Elbow Injuries in the Young Throwing Athlete

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2018
LITTLE LEAGUE
WORLD SERIES
CHAMPIONS

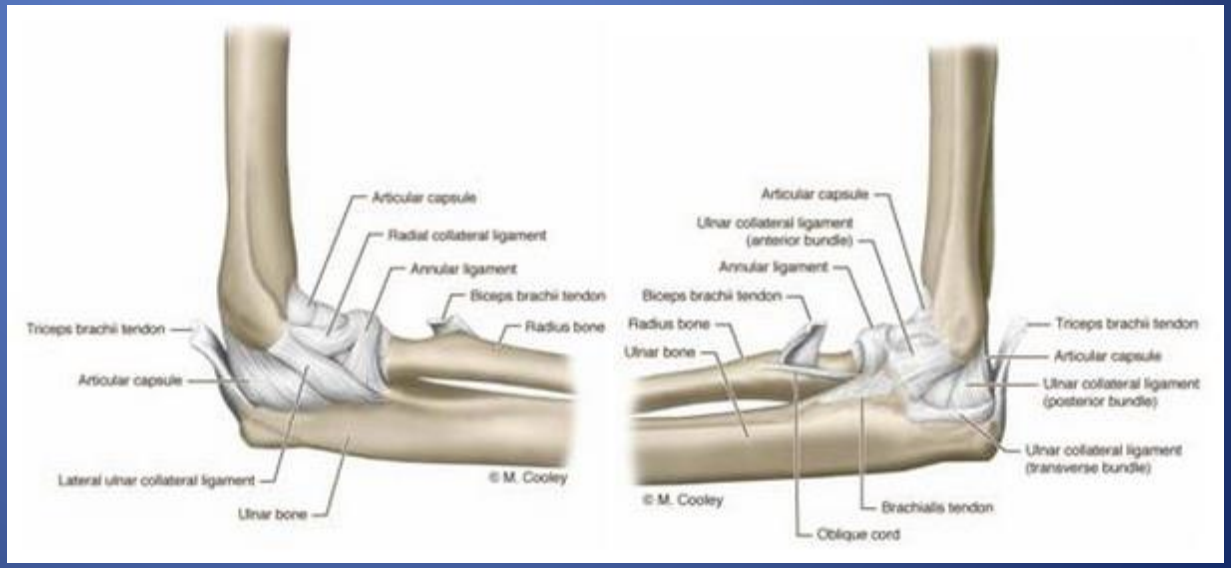

Indians

Objectives

- Review relevant elbow anatomy and throwing biomechanics
- Discuss common elbow injuries and their treatment in throwing athletes
- Understand risk factors and how to prevent elbow injuries in young throwers

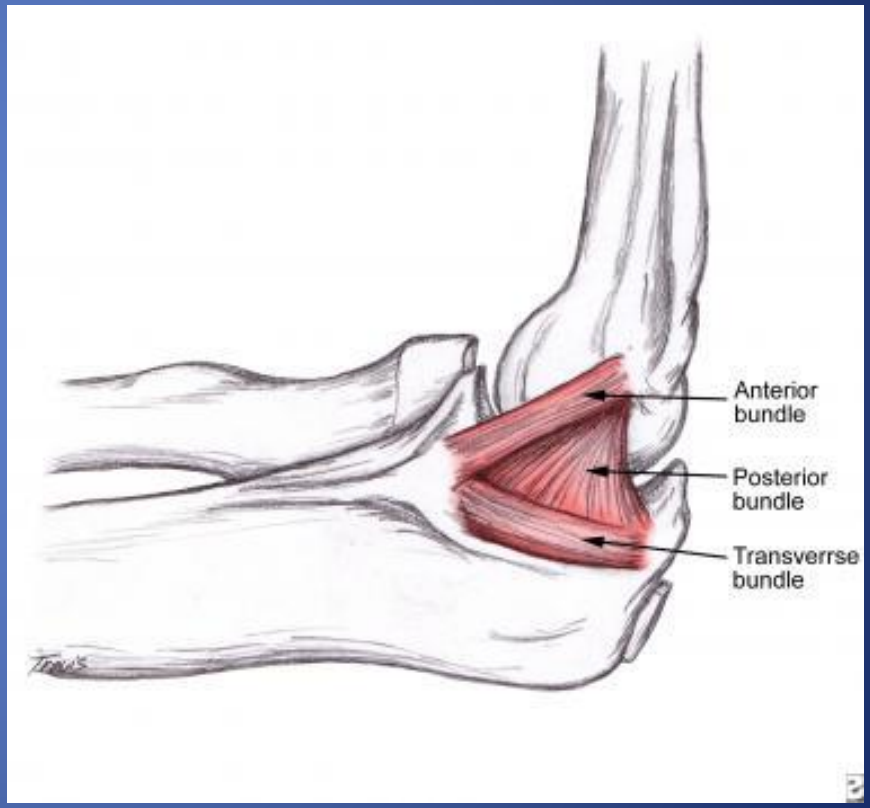
Primary Elbow Stabilizers

- Bone
  - Ulnohumeral articulation 50%
    - Primarily at end ROM
- Ulnar collateral ligament
  - Valgus stress
- Lateral UCL
  - Varus stress



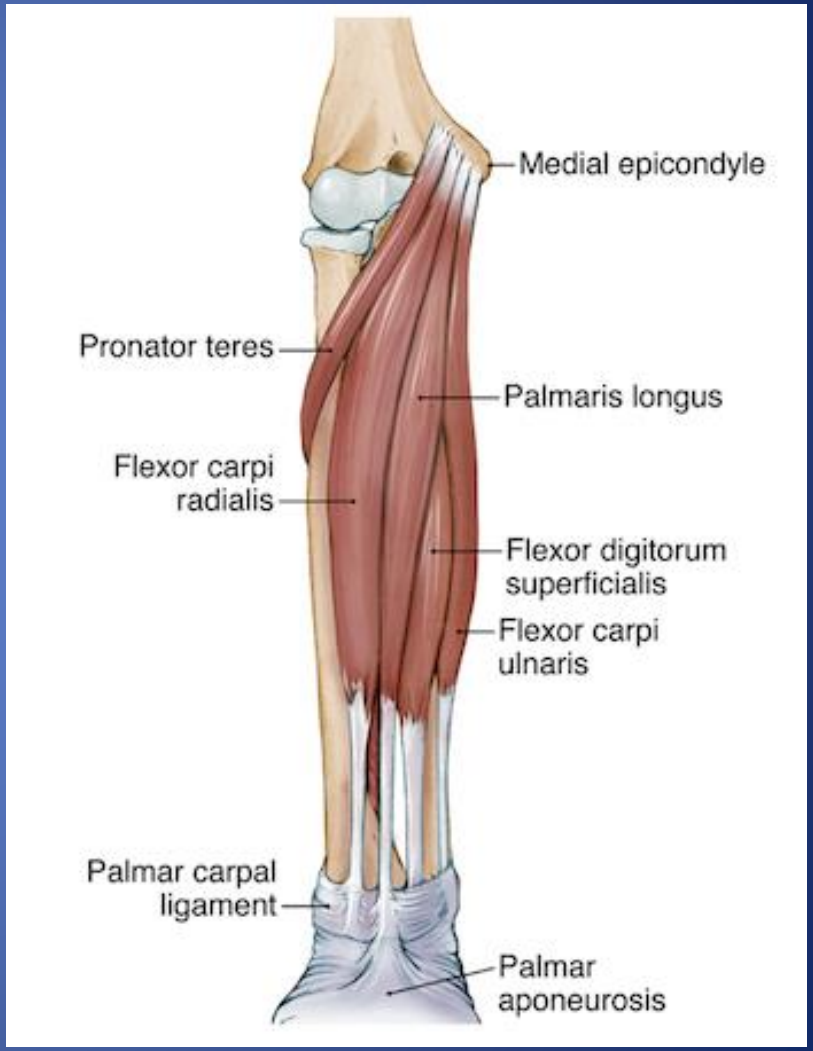
Ulnar Collateral Ligament Complex

- Anterior Bundle
  - Valgus stability throughout entire ROM
  - Anterior and Posterior Bands
- Transverse Bundle
  - Does not cross joint
- Posterior Bundle
  - Secondary stabilizer in flexion
- Load to failure ~32 Nm

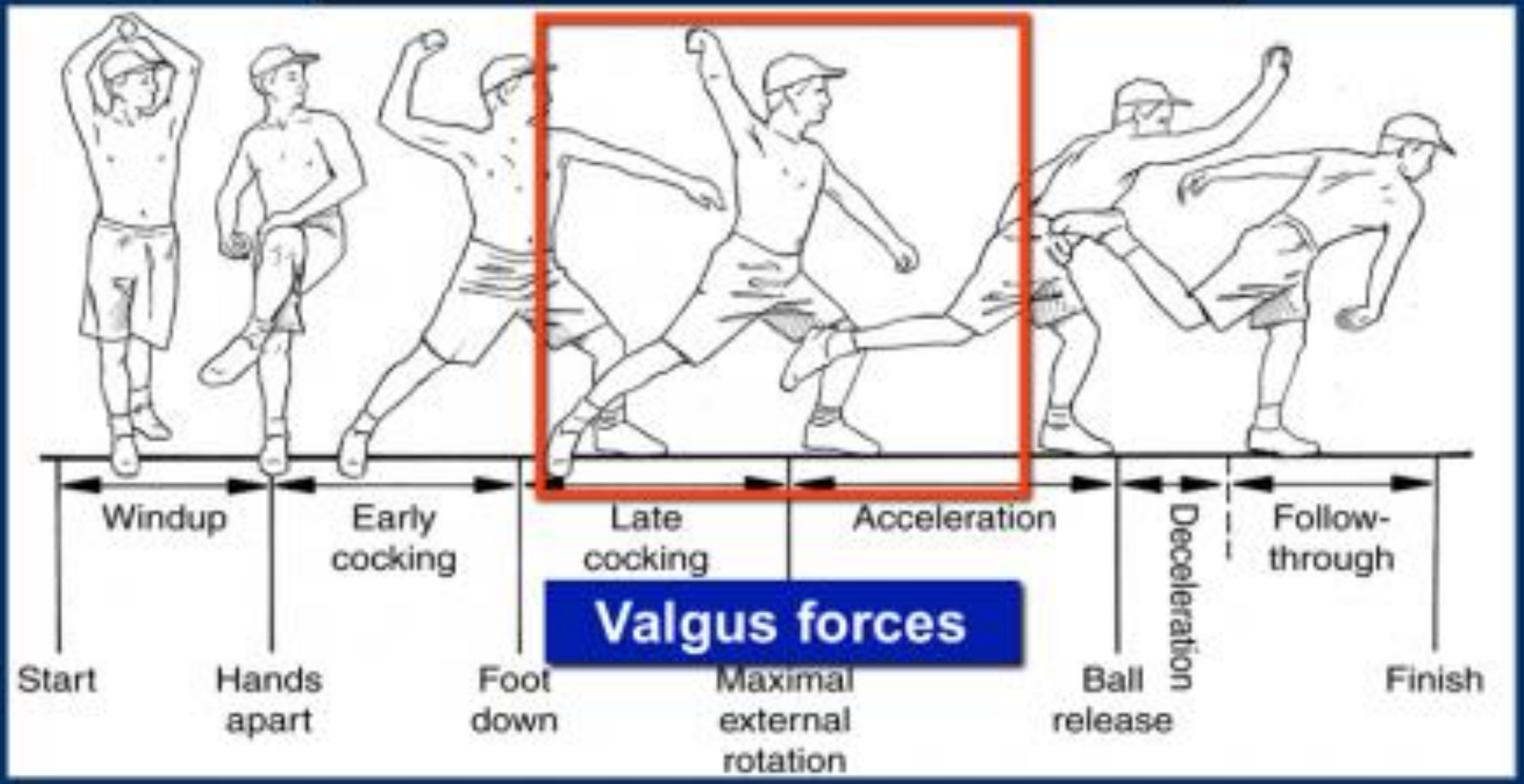


Secondary Stabilizers

- Functionally stabilize elbow against valgus stress during active ROM
  - Radiocapitellar articulation
  - FCU
  - FDS
  - PT

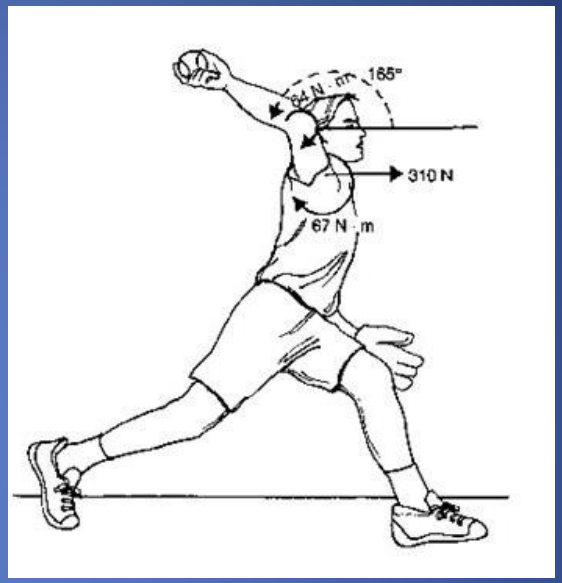


Throwing motion



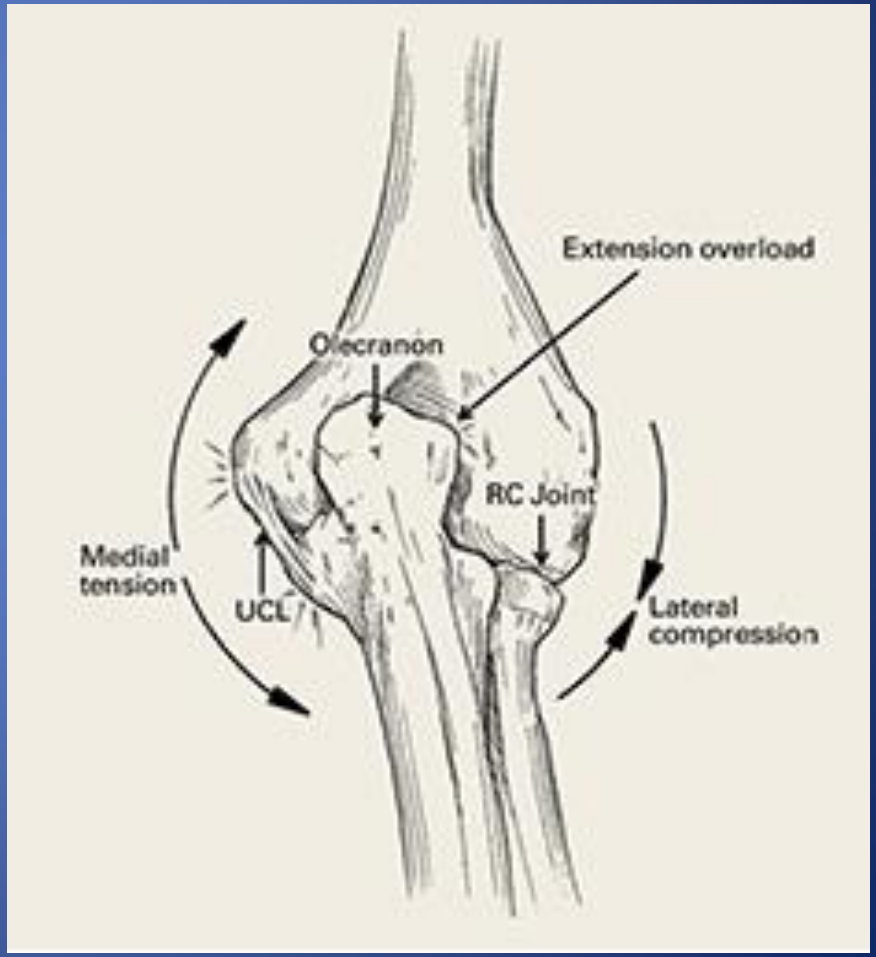
Elbow Stresses During Throwing

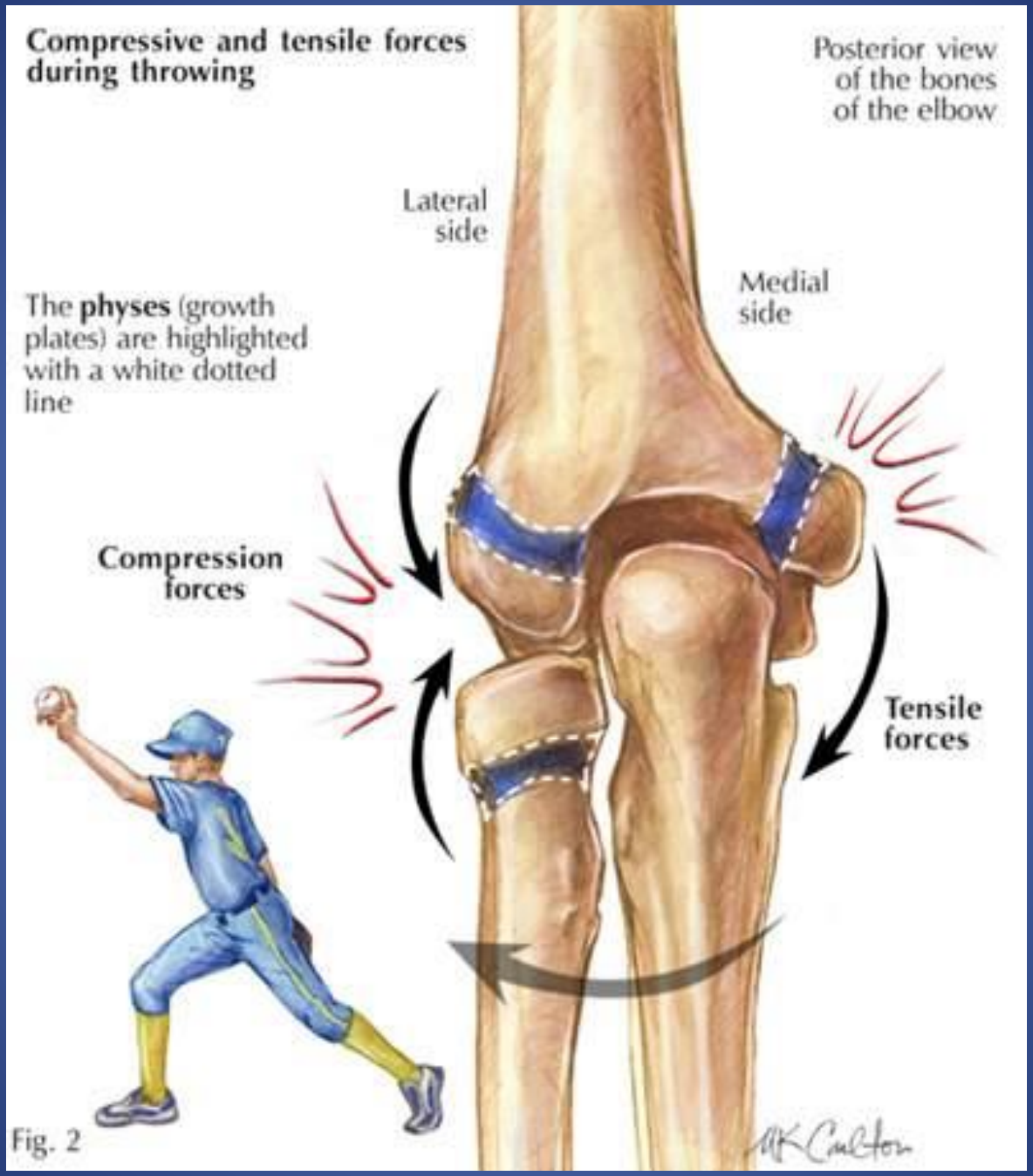
- Most elbow injuries occur during acceleration
  - Humeral IR torque
  - 64 Nm of valgus stress (can be much higher)
  - Rapid elbow extension
  - 500 N compressive force at radiocapitellar joint



Valgus Extension Overload

- Tensile Stress Medially
- Shear Stress Posteriorly
- Compressive stress laterally




Compressive and tensile forces during throwing
Posterior view of the bones of the elbow
Lateral side
Medial side
The physes (growth plates) are highlighted with a white dotted line
Compression forces
Tensile forces
Fig. 2

Panner's Disease

- AVN of the capitellum followed by reossification
- Chronic repetitive trauma
- Self-limiting
- 6-10 years of age
- Lateral elbow pain, aggravated by activity
- TTP over capitellum
- 20-30° extension lag
- Rest, NSAIDs, PT

Capitellar OCD

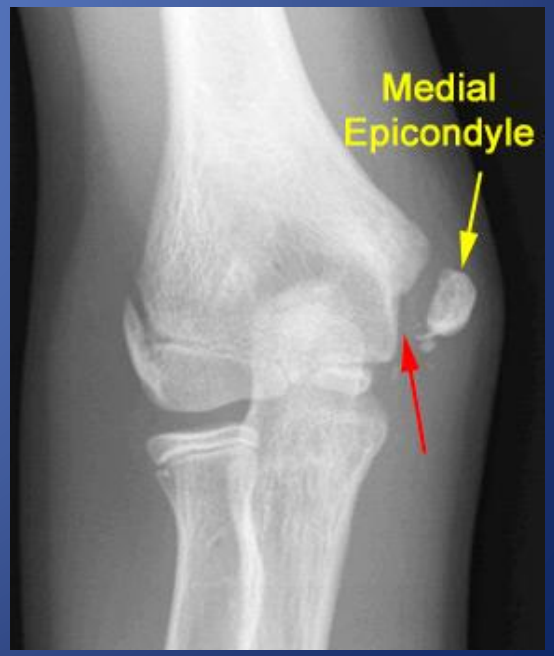
- Fragmentation of bone and overlying cartilage
- Chronic lateral compression
- 10-16 years of age
- Lateral elbow pain
  - Worse with activity
  - Mechanical symptoms
  - Elbow joint effusion
  - Decreased ROM
- Rest, NSAIDs
- Surgery

Olecranon Apophysitis/Stress Fracture

- Repetitive microtrauma
  - Olecranon impingement
  - Triceps tensile stress
- Age dependent injury pattern
- Posterior elbow pain
- TTP over olecranon
- Rest, NSAIDs
- Surgery

Little League Elbow

- Medial epicondyle apophysitis
- Repetitive valgus overload
- 10-15 year old
- TTP over medial epicondyle
- Pain with resisted wrist flexion and pronation
- Pain worse with throwing
- Rest, NSAIDs, PT
- Surgery



Ulnar Collateral Ligament Injury

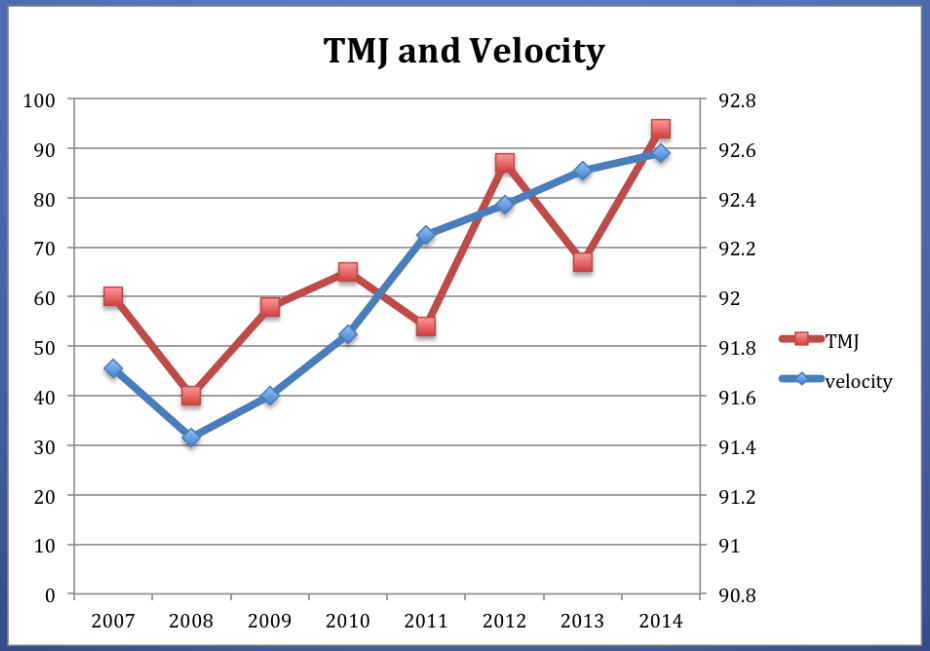
- Rarely occurs before fusion of the medial epicondyle
- Valgus extension overload
- Repetitive microtrauma more common than acute "pop"
- Medial elbow pain during late cocking/early acceleration
- Decreased accuracy and velocity
- Ulnar nerve symptoms

UCL load to failure = 32 Nm

Valgus stress during acceleration = 64 Nm

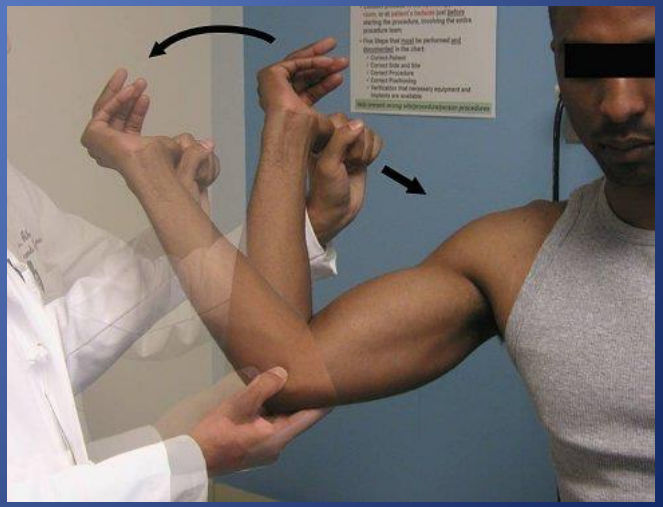
	Youth (n=23)	High School (n=33)	High School (n=115)	Professional (n=60)
Elbow Varus Torque (Nm)	28+-7	48+-13	55+-12	64+-15
Ball Speed (MPH)	62+-2	73+-4	78+-4	82+-4

Fleisig, et al., *J Biomechanics*, December 1999



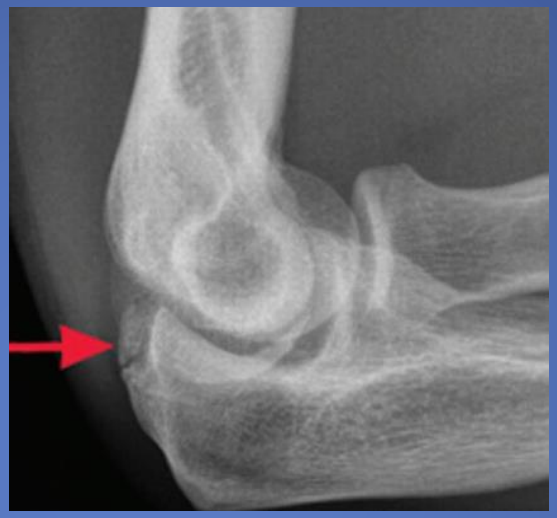
Physical Examination

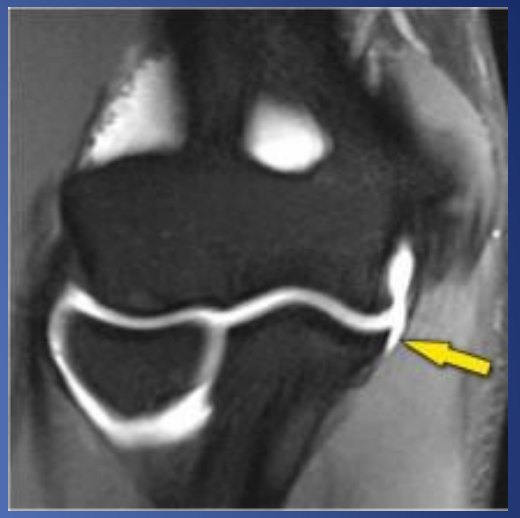
- TTP 1-2 cm distal to medial epicondyle
- No pain with resisted wrist flexion
- Stress tests
  - Valgus stress test
  - Milking maneuver
  - Moving valgus stress test



Imaging

- X-Ray
  - Avulsion
  - Osteophytes
- Stress XR
  - Rarely used
- MRI
  - Study of choice
  - +/- Arthrogram





UCL Tear Treatment

- Non-operative
  - Partial tears
  - Rest, hinged brace, strengthening (Flexor-Pronator), throwing program
  - *AJSM*, March 2016, Ford, et al.
    - 26/31 (84%) who completed rehab RTSP
  - *Journal of Sports Rehabilitation*, February 2019, Cascia, et al.
    - 100% RTP with grade 1 injury
    - 66-94% RTP with grade 2 tear
  - PRP?
    - 88% RTP at 12 weeks (Podesta, *AJSM*, 2013)
    - 96% RTP with improved MRI (Deal, *OJSM*, 2017)

UCL Tear Treatment

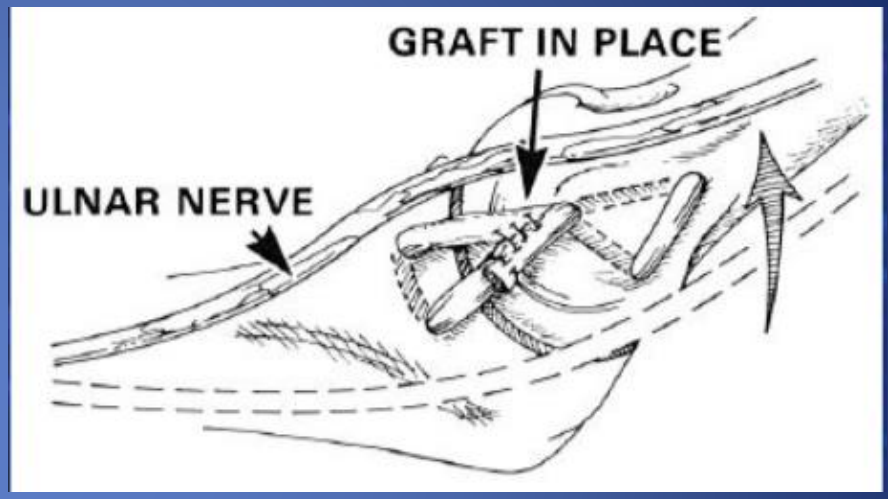
- Operative
  - Complete tears
  - Partial tears that fail rehab
  - Repair vs. Reconstruction

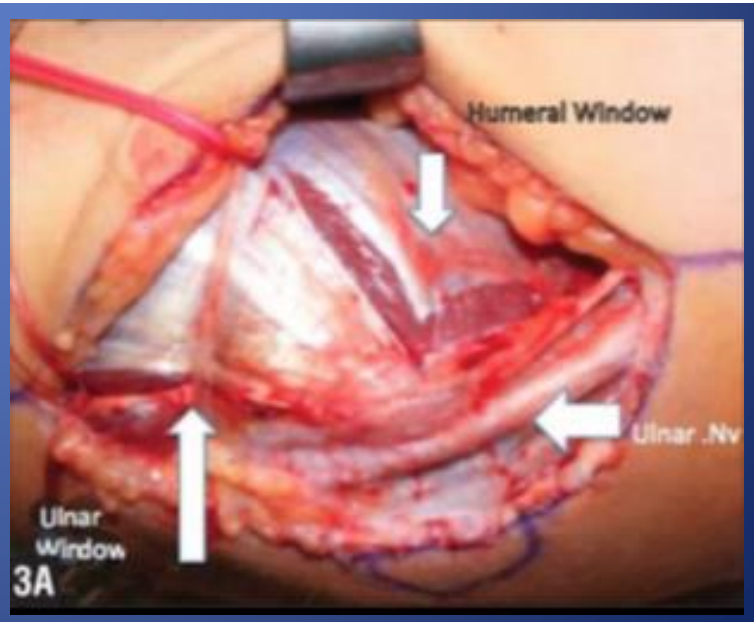
UCL Reconstruction

- First performed by Jobe in 1974
- Described in *JBJS* 1986
- Reconstruct anterior band of UCL
- Gold standard
- “Tommy John Procedure”
- Many subsequent modifications
- High RTP rates
  - 66-97%

UCL Reconstruction Techniques

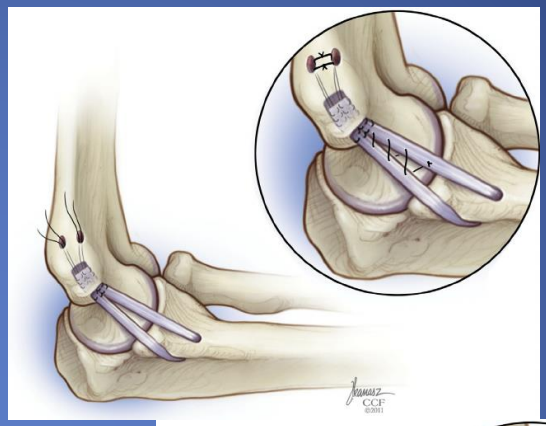
- Original Jobe technique
  - Harvest ipsilateral Palmaris longus
  - Reflect FP mass
  - Transpose ulnar nerve
  - Bone tunnels in distal humerus and olecranon
- Modified to split FP muscle and leave ulnar nerve in place
  - Better outcomes
  - Fewer complications
  - Less ulnar neuropathy

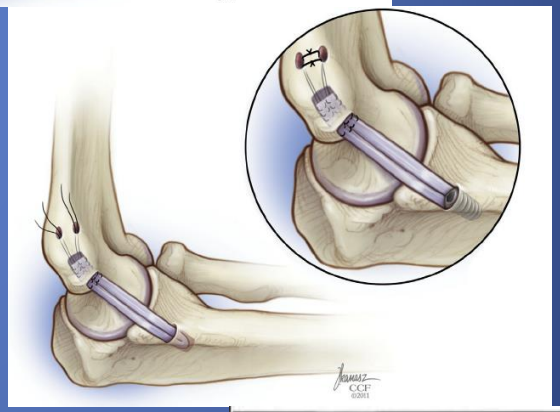




UCL Reconstruction Techniques

- Docking procedure
  - Blind humeral tunnel
  - 2 drill holes in ulna
- DANE TJ procedure
  - Docking in humerus
  - Interference screw in ulna
- Cortical buttons
- All designed to decrease number of tunnels and risk of tunnel failure



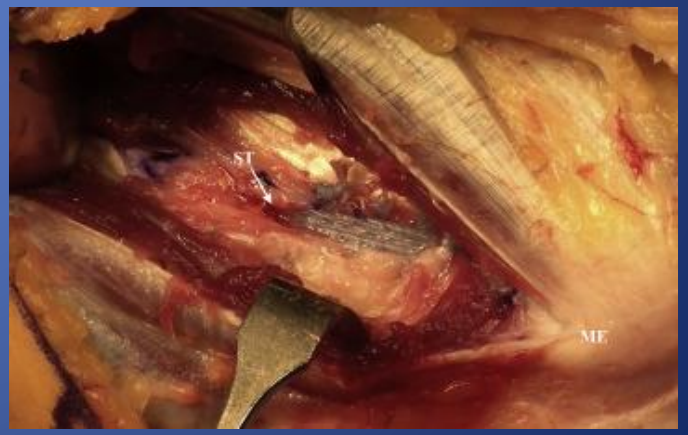


UCL Reconstruction Outcomes

- Saper, et al., *OJSM*, April 2018
  - 140 patients, 13-19 years old
  - ASMI technique (Docking + UNT)
  - 90% Return to same level of sport
- Peters, et al., *JSES*, March 2018
  - Systematic review, 22 studies
  - MLB, MiLB, College, HS
  - 79% Return to same level of sport
  - ***Increased ERA, walks, hits/inning***
  - ***Decreased innings and FB velocity***

UCL Repair

- Repair +/- Augmentation may be indicated in select patients
- Proximal or Distal Injuries only
  - Savoie, et al., *AJSM*, June 2008
    - 60 patients, 17.2 years old, 5 year F/U
    - Primary repair with drill holes or anchors 58/60 RTS by 6 months
    - 4 failures (2 early, 2 late)
  - Erickson, et al., *OJSM*, January 2017
    - Meta-analysis, 4 studies, 92 patients
    - 87% RTS
  - Walters, et al., *OJSM*, March 2016
    - 13 pitchers, 17.8 years old
    - Primary repair with Internal Brace Augmentation
    - 12/13 RTS by 6 months



UCL Reconstruction Rehab

- Splint for 7 days
- Gradually increase ROM over 4-8 weeks (+/- brace)
- Protected strengthening and conditioning week 8-16
- Interval throwing week 17-28
- Return to mound week 29
- Live batters week 40
- Return to play 12-18 months
- May be quicker for repair

Risk Factors and Injury Prevention

- Pitching with fatigue or pain
- Pitching >8 months/year
- Pitching on multiple teams with overlapping seasons
- Pitching >100 innings/year
- Pitching multiple games/day
- Pitching back to back days
- Playing pitcher and catcher
- Too many pitches
- Poor mechanics
- Increased velocity

Conclusions

- Overhead throwing exposes the elbow to significant stress
- Valgus Extension Overload is the underlying mechanism for many elbow injuries regardless of age
- Proper mechanics and avoiding overuse are essential to preventing injuries