. This system is probably most beneficial for arthritis associated with irregularity of the sigmoid notch that cannot be corrected with minimal burring.

A partial ulnar head replacement arthroplasty was designed for primary treatment of arthritis of the DRU joint, irreparable acute ulnar head fractures (Figure 1), and failed partial ulnar head resections (Figure 2) (Integra Life Sciences, Plainsboro, NJ, USA). This anatomic concept is to replace only the articular surfaces of the ulnar head and to preserve most of the native soft tissue restraints of the DRU joint, thus reducing the risk of instability. This implant is contraindicated in patients with substantial ulnar positive variance in which proper DRU joint congruity cannot be obtained and in those with a previous complete ulnar head resection. In a cadaveric study, the implant provided a close match to the native ulnar head as well as good joint alignment and stability (Conaway et al., 2009). This implant is probably preferable to a total ulnar head when preoperative joint alignment is good, but because of its monoblock design it cannot be used when the DRU joint is substantially dysplastic.

A pyrocarbon partial ulnar head replacement has also been designed and has shown promising results, but its availability is not widespread (Tornier, Saint Marin, France) (Bigorre et al., 2016; Garcia-Elias, 2007). A radioulnar-linked implant with a fixed bearing that replaces the DRU joint is also available (Aptis Medical, Glenview, KY, USA). Although it was originally intended for severe cases of joint instability or bone loss, the implant is now reportedly used for a variety of conditions. Further discussion of this implant design and its outcomes are discussed elsewhere in this special issue.

My preference for implant selection is strongly biased by the preoperative alignment of the

DRU joint. Unconstrained implant systems have substantial risk of post-operative instability if the arthritic joint or ulnar stump is unstable preoperative. Thus, I prefer a partial ulnar head implant when the arthritic joint or partially resected head is stable and total ulnar head implant for a failed total head resection with a relatively stable ulnar stump regarding anterior–posterior translation despite radioulnar impingement. Alternative salvage procedures or implant systems should be used for unstable joints and ulnar stumps.

Author's preferred operative technique for partial ulnar head arthroplasty

If a malunited radius or ulna is present, a corrective osteotomy is recommended before implant arthroplasty in order to achieve reliable DRU joint stability. I review the preoperative radiographs to plan 1.5 to 2 mm negative ulnar variance. I prefer a dorsal approach unless previous surgery has been performed. Although the technique for partial ulnar head implantation will be described, the technique for a total head replacement is similar. Make a longitudinal skin incision over the ulnar head between the 5th and 6th extensor compartments. Open the 5th extensor compartment and retract the extensor digiti minimi tendon to expose the DRU joint dorsal capsule followed by a C-shaped, dorsal capsulotomy, leaving approximately 3 mm of capsule attached to the notch for easier closure. Be careful not to cut the dorsal radioulnar ligament, and the ECU sheath is not typically opened to preserve its (Adams and Gaffey) important stabilizing function; if an ulnar styloid nonunion is present, it can be resected or retained. Sharply release only the foveal attachments of the triangular fibrocartilage complex by passing a scalpel blade proximal to the disk towards the base of the ulnar styloid, which preserves its attachments to the styloid.

Place a small Hohman retractor beneath the ulnar head to lift it dorsally while fully flexing the wrist and maximally pronating the forearm. Enter the ulnar shaft through the fovea with the awl. Insert sequentially larger reamers until there is cortical contact in the canal. Apply the cutting guide to the reamer handle, properly align it, and resect the articular surfaces. Inspect the sigmoid notch and contour its surface if substantially misshapen, however breaching the subchondral bone may increase the risk of erosion. Determine proper implant head size by matching the resected portion of the head to the implant trials. Insert the trial, reduce the joint, and assess stability and motion. The head size is chosen to tension the soft tissues, but avoid overstuffing the joint. Insert the final implant with a press-fit. Close the DRU joint capsule together with the retinaculum as a single layer, leaving the extensor digiti minimi tendon subcutaneous. A long arm splint is applied for 2 weeks, followed by a short arm cast for 2 weeks, which allows only a short arc of forearm rotation.

A removable splint is used for another 4 weeks while motion exercises are begun. Strengthening and loading activities are advanced as wrist and forearm motion recovers.

Personal series

After receiving institutional review board approval, a retrospective review was performed of the senior author's initial consecutive series of patients, 28 who had undergone distal ulnar implant arthroplasty. A partial ulnar head implant was used in 18 wrists and a total ulna head replacement in ten. Patients were contacted to return for clinical and radiographic evaluation to include range of forearm motion, grip strength, and complications. The patients completed the Patient-Rated Wrist Evaluation survey. Radiographs were obtained preoperatively and at multiple follow-ups, including the final follow-up.

The mean age at surgery was 54 years (range 23–82). The dominant hand was operated on in 22

patients. The preoperative diagnoses were: primary DRU joint arthritis (14); arthritis secondary to fracture or malunion (10); rheumatoid arthritis (2); and acute ulnar head fracture (2). A total of 12 patients had undergone previous operations on the distal ulna: distal radius fracture fixation (4); Darrach procedure (2); partial ulnar head resectional arthroplasty (3) (Figure 3); silicone ulnar head implant (1); and wrist arthrodesis (1). A total of 16 patients had concurrent procedures with ulnar head replacement: wrist arthrodesis (5) (Figure 4); carpal tunnel release (3); distal radius fracture fixation (3); extensor tendon transfers (3); distal radius hemiarthroplasty (1); and radiolunate arthrodesis (1) (Figure 5). The distribution of diagnoses, previous surgeries, and concurrent

procedures was similar between those having a partial and those having a total ulnar head implant, except those with a previous Darrach procedures were all treated with a total ulnar head replacement.

A total of 21 patients returned for clinical evaluation at a mean of 4.6 years (range 1–10). Four patients were lost to follow-up at 3 and 5 years post-operative, two died prior to final follow-up at 5 and 7 years postoperative, and one had the prosthesis removed for pain and DRU joint instability at 1 year post-operatively; that had been implanted after a wrist arthrodesis.

The forearm range of motion at final follow-up was a mean of 71° pronation and 55° supination. In the patients without a wrist arthrodesis, the mean wrist motions were flexion 55°, extension 52°, ulnar deviation 23°, and radial deviation 15°. These motions were similar between the partial and total ulnar head replacements. The grip strength for all 21 patients at final follow-up averaged 35 kgf on the operative side compared with 41 kgf for the opposite side. At final follow-up, average Patient-Rated Wrist Evaluation scores for all 21 patients were 18 for pain and 16 for function, with a total score of 34. The 21 patients who returned for follow-up were asked specifically if their pain compared with preoperative was worse or not improved, improved, or pain free. The responses were: worse or not improved in two, improved in 17, and pain free in two. All 17 patients with improved pain claimed there was no or minimal pain during regular activities, but greater pain during strenuous activities, which was tolerable and resolved within hours when the activities were completed. All 27 patients with retained implants had minimum 1-year follow-up radiographs, and 25 had postoperative radiographs ranging from 2 to 10 years. The mean neck resorption found on most recent radiographs, as measured from the proximal edge of theimplant head to the distal margin of the intact ulnar neck, was 5.5 mm (range 1 to 9) for the total ulnar head replacements (Figure 3) and 1.7 mm (range 0 to9) for the partial ulnar heads (Figures 2, 4, and 5).

Sigmoid notch erosion was assessed by comparing the most recent radiographs with the immediate post operative radiographs, and measuring the site of greatest change in the sigmoid notch sclerotic margin on the posterior–anterior radiographs. Erosion was a mean of 4 mm (range 1 to 7) for the
total ulnar head and 2 mm (range 0 to 7) for the partial ulnar head (Figures 4 and 5).

No patient had evidence of stem loosening, but sclerotic margins formed around parts of the stem in six implants and some resorption consistent with stress shielding in two implants (Figure 5). Small cystic changes formed in the lunate in three wrists, which appeared similar to findings of ulnar impaction syndrome (Figure 1). One patient had a revision for instability that responded to converting to a smaller implant head and soft tissue reconstruction. One implant was removed at another institution for pain and joint instability.

Discussion

Although biomechanical testing shows that ulnar head implants restore DRU joint kinematics to near normal and clinical experience is increasing, optimal patient selection and long-term outcomes are not yet established (Douglas et al., 2014; Gordon et al., 2003; Sauerbier et al., 2002). Based on several publications and the senior author’s personal series, implants appear to be particularly useful for patients with radioulnar impingement after a failed partial or complete distal ulnar resection and for primary treatment of select patients with arthritis in order to maintain a higher level of function. An early study by van Schoonhoven and associates (van Schoonhoven et al, 2000) reported on the use of the Herbert prosthesis (KLS Martin, Tuttlingen, Germany), which is a ceramic head fixed to a porous coated titanium stem inserted in the ulnar medullary canal. The head is spherical in the transverse plane and features a concave distal surface to decrease pressure across the ulnocarpal joint. A total of 23 patients with chronic painful ulnar stump instability following ulnar head resection and an average of three previous operations were reviewed. Symptoms were significantly improved in all patients. Stability was achieved initially in all cases, but two developed recurrence. Both patients were treated successfully by revising the implant.

Slight remodelling of the sigmoid notch and 1 to 2 mm of resorption beneath the collar

occurred in all patients, but it was not progressive. The authors were cautiously optimistic with the short-term results. In an early prospective study of 19 implants in 17 patients treated for radioulnar convergence or arthritis by total ulnar head replacement, pain scores diminished by 50%, grip strength improved by 16%, and forearm rotation was unchanged (Willis et al., 2007). Many patients had multiple previous operations. Two failures occurred at 7 and 14 months post-operatively.

Similar clinical and radiographic outcomes at longer follow-up for 22 Herbert ulnar head implants with a mean 7.5 years (range 2.0–12.5) follow-up was recently published (Axelsson et al., 2015). Five were primary procedures; the remaining 17 were done after a median of 2 (range 1–5) previous operations. The indications were: painful DRU joint instability after previous resection arthroplasty (10); pain due to osteoarthritis (9); and rheumatoid arthritis (3). The wrist range of motion was not affected by the arthroplasty; supination improved from 55° to 70°. Grip strength was similar to the unoperated side. The visual analogue scale-pain was a mean of 2.9 (range 0–8.7) during activity and 1.7 (range 0–7) at rest. None of the implants showed any radiographic signs of loosening. A review of 79 implants in 74 patients, with 47 returning for clinical evaluation, found a range of indications, including post-traumatic (32 patients), inflammatory arthritis (19), and osteoarthritis or abutment (12) (Sabo et al., 2014). A total of 53 patients (67%) had a Herbert prosthesis (KLS Martin, Tuttlingen, Germany) and six had a First Choice implant (Ascension Orthopaedics Inc, Austin, TX). Follow-up ranged from 3 to 11 years. As defined by implant removal, 90% survival was found at both 5 and 10 years. A functional range of motion and 67% grip strength was achieved. Patient satisfaction was generally high, but outcome scores indicated substantial residual disability. Patients with prior wrist surgery and those with post-traumatic arthritis had poorer outcomes. Another recent study showed similar results (Warwick et al., 2013).

Achieving a good, well-balanced soft tissue envelope around an unconstrained implant can be challenging in patients with inflammatory arthritis, however substantial improvement in pain and range of motion in patients with rheumatoid arthritis was reported by Kopylov and Tagil (2007) using both partial and total ulnar head replacements. Nevertheless, until greater experience with ulnar head replacement is reported, more caution should be used when considering any DRU joint implant arthroplasty in patients with active rheumatoid disease.

We believe that the best indication in rheumatoid arthritis is likely a younger, active patient who has painful arthritis but a stable and well aligned DRU joint and adequate bone quality. Based on the senior author's outcomes and a review of the literature, patients are currently advised that pain is improved but some pain and swelling are common after strenuous activities. Ulnar neck resorption is common, however implant loosening is rare. Ulnar neck resorption may be less with partial ulnar head replacement, perhaps because of the retained attachments of the ECU sheath and capsule. Sigmoid notch erosion is probably the greatest long-term concern. Whether erosion stabilizes at approximately 2 years, as reported by several authors, will need to be confirmed by longer follow-up studies. Despite some of the drawbacks of ulnar head replacement, revision rates are low.

Conclusion

Non-constrained ulnar head implant arthroplasty has shown promising early clinical outcomes for a variety of arthritic conditions and surgical failures, however non-constrained implants are likely best for active patients who have a generally stable, well-aligned joint or ulnar stump and adequate soft tissue and bone quality.

Ulnar neck resorption and sigmoid notch erosion are concerning radiographic findings, but appear not to be clinically significant. A partial ulnar head replacement that retains the bony architecture and soft tissue restraints may have benefit over a total ulnar head in suitable patients. When appropriate patient selection criteria are met, partial and total ulnar head replacement typically produce reliable results.

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On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

15 Minutes

Constrained Implant Arthroplasty

Douglas P. Hanel, MD

- Acumed: Speaker
- Trimed: Speaker
- Aptis: Speaker

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SEPTEMBER 30 - OCTOBER 2, 2021

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knowledge commitment compassion

Constrained Implant Arthroplasty

Doug Hanel MD

San Francisco, CA SEPTEMBER 30 - OCTOBER 2, 2021

1

Disclosures

This Lecture is
Level 3, 4 & 5 Evidence

2

Chelsea Boe MD & Abhi Bhashyam MD
Combined Hand Program

Orthopaedics and Sports Medicine
UNIVERSITY of WASHINGTON

3

How Successful Are Resection Arthroplasty Procedures ?

The Community Standard

4

Typically:
"94% of the patients were satisfied".

Nawijn, Verhiel, Jupiter, Chen

Hemiresection Interposition Arthroplasty of the Distal Radioulnar Joint: A Long-term Outcome Study. Hand (NY) 2019.

This Years Community Standard

5

What Becomes of The Other 6% ?

Each Had The Community Standard Operation

6

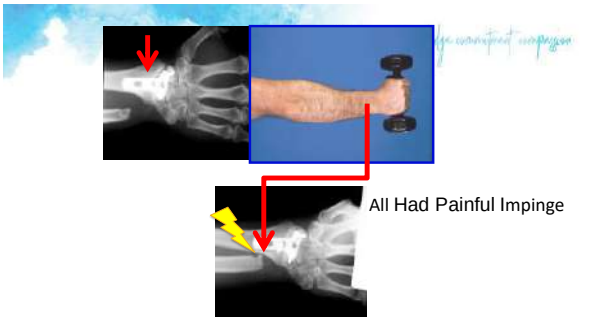
53 Y/O Artist Educator
Kienbock's
Rx Radial Shortening *20 Yrs Ago*
Ulnar Impingement Pain
SK *15 Yrs Ago*
Continued Pain
ECU Tenodesis *10 Yrs Ago*
Continued Pain
Achilles Interposition *5 Yrs Ago*
Continued Pain
Ulnar Shortening & Revision Tenodesis *1 Yr Ago*

7

What Do These People Have In Common?

DASH
45-65
Work Modification
100%
Average 2.5 Previous Procedures
Resting Pain Scale
5.5/10
Pain With Pronation-Supination
Esp When Holding Anything >1.5 Kg

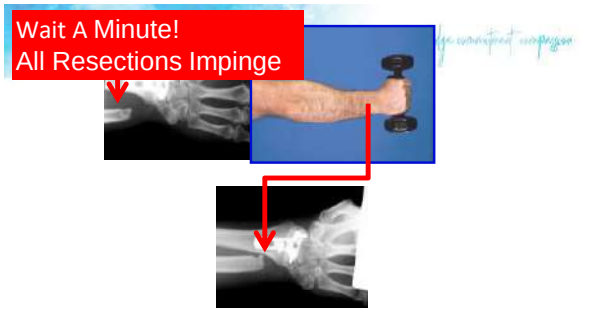
8



All Had Painful Impinge

The Radiological Demonstration of Dynamic Ulnar Impingement Lees & Scheker J Hand Surg BR 1997

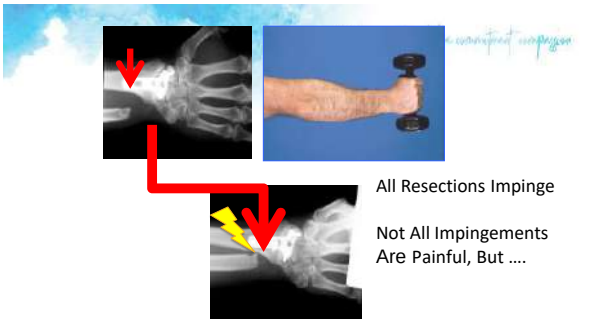
9



Wait A Minute!
All Resections Impinge

The Radiological Demonstration of Dynamic Ulnar Impingement Lees & Scheker J Hand Surg BR 1997

10



All Resections Impinge

Not All Impingements
Are Painful, But ….

11

…WHEN IMPINGEMENT IS PAINFUL IT IS LIFE CHANGING

12

Revision DRUJ Arthroplasty ?

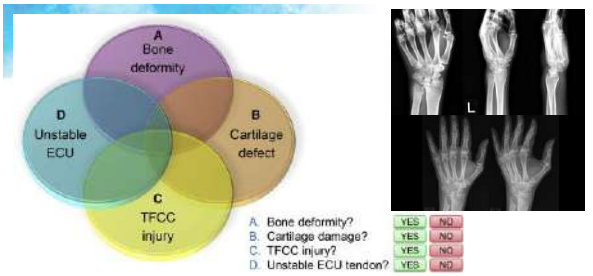
CURRENT CONCEPTS

The "Four-Leaf Clover" Treatment Algorithm: A Practical Approach to Manage Disorders of the Distal Radioulnar Joint

Sanjeev Kakar, MD,* Marc Garcia-Elias, MD, PhD†‡

JHand Surg Vol 41 April 2016

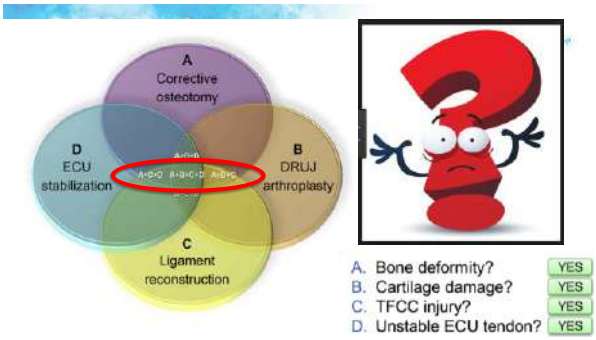
13



The "Four-Leaf Clover" Treatment Algorithm: A Practical Approach to Manage Disorders of the DRUJ:
Kakar & Garcia-Elias JHand Surg Vol 41 April 2016

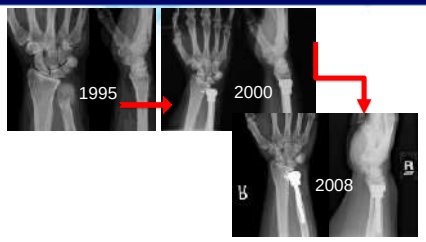
14

15



17

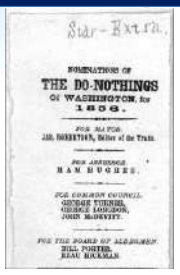
48 y/o Bus Driver



18

Five Choices

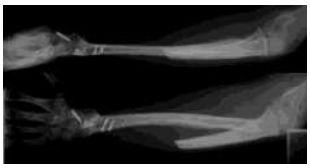
1. Do Nothing



19

Five Choices

1. ~~Do Nothing~~
2. Distal Resection (Bigger is Better)



Wide Excision of the Distal Ulna:
A Multicenter Case Study

Wolfe, Mih, Hotchkiss, Culp, Kiefhaber, Nagle

J Hand Surg 23A:222-228,1998

20

Five Choices

1. ~~Do Nothing~~
2. ~~Distal Resection~~
3. One Bone Forearm

One Bone Forearm
Hanel, Schiffman
Hand Clinics 36:4 531-538
Oct 2020

21

Five Choices

1. Do Nothing
2. Distal Resection
3. One Bone Forearm
4. Repeat Interposition

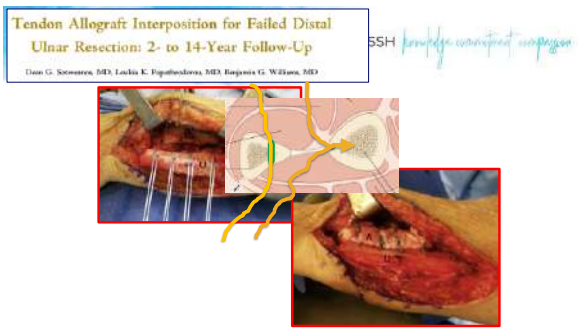
22

Five Choices

1. ~~Do Nothing~~
2. ~~Distal Resection~~
3. ~~One Bone Forearm~~
4. Repeat Interposition

J Hand Surg Am 39A: 443-448, 2018

23



24

26 Cases

Follow Up:	25 PTS	174 Mo's
VAS Score:	8.6 >>>	1.6
Pronation:	59º >>>	87º
Supination:	04º >>>	85º
Grip Strength:	21% >>>	93%
Complications:	01 Failed	01 Fracture

25

Five Choices

1. ~~Do Nothing~~
2. ~~Distal Resection~~
3. ~~One Bone Forearm~~
4. ~~Repeat Interposition~~
5. Semiconstrained Arthroplasty

SURGICAL TECHNIQUE

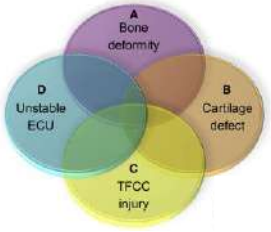
Implant Arthroplasty for the Distal Radioulnar Joint

Lain R. Scheker, MD

J Hand Surg 33A : 1639-1644

27

Indications: Semiconstrained ?



28

J Hand Surg Am 2008
33A : 1639-1644

29

SCIENTIFIC ARTICLE

Functional Outcomes of the Aptis-Scheker Distal Radioulnar Joint Replacement in Patients Under 40 Years Old

Antonio Rampazzo, MD, PhD,* Babar Basseri Ghaeh, MD, PhD,* Guy Brock, PhD,† Lain R. Scheker, MD‡

J Hand Surg Am 2015,
40A : 1397- 1403

2/46 = 5%

46 Cases

Follow Up:	24 – 99 Mo's
VAS Score:	08 >>> 02
Pronation:	69º >>> 70º
Supination:	62º >>> 73º
Grip Strength:	20% >>> 90%
Complications:	1 Failed, 1 Fracture

30

If Peter Stern MD Had Written This Article The Complication Rate Would Have Gone From

2/46 (5%) to 18/46 (39%)

31

SCIENTIFIC ARTICLE

Functional Outcomes of the Aptis-Scheker Distal Radioulnar Joint Replacement in Patients Under 40 Years Old

Antonio Rampazzo, MD, PhD,* Babar Basseri Ghaeh, MD, PhD,* Guy Brock, PhD,† Lain R. Scheker, MD‡

18/46 =39%

46 Cases
Complications:

ECU Tendonitis	9
Implant Revision	2
Metal Failure	2
Ball Failure	2
Infection	1
Ectopic Bone	2

32

Annual Meeting ASSH 2016
J Hand Surg 2017


SCIENTIFIC ARTICLE

Complications of Semiconstrained Distal Radioulnar Joint Arthroplasty

Kate D. Bellevue, MD,* Mary K. Thayer, MD,* Michael Poulos, MD,* Jerry I. Huang, MD,* Douglas P. Hood, MD*

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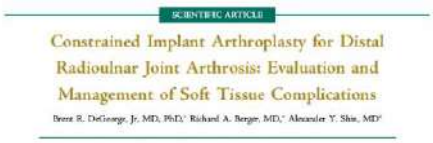
Complication Rate

29%

33

Annual Meeting ASSH 2016
J Hand Surg 2019


SCIENTIFIC ARTICLE

Constrained Implant Arthroplasty for Distal Radioulnar Joint Arthrosis: Evaluation and Management of Soft Tissue Complications

Brent R. DeGeorge, Jr, MD, PhD,* Richard A. Berger, MD,* Alexander Y. Shin, MD*

Complication Rate

44%

34

"Wonderful! Just Wonderful!...So much for instilling them with a sense of Awe"

Far Side – Gary Larsen

35

Revision DRUJ Arthroplasty

Do You Still Do This?
What Has Changed ?

36

Yes, I still do this operation. What a Has Changed ?

One Complication at a Time

37

54 Cases (2007 – 2016)

Complication Rate 29%

2 Distal Synostosis

38

54 Cases (2007 – 2016)

Complication Rate 29%

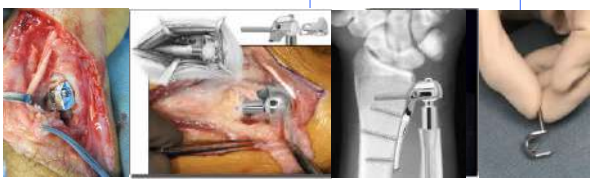
2 Distal Synostosis
2 Caps Loosened

39

54 Cases (2007 – 2016)

Complication Rate 29%

2 Distal Synostosis
2 Caps Loosened



40

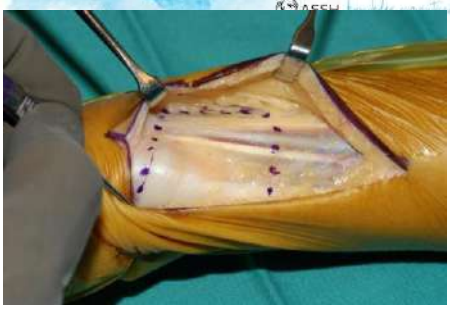
54 Cases (2007 – 2016)

Complication Rate 29%

2 Distal Synostosis
2 Caps Loosened
2 Tendon Adhesion

Avoid Immobilization > 72 Hours

41



42

43

Interpose retinaculum, dermal fat graft, or fascia lata allograft

44

54 Cases (2007 – 2016)

Complication Rate 29%

3 Late Infections

45

54 Cases (2007 – 2016)

Complication Rate 29%

3 Late Infections
2 RX Exchange

Antibiotic Coverage With Dental Procedures

46

54 Cases (2007 – 2016)

Complication Rate 29%

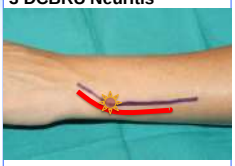
3 Late Infections
2 RX Exchange
1 *Permanent Explant*
RX 1-Bone Forearm

47

54 Cases (2007 – 2016)

Complication Rate 29%

3 DCBRU Neuritis



2 Presented Pre Op
1 Presented Post Op

48

54 Cases (2007 – 2016)

Complication Rate 29%

3 Painful PRUJ
Incr Forearm Motion
Incr PRUJ Pain

49

54 Cases (2007 – 2016)

Complication Rate 29%

4 Radius Stress Fx
All Related to Impact Loading
2 Demolition
1 Wood Splinting
1 "Car Racing"
Each Within 6 Wks of 1º Procedure

50

1. Shares Forearm Convergent Load
2. Prevents Volar/Dorsal Translation
3. Follows Forearm Axis of Rotation
4. Demands Attention to Detail
5. What's Different?
   - Complication Rate in Second
   - Cohort of Patients Markedly Improved

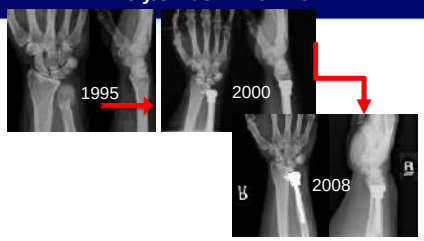
51

TECHNIQUE

This is Not an Easy Procedure
But It Is Well Illustrated On Line

52

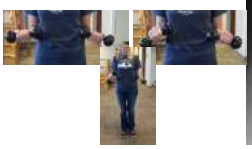
48 y/o Bus Driver Work



53

X-ray 12 Year Post

Full ROM,
No Pain,
Returned To Work



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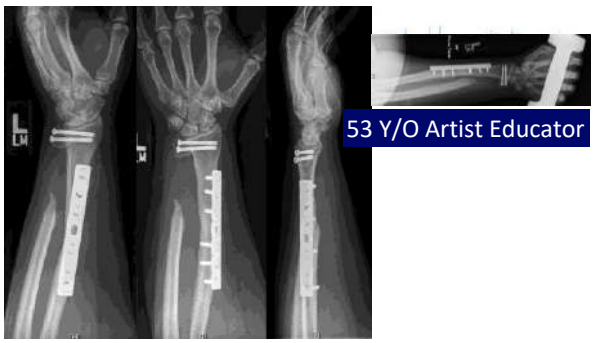

53 Y/O Artist Educator

55

POD #12
Pro 80/Sup70
WE 30/WF 30
No Impingement Pain

57

THANK YOU

58

On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

15 Minutes

ECU Pathology

Michelle G. Carlson, MD

No relevant conflicts of interest to disclose

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SEPTEMBER 30 - OCTOBER 2, 2021

Speaker has not provided a handout for this presentation.

Session Handouts

OnDemand

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SEPTEMBER 30 – OCTOBER 2, 2021
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On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

30 Minutes

Rapid Fire Cases: Pisotriquetral Arthritis

Maureen A. O'Shaughnessy, MD
No relevant conflicts of interest to disclose

76TH ANNUAL MEETING OF THE ASSH
SEPTEMBER 30 - OCTOBER 2, 2021

76TH ANNUAL MEETING OF THE ASSH

knowledge commitment compassion

Queen's Gambit Rapid Fire Case #1

Pisotriquetral Arthritis

Maureen A. O'Shaughnessy, MD

Dept of Orthopedic Surgery, University of Kentucky

San Francisco, CA SEPTEMBER 30 – OCTOBER 2, 2021

1

76TH ANNUAL MEETING OF THE ASSH

knowledge commitment compassion

No Disclosures

San Francisco, CA SEPTEMBER 30 – OCTOBER 2, 2021

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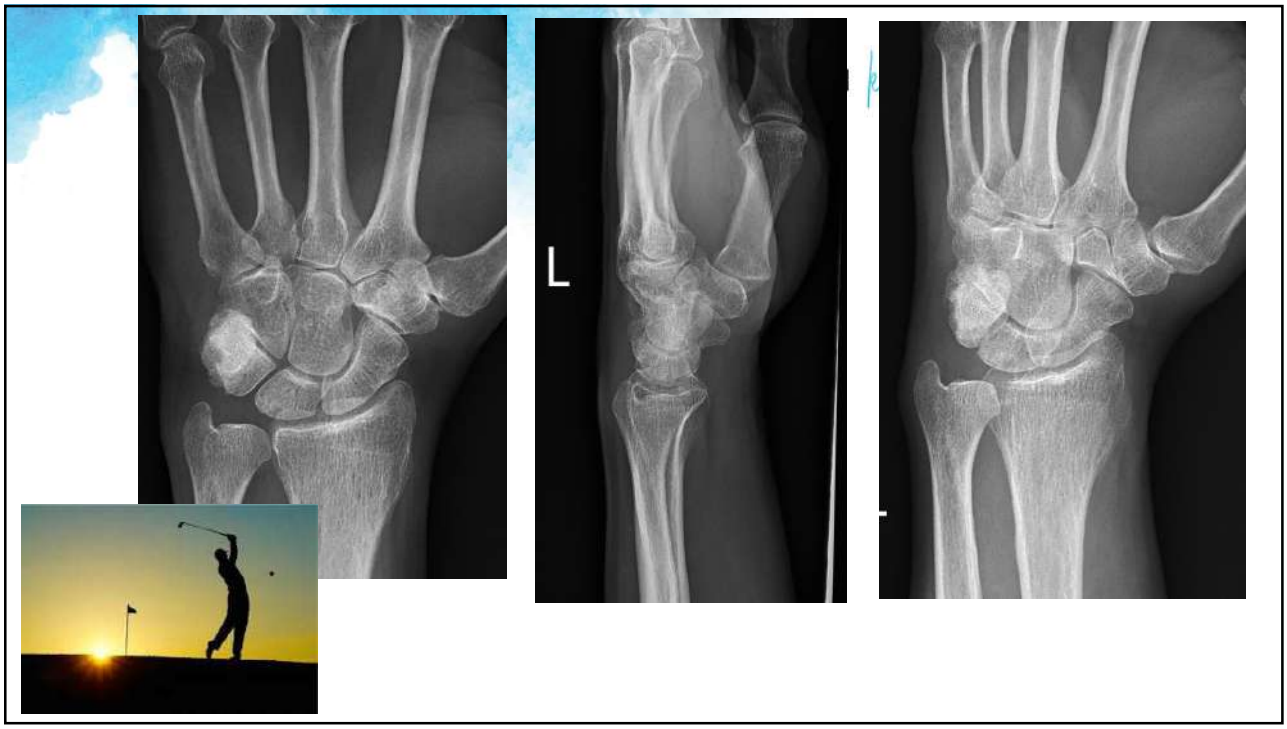

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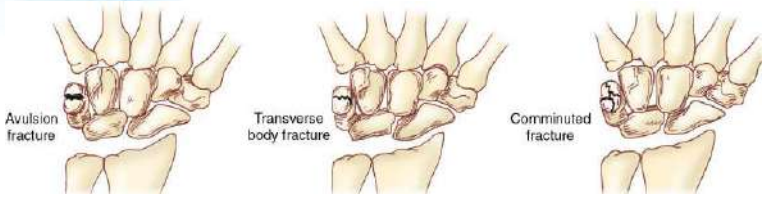
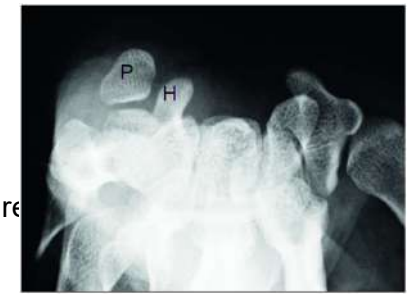
4

Pisotriquetral Joint Pathology

- Uncommon diagnosis
- Arthritis
- Fracture
- Avascular necrosis
- Osteochondritis dissecans
- FCU tendonitis
- PT instability
- Attritional rupture of flexor tendons re





5

Prevalence of Arthritis

Yamaguchi et al JHS 1998

83% of cadaveric specimens showed PT joint degeneration

Yamaguchi, S., S.F. Viegas, and R.M. Patterson, *Anatomic study of the pisotriquetral joint: Ligament anatomy and cartilaginous change*. Journal of Hand Surgery, 1998. **23**(4): p. 600-606.

6

Anatomy

- FCU tendon insertion (50% of fibers)
- Pisiform acts as sesamoid bone in FCU tendon
  - Increases lever arm and force of ulnar wrist flexion
- PT joint and soft tissue confluence important role in ulnar column stability of the wrist
- Susceptible to traction and pressure forces

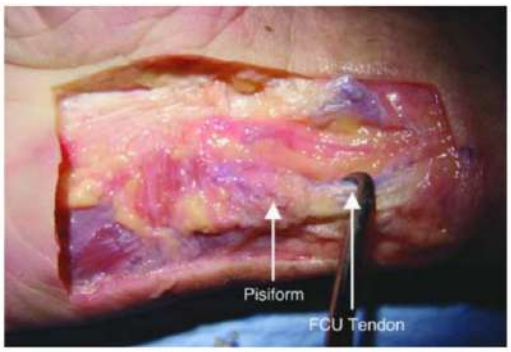


FIGURE 4. The ulnar nerve exposed by retraction of the flexor carpi ulnaris (FCU) tendon, showing its intimate relationship with the pisiform bone.

Collins, E.D. and I. Gharbaoui, *Imaging and anatomic study of the pisiform bone/ulnar nerve relationship-evaluation of the preferred surgical approach for the excision of the pisiform bone.* Techniques in Hand and Upper Extremity Surgery, 2010. **14**(3): p. 150-154.

7

Pisiform ligament complex (PLC)

- Rayan et al
- Interplay of 12 structures work together to ensure appropriate movement of the volar ulnar wrist

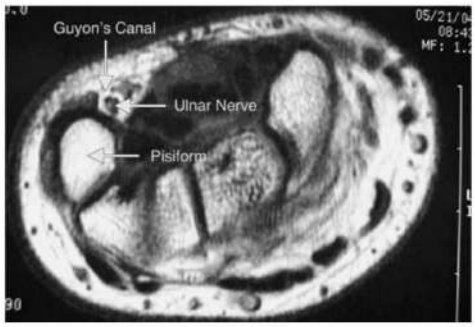
Rayan, G.M., B.H. Jameson, and K.W. Chung, *The pisotriquetral joint: anatomic, biomechanical, and radiographic analysis.* J Hand Surg Am, 2005. **30**(3): p. 596-602.

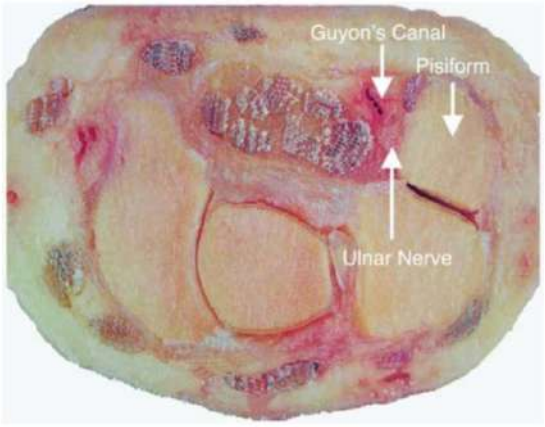
Figure 1. The base of the fifth metacarpal (large arrow), hook of hamate (hamulus) (arrowhead), and pisiform (small arrow with dot) centrally located with the following attachments: flexor carpi ulnaris tendon proximally, PH ligament radially, and PM ligament distally.

8

Guyon's Canal

- Space holder for canal
- Collins et al 2010
  - Less than 1 mm space separates pisiform from ulnar nerve





Collins, E.D. and I. Gharbaoui, *Imaging and anatomic study of the pisiform bone/ulnar nerve relationship-evaluation of the preferred surgical approach for the excision of the pisiform bone.* Techniques in Hand and Upper Extremity Surgery, 2010. **14**(3): p. 150-154.

9

Examination of the Pisotriquetral Joint

- Direct palpation or grind over pisiform produces pain
- PT shear test
- "Ward maneuver"
  - Resisted FCU flexion
  - Pain in wrist extension >> wrist flexion

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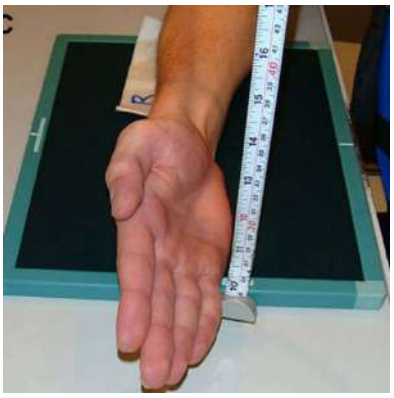
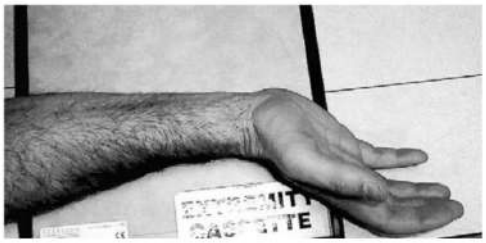
Special Radiographic Views

- 30 degree semi-supinated oblique view
- Garraud view
  - 30 degree semi-supinated, slight wrist extension oblique view





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Advanced Imaging

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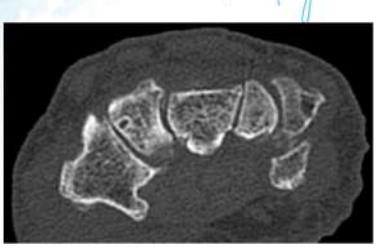
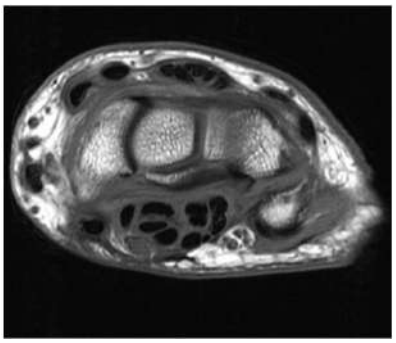
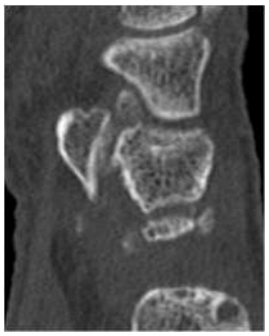
- CT
- MRI
- Ultrasound







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Treatment

- Conservative
  - Activity modification, splinting, NSAIDs, immobilization period
- Corticosteroid injection
  - Diagnostic and/or therapeutic
- Surgery

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Pisiformectomy

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- 1899 van der Donck
- Krag (1974),Green (1979), Carroll (1985), Palmieri (1982), Johnston (1986), Paley (1987), Trail and Linscheid (1992)
- Considered standard treatment
- Relatively simple surgery and recovery

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Pisiformectomy: Operative Technique

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Exposure

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Localization

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Subperiosteal dissection

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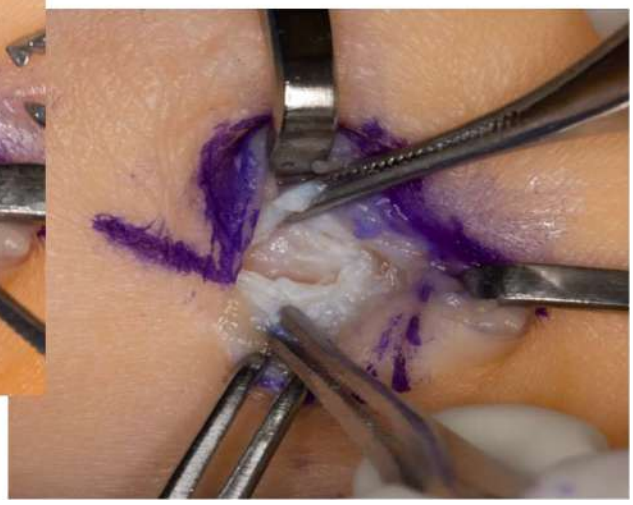

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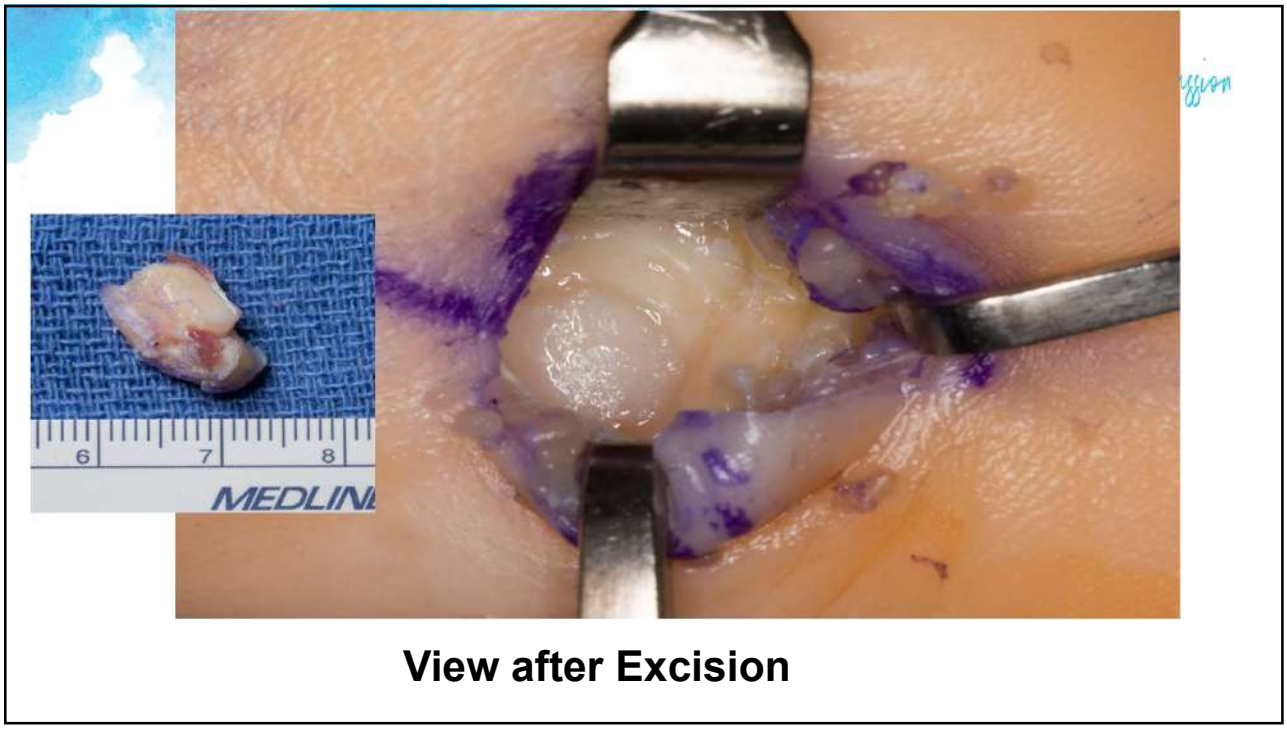
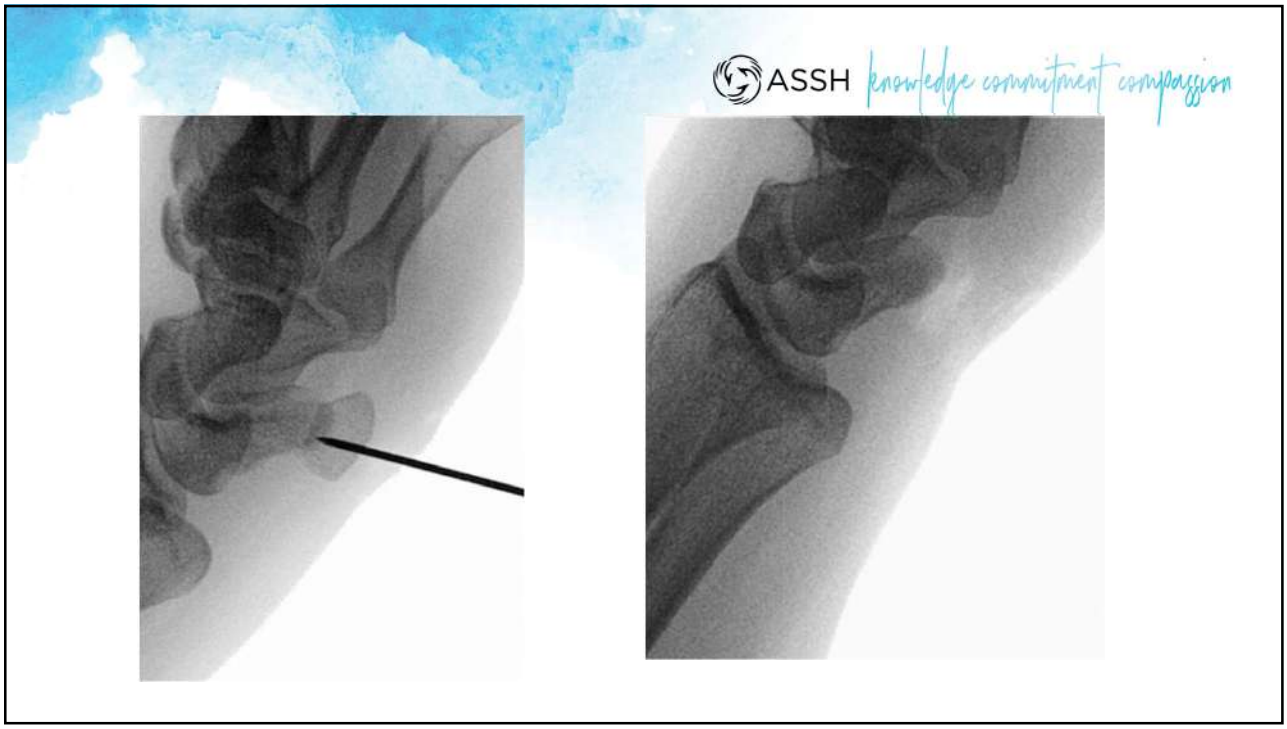


View after Excision

19

20



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Postoperative management

- Volar resting splint and/or cast 2-6 weeks
- Early digit ROM, lifting restrictions
- Gentle progressive motion and activity

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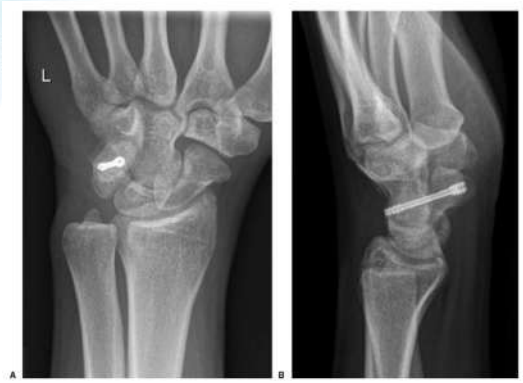
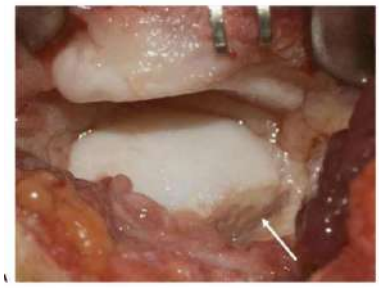
Other options

- Opponents cite altered kinematics
- Concern for neurovascular compromise

- Fusion
  - Headless compression screw
  - Maintenance of biomechanical and anatomic advantages
  - Limited data





Singer, G., R. Eberl, and M.E. Hoellwarth, *Pisotriquetral arthrodesis for pisotriquetral instability: Case report.* Journal of Hand Surgery, 2011. **36**(2): p. 299-303.

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Functional Outcomes

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- Lam et al
  - 20 patients average of 65 months after surgery
  - No significant difference in grip strength, range of motion, static strength or dynamic power

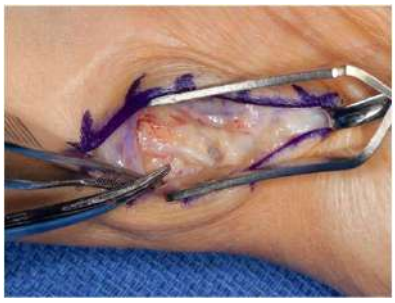
Lam, K.S., S. Woodbridge, and F.D. Burke, *Wrist function after excision of the pisiform.* Journal of Hand Surgery, 2003. **28 B**(1): p. 69-72.

24

Functional Outcomes

ASSH knowledge commitment compassion

- Campion et al
  - 12 patients average 7.5 years follow up
  - Wrist flexion 99%, extension 95% of nonsurgical hand
  - Grip 90% of non-operative
  - Mean static flexion strength 94%, dynamic 113%
  - Mean ulnar static flexion 87%, dynamic 103%



Campion, H., et al., *Pisiform excision for pisotriquetral instability and arthritis.* J Hand Surg Am, 2014. **39**(7): p. 1251-1257.

25

Functional Outcomes

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- van Eijzeren et al
  - 9 patients post-pisiformectomy
  - Compared to age-matched controls
  - No significant difference in grip or pinch strength, flexion and extension forces, ulnar and radial deviation and flexion
  - Wrist extension was significantly reduced in the operative group
  - Postoperative functional outcomes worse DASH and MHOQ score in operative group
  - Patients reported satisfaction

van Eijzeren, J. and R.P. Karthaus, *The effect of pisiform excision on wrist function.* J Hand Surg Am, 2014. **39**(7): p. 1258-63.

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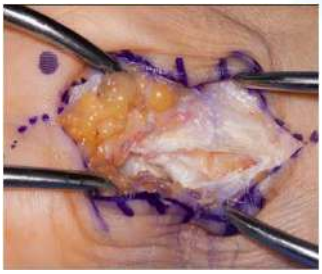
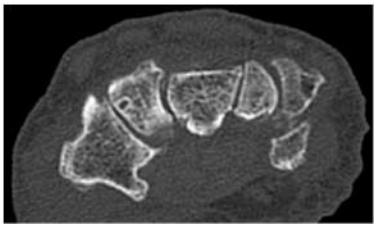
Long Term Outcomes





- O'Shaughnessy, Lewallen, Moran, Rizzo JSOA 2019

- All pisiformectomies 1988-2015 Mayo Clinic
- 61 pts, average 8.2 year follow up
- Post-traumatic OA 81%
- Good outcomes and minimal complications (3%) noted
- Similar strength, range of motion with contralateral
- 57/61 (93%) did not require further procedures

27

Satisfaction

- Campion et al
  - 12/12 patients satisfied with outcome of pisiformectomy average of 7.5 years after surgery

Campion, H., et al., *Pisiform excision for pisotriquetral instability and arthritis.* J Hand Surg Am, 2014. **39**(7): p. 1251-1257.

- Lautenbach et al
  - 35 patients
  - Visual analog scale (VAS) score 7.8 pre → 1.3 post ($p<0.01$)
  - DASH score 25.3

Lautenbach, M., et al., Comparison of clinical results after pisiformectomy in patients with rheumatic versus posttraumatic osteoarthritis. Orthopedics, 2013. 36(10): p. 01477447-20130920.

28

Complications

- Ulnar neuropraxia
  - vanEijerzen 80%, O'Shaughnessy 1%
- Scar pain, sensitivity (pillar pain)

29

Post partial or total wrist fusion pain

Figure 3. (A, B) Posteroanterior radiograph of wrist in radial deviation pre- and post–four-corner fusion demonstrating decrease in pisiform excursion following arthrodesis (decreased space between marker pins after four-corner fusion).

- Gaston et al
- 9 patients developed pain after partial or total wrist fusion
- Underwent pisiformectomy with resolution of pain

Gaston, R.G., et al., *Pisotriquetral Dysfunction Following Limited and Total Wrist Arthrodesis.* Journal of Hand Surgery, 2007. **32**(9): p. 1348-1355.

30

Summary

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- Pisotriquetral joint pathology rare
- Volar ulnar symptoms
- PLC important role in ulnar column stability of volar wrist
- Meticulous dissection crucial
- Maintenance of soft tissue confluence and stable repair
- Reasonable functional long term outcome data
- Pisiformectomy reliable pain-relieving procedure

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Thank You

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San Francisco, CA SEPTEMBER 30 – OCTOBER 2, 2021

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On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

30 Minutes

Rapid Fire Cases: Guyons Canal

Geneva Vicenta Tranchida, MD
No relevant conflicts of interest to disclose

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Speaker has not provided a handout for this presentation.

Session Handouts

OnDemand

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On-Demand Pre14: The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check

30 Minutes

Rapid Fire Cases: Hook of Hamate

Hannah H. Lee, MD, PhD
No relevant conflicts of interest to disclose

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The Queens Gambit: Strategies for Keeping Ulnar Sided Wrist Pain in Check (AM21)

Rapid Fire Cases: Hook of Hamate

Hannah H. Lee, MD, PhD
University of Pennsylvania

San Francisco, CA SEPTEMBER 30 - OCTOBER 2, 2021

1

Hook of hamate fractures

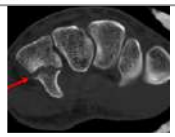
- Mechanism: Direct trauma to the proximal aspect of the palm
  - Golfers, baseball players, and racquet-sport players
- Presentation: Point tenderness on the proximal aspect of the palm directly over the hamate hook
  - Associated ulnar nerve irritation

2

Hook of hamate fractures

- Diagnostic imaging
  - Plain XR
  - CT: Most frequently utilized
  - MRI
- Treatment: Acute injuries may be treated with 6 wks of cast immobilization

	Imaging detection rate* (%)
Plain radiographs	5/68 (10%)
Carpal tunnel view	7/16 (43%)
CT	37/40 (92%)
MRI	19/19 (100%)
Bone scan	10/11 (91%)



- Kadar et al, 2018
- Spencer et al, 2019

3

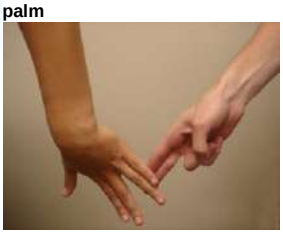
Hook of hamate fractures

- Hook of hamate nonunion
  - Presentation: Ulnar sided wrist pain, especially with weight bearing
  - Symptoms: Flexor tendinopathy/rupture; ulnar neuropathy
  - Treatment: Excision of the symptomatic fragment
    - Possible ORIF and bone grafting for large fragments.

4

Case presentation: Pain in ring and small fingers in outfielder after fall on palm

- Hook of hamate tenderness



- Hook of hamate pull test

5

Imaging

- Plain films and CT (-)
- MR shows “inflammation about SF FDP”

6

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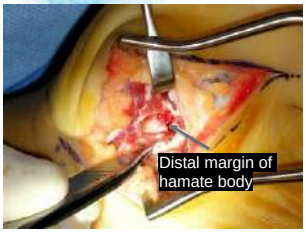

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Pro Baseball Player with recurrent pain post-excision hamate hook

12

- Heterotopic Ossification after Hamate Hook Excision

13

- Incision centered on hamate hook.
- Note prior midline incision

14

- Find and retract motor br.

15

- HO exposed

16

- HO resected; Adjacent FDP

17

Rehabilitation

- Resume aerobic work outs 3-5 days
- Baseball/Hockey
  - Dry swings/Stick handling 2 weeks
  - Batting off Tee/Light Scrimmage 3 weeks
  - BP/Full scrimmage 4 weeks
  - RTP 5-6 weeks

- Burleson, 2018

18

Acknowledgement

- Dr. Mark Baratz
- Dr. David Bozentka

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