TFCC Tears and Repair

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Disclosures

• The following relationships exist:

1. Grants
   American Foundation for Surgery of the Hand

2. Royalties and stock options
   Arthrex

3. Consulting income
   Smith and Nephew Endoscopy, Arthrex, Axogen

4. Research and educational support
   Arthrex

5. Editorial Honoraria
   Elsevier, Lippincott

6. Speakers Bureaus
   Arthrex, Trimed
Ulnar Sided Wrist Pain

I love it!
TFCC Anatomy

- TFCC (Triangular Fibrocartilage Complex)
  - Distal radioulnar ligaments
    - Palmar
    - Dorsal
  - Articular Disk
  - ECU Subsheath
  - Meniscal homologue
  - Ulnar collateral ligament
  - Ulnar extrinsic ligaments
Anatomy - Blood Supply

Only peripheral 10-30% has a blood supply

Bednar, Arnoczky, Weiland, JHS 1991
TFCC Injuries

- Tears of the TFCC are a common cause of ulnar-sided wrist pain.
- Traumatic tears usually occur with an extension and pronation force to an axially loaded wrist.
- Patients typically have pain with ulnar deviation and rotation of the wrist; gripping.
- More common in patients who are ulnar positive or neutral.
  - Ulnar negative patients have thicker articular disks.
Clinical Evaluation - Physical Exam

- **Fovea sign**
  - Focal tenderness to palpation at ulnar styloid base
- **TFCC stress test**
  - Axial load, ulnar deviation, rotation
- **Pain with maximal pronation/supination**
- **Test for DRUJ stability** (piano key & shuck test) in all positions - neutral, pronation & supination
Examination
Imaging - MRI

- Radial attachment of articular disk at sigmoid notch
- Articular disk
- Styloid insertion
- Foveal insertion
- Ligamentum subcruentum
Imaging - MRI

- ± MR Arthrography (Intra-articular injection)
- ± Indirect MR Arthrography (IV contrast)
- 1.5T: 85% sensitive
- 3.0T: 94% sensitive

Anderson et al JHS 2008, Faber et al JHS 2010
Imaging - Arthroscopy

• Gold Standard
• Diagnostic as well as therapeutic
• Can detect TFCC tears as well as other pathology
  – chondral lesions
  – other ligamentous injuries
• TFCC Tears:
  • Loss of resiliency to probing (Trampoline test)
  – Indirect visualization of a peripheral tear
    • Hyperemia along periphery
    • Tears of LT ligament
    • ECU sheath injury
### Palmer’s Classification of TFCC Injuries

#### Class 1: Traumatic
- **Type A:** Central perforation
- **Type B:** Medial avulsion (ulnar attachment)
  - With distal ulnar fracture
  - Without distal ulnar fracture
- **Type C:** Distal avulsion (carpal attachment)
- **Type D:** Lateral avulsion (radial attachment)
  - With sigmoid-notch fracture
  - Without sigmoid-notch fracture

#### Class 2: Degenerative (ulnocarpal impaction syndrome)
- **Stage A:** TFCC wear
- **Stage B:** TFCC wear with lunate and/or ulnar chondromalacia
- **Stage C:** TFCC perforation with lunate and/or ulnar chondromalacia
- **Stage D:** TFCC perforation with lunate and/or ulnar chondromalacia and
  lunotriquetral-ligament perforation
- **Stage E:** TFCC perforation with lunate and/or ulnar chondromalacia,
  lunotriquetral-ligament perforation, and ulnocarpal arthritis

Palmer Traumatic Tears - Type 1
TFCC Treatment

• History, clinical findings, and studies are all used to formulate a plan
• Non-operative management is the initial treatment
  – Unless there is gross instability
  – Immobilization for 4-6 weeks may allow healing of a TFCC tear
    • 57% versus 43% (Yao, et al 2010)
    • Acute peripheral tears may heal given their vascularity
  – Corticosteroid injections
• Otherwise, surgical intervention
  – Debridement vs repair
  – Based on location of tear
TFCC Tears

- Classification of TFCC tears
  - Palmer, 1989
  - Traumatic
    - IA – central perforation - DEBRIDE
    - IB - ulnar/peripheral avulsion - REPAIR
    - IC – distal/volar avulsion - DEBRIDE
    - ID – radial avulsion - DEBRIDE
  - Degenerative
Palmer 1A Tear

- Central tear
- Unlikely to heal (avascular)
- May be debrided
  - up to 2/3 of disk without affecting load transfer
- Typically ulnar positive variance:
  - Consider ulnar recession (wafer) or shortening osteotomy
Palmer 1C Tear

- Usually treated non-operatively or with debridement
- If repair is necessary be mindful of ulnar artery and nerve in region whether repairing through scope or open
- Ulnar extrinsic split tears
  - Berger, et al.
Palmer 1D Tear

• Controversial
• Little if any vascularity to area
• Open and arthroscopic (difficult) treatments report good outcomes
  – Scope:
    • Meniscal repair sutures used
    • Exit between 1st and 2nd wrist extensor compartments
      (radial sensory nerve)
  – Open:
    • Dorsal approach between 5th and 6th extensor compartments
• Simple debridement has satisfactory results
Palmer 1D Repair
Palmer 1B (Peripheral) Tear
Surgical Options for IB Tears

- **Open Repair**
  - Bone tunnels
  - Suture anchors

- **Arthroscopic-Assisted**
  - Inside-out
  - Outside-in (Whipple & Geissler)

- **All-Arthroscopic**
  - Yao et al (Arthroscopy, 2007)
  - Aztei (THUES, 2008)
  - Geissler (Hand Clin 2011)
  - Nakamura (Hand Clin 2011)
  - Shinohara (JHS 2013)
  - Etc, etc
Open Repair
Arthroscopic -Assisted Repair
Disadvantages of Current Techniques

• Extra/larger incision
• Prominent subcutaneous suture knots
• Patient intolerance of buttons
  – Painful, unsightly, malodorous, skin changes
  – Septic arthritis
• Possible nerve injury
Introduction

• All-Arthroscopic Method of Repair
  • Yao et al, Arthroscopy, 2007
All-Arthroscopic TFC Repair

• Pretied suture device
• Designed for knee meniscal repair
• New technique for the use in TFC repairs
• Potential for Decreased:
  – Operative time
  – Incisions
  – Prominent suture knots
• Increased
  – Efficiency
  – Safety
  – Strength
Biomechanical Strength and Safety Study

- 10 matched fresh-frozen cadaveric wrist specimens
- Iatrogenically produced peripheral TFC tears
- Experimental group:
  - Two pretied suture devices in vertical configuration
- Control group:
  - Two outside-in 2-0 PDS sutures in vertical configuration (ala Whipple/Geissler)
- Location of implants relative to the N/V structures
- Instron MTS
  - Specimens loaded to failure
Ulnar Dissection

Whipple/Geissler (PDS)
Distance from UNB: 1.9 cm
Distance from DBUN: 4.6 mm

Suture Device
Distance from UNB: 1.8 cm
Distance from DBUN: 17.1 mm
Biomechanical Strength of Repair

Figure 3: Load to failure of Suture Device versus 2-0 PDS (*p<0.05)

Yao, JHS, 2009
Arthroscopy Set-Up
Portals

ECU over ulnar head

Lister’s tubercle

EPL

6-R

3-4
Arthroscope in 3-4 Portal, Instruments in 6R Portal
Arthroscope in 4-5 Portal
Suture Device in 3-4 Portal
After Repair
Arthroscope in 3-4
Probe in 6R

Before Repair
Pre-Repair

Post-Repair

Arthroscope in 3-4

Probe in 6R

Pre-Repair
Clinical Experience

• Retrospective Review 2005-2009
  – One hand surgeon
  – Patients with persistent ulnar-sided wrist pain despite immobilization and injections
  – MRI consistent with TFC tear
  – No concomitant DRUJ instability

Yao, et al. JHS 2011
Results

- 12 patients
- Mean f/u: 17.5 months
- Supination: 78 (+/- 14)
- Grip strength: 64% (+/- 16)
- quickDASH: 11 (+/- 12)
- PRWE: 19 (+/- 14)
- Mean time to full activity: 5 months
- 0 surgical complications

Yao, et al.  JHS 2011
All-Arthroscopic Repair

- All-arthroscopic repair of peripheral TFC tears show excellent short term results
  - 1 year followup, 93% achieved excellent subjective outcomes based on quickDASH and PRWE

- Benefits of this technique are
  - ease of use… and it’s FAST!
  - lack of prominent suture knots or button
  - no extra incisions
  - safety
  - strength of repair
    - reduced immobilization from long arm Munster cast (6 wks) to short arm splint (2 wks) to NO immobilization (Gaston)
Foveal vs Capsular Repair?
### Comprehensive Classification of TFCC Peripheral Tears

Table: Comprehensive Classification of TFCC Peripheral Tears and associated Ulnar Styloid Fractures

<table>
<thead>
<tr>
<th>CLASS 0</th>
<th>CLASS 1</th>
<th>CLASS 2</th>
<th>CLASS 3</th>
<th>CLASS 4</th>
<th>CLASS 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated styloid fracture without TFCC Tear</td>
<td>Distal TFCC Tear</td>
<td>Complete TFCC Tear</td>
<td>Proximal TFCC Tear</td>
<td>NON-repairable TFCC Tear</td>
<td>DRUJ Arthritis</td>
</tr>
<tr>
<td>DRUJ Ballottement Test</td>
<td>Negative</td>
<td>Slight Laxity (Hard end-point)</td>
<td>Mild to Severe Laxity (Soft end-point)</td>
<td>Variable</td>
<td></td>
</tr>
<tr>
<td>Intact Ulnar Styloid or Tip Fracture of the Ulnar Styloid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basilar Fracture of the Ulnar Styloid</td>
<td>(Floating styloid*)</td>
<td></td>
<td>CLASS 3-A Avulsion Fracture of TFCC Insertion</td>
<td>CLASS 4-A</td>
<td>CLASS 4-B</td>
</tr>
<tr>
<td>Appearance of the Distal TFCC (during RC Arthroscopy)</td>
<td>Normal Appearance (NO tear)</td>
<td>Peripheral Tear</td>
<td>Normal Appearance (NO tear)</td>
<td>Massive Tear Degenerated Edges</td>
<td>Frayed Edges Fails Suture</td>
</tr>
<tr>
<td>Tension of the proximal TFCC (Hook Test)</td>
<td>Teut TFCC (Negative Hook Test)</td>
<td></td>
<td>Loose TFCC (Positive Hook Test)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cartilage status of DRUJ</td>
<td>well preserved Cartilage</td>
<td></td>
<td></td>
<td>Degenerative or Traumatic Cartilage Defect</td>
<td></td>
</tr>
</tbody>
</table>

**Suggested treatment**
- CLASS 0: Splinting for pain relief (Fragment removal in chronic painful cases)
- CLASS 1: TFCC Suture (Splinting of acute cases)
- CLASS 2: TFCC Forveal Refixation
- CLASS 3: Styloid fixation
- CLASS 4: Tendon Graft Reconstruction
- CLASS 5: Arthroplasty
Foveal vs Capsular TFCC Repair: What’s the Evidence?

- Anderson and Berger, et al. (JHS 2008)
  - 75 patients over 10 years
  - 36 arthroscopic, 39 open
  - Mean f/u: 43 months
  - **NO** significant differences in objective and subjective outcomes
  - Non-significant trend toward increased ulnar nerve irritation with open repair
  - 17% total reoperation rate for DRUJ instability
    - 8 open, 5 arthroscopic
TFCC Tears - Summary

- TFCC
  - major stabilizer of the DRUJ
  - provides suspensory mechanism for ulnar carpus
  - central articular disk is the load-bearing component of TFCC
  - allows transmission of axial load from carpus to forearm
  - Injuries are a common cause of ulnar sided wrist pain
Conclusion

• Central, Volar and Radial TFCC tears should be debrided
  – UE split tears?

• Peripheral TFCC tears should be repaired

• Not all peripheral tears are the same
  – Palmer 1B
  – Atzei & Luchetti Classification
    • DRUJ instability

• If DRUJ stable, any repair technique is fine
• If DRUJ unstable, foveal/bony repair should be employed
  – Open
  – Arthroscopic
Thank You!