Osseous Injuries in Skeletally Immature Throwing Athletes

Michael T. Freehill M.D.
Associate Professor of Orthopaedic Surgery
University of Michigan

ISAKOS
Shanghai, China
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Disclosures

Consultant: Smith and Nephew, Mitek

Research support: Smith & Nephew, RTI

Committee member: AOSSM, AAOS, AANA, ISAKOS
Special Thanks

MANAGEMENT OF PHYSEAL ELBOW INJURIES IN THE SKELETALLY IMMATURE ATHLETE:
A SYSTEMATIC LITERATURE REVIEW

Haws BE, Stone AV, Usoro AO, Marquez-Lara A, Mannava S, Freehill MT.

Special Acknowledgement:

Brittany Haws B.S.
Sport Specialization

- Intensive, yr-round (8+months/yr) training/competition in a single sport to exclusion of all other organized sports
- No empirical evidence indicating early sport specialization enhances performance and/or progression to elite level
- Single sport baseball players w/ increased risk of UCL injury

Bruce, Andrews 2014
# Pitch counts

<table>
<thead>
<tr>
<th>AGE</th>
<th>DAILY MAX (PITCHES IN GAME)</th>
<th>REQUIRED REST (PITCHES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 Days</td>
</tr>
<tr>
<td>9-10</td>
<td>75</td>
<td>1-20</td>
</tr>
<tr>
<td>11-12</td>
<td>85</td>
<td>1-20</td>
</tr>
</tbody>
</table>
The Physis

- Physeal fractures
  - most commonly occur at junction of calcified and uncalcified hypertrophic cells
- Ligaments in children are stronger than physis
  - less likely to be site of injury
Systematic review- Methods

• Search terms:
  – Pediatric elbow injury
  – Adolescent elbow injury
  – Elbow physeal injury
  – Avulsion fracture medial epicondyle
  – Little league elbow
  – Throwing
  – Athlete
Systematic review- Methods

• Inclusion criteria:
  – Physeal elbow injury as a direct consequence of athletic activity
  – Distinct treatment modality and/or outcome
  – Patients with demonstrated skeletal immaturity
  – Level of Evidence I-IV
PubMed, ScienceDirect Review

1235 records

231 duplicates removed

1004 records

947 excluded after title or abstract review

57 full text articles reviewed

39 articles excluded

18 articles

6 articles excluded due to single patient case reports

12 articles met all criteria
Systematic review

- 12 studies met inclusion criteria
- Total of 157 patients
- Injury types:
  - Avulsion fracture of the medial epicondyle (46.5%)
  - Medial epicondylar fragmentation (38.9%)
  - Olecranon apophysitis (5.1%)
  - Persistence of the olecranon physis (5.1%)
  - Olecranon physeal stress fracture (4.5%)
Avulsion Fracture Medial Epicondyle (AFME)

- Non-operative treatment = 31.5%
- Immobilization in a splint or long arm cast
- Gradual increase in activity
- Avg time RTP = 8.4 months (range 6-10 months)
- Complications:
  - Loss of ROM (3 pts <10°, 1 pt 30°)
  - Intermittent numbness (1 pt)
  - Continued pain (1 pt)
- All patients able to RTP at previous level
Avulsion Fracture Medial Epicondyle (AFME)

- Operative treatment = 68.5%
  - cannulated screw or K-wires
- Avg time RTP = 3.3 months (range 1-10 mos)
- Complications:
  - Intermittent numbness (12%)
  - Loss of <10° of ROM (5%)
• 14 yo M RHD w/ acute R elbow pain
  – after throwing ball from 1st to 3rd base
  – 1 mo h/o elbow pain preventing him from pitching
Avulsion Fracture Medial Epicondyle

• Placed in long arm splint
  – Discussed operative intervention
• f/u in clinic 2 weeks later
• Decided to proceed with operative fixation
  – 4 weeks after injury
  – Throwing athlete
• 4.0 cannulated screw
  – Placed in bivalve cast
  – Sling x 2 weeks
Avulsion Fracture Medial Epicondyle

- **2 wks post-op**
  - PROM>AAROM>AROM
- **4 wks post-op**
  - Strengthening
- **Throwing program**
  - Once fracture healed
Medial Epicondylar Fragmentation

• All cases treated non-operative
• Activity limitation with gradual return to full activity
• Avg time RTP= 3.8 months (range 1-8 months)
• Complications:
  – Continued pain
  – Recurrence

Harada et al. AJSM 2012
Outcome of Nonoperative Treatment for Humeral Medial Epicondylar Fragmentation Before Epiphyseal Closure in Young Baseball Players

Mikio Harada,**† PhD, Masatoshi Takahara,‡ PhD, Tomoyuki Hirayama,‡ PhD, Junya Sasaki,§ MD, Nariyuki Mura,† PhD, and Toshihiko Ogino,† PhD
Investigation performed at Yamagata University School of Medicine, Yamagata, Japan

- 55 patients
- 9-13 y/o
- At 1 year
  - Bony union > decreased pain
- At 6 mos & 1 year
  - Delayed union associated with return to full throwing before union
Olecranon Epiphyseal Stress Fracture

- 85.7% treated operatively
  - cannulated screw
- Average time to return to play
  - 7 months (range 4-10 months)
- Postoperative hardware irritation
  - common
Olecranon stress fracture Case

- 14M RHD
- Baseball pitcher and volleyball player
- 2 months insidious onset posterior pain
  - (with throwing or hitting volleyball)
- Tenderness posterior elbow over olecranon
- Right 0-0-150; Left 0-0-150 on the left
- UCL testing is symmetric bilaterally
Olecranon stress fracture

- Long arm cast
  - 3 weeks
Olecranon stress fracture

- 6.5mm x 7cm partially threaded cannulated screw
- Posterior slab splint > regular sling for the next 2 weeks
- No active flexion beyond 90 degrees for the first 6 weeks
- Strengthening starting at 8 weeks
- Throwers 10 program
- Advanced throwers 10 program with plyometrics
- Throwing program at 12 weeks
Olecranon stress fracture

- 2 week post-op
- Final follow-up
- Removal hardware (33%)


Cannulated screw fixation of refractory olecranon stress fractures with and without associated injuries allows a return to baseball.

Paci JM¹, Dugas JR, Guy JA, Cain EL Jr, Fleisig GS, Hurst C, Wilk KE, Andrews JR.
Other posterior compartment injuries

Persistence of the olecranon physis
- Is this precursor stress fracture?
- 87.5% treated operatively
  • All returned to play at 4 months
- Non-operative treatment
  • Return to play at 6 months

Olecranon apophysitis
- All treated non-operatively
- Cryotherapy, rest, physical therapy
  • Return to play not reported
## Summary

<table>
<thead>
<tr>
<th>Injury</th>
<th>Operative</th>
<th>Nonoperative</th>
<th>Return to play (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFME</td>
<td>68.5%</td>
<td>31.5%</td>
<td>3.3</td>
</tr>
<tr>
<td>Medial epicondylar fragmentation</td>
<td>--</td>
<td>100%</td>
<td>--</td>
</tr>
<tr>
<td>Olecranon physeal stress fracture</td>
<td>85.7%</td>
<td>14.3%</td>
<td>7</td>
</tr>
<tr>
<td>Persistence of olecranon physis</td>
<td>87.5%</td>
<td>12.5%</td>
<td>4</td>
</tr>
<tr>
<td>Olecranon apophysitis</td>
<td>--</td>
<td>100%</td>
<td>--</td>
</tr>
</tbody>
</table>
Conclusions:
Osseous Injuries
Skeletally Immature Throwing Athletes

• Limited literature!
• Acute Fracture Medial Epicondyle
  – Operative intervention = faster RTP
• Medial Epicondyle Fragmentation
  – Non-op = RTP 100% less than 4 months
• Persistence of Physis - Stress Fracture
  – Large screw improves RTP
  – High % of screw removal
References

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Thank you