

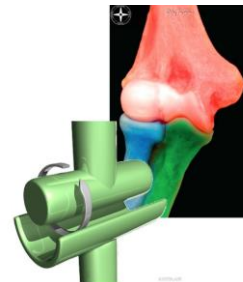


Throwers Elbow – Management and Treatment

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Special thanks to Aaron Venouziou MD

Anatomy

- Complex hinge
- 3 Articulations
 1. Ulnohumeral joint
 2. Radiocapitellar
 3. Proximal radio-ulnar



Anatomy - Medial

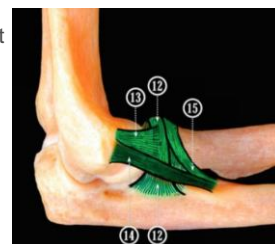
Medial collateral ligament
Anterior bundle -16
Transverse bundle – 17
Posterior bundle -18

Annular ligament -19

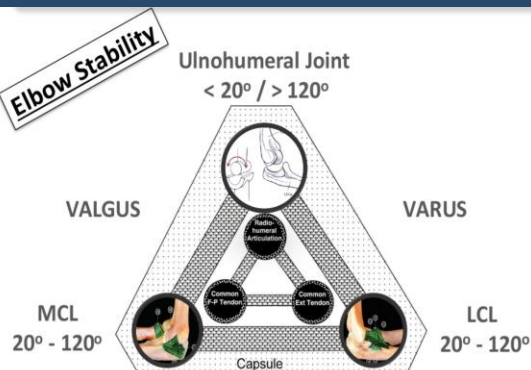


Anatomy - Lateral

Lateral Collateral Ligament
Annular -12
Radial collateral – 13
Lateral collateral -14
Accessory lateral col-15



Biomechanics



Pathomechanics

Overhead throwing



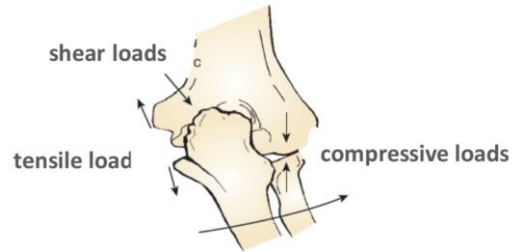
90 mph

Pathomechanics



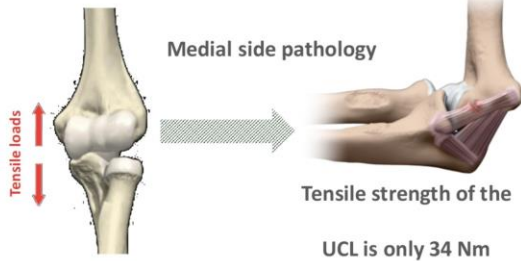
Pathomechanics

extremely high valgus stresses



Pathomechanics

64 Nm of valgus torque



Pathomechanics



Medial side pathology

- MCL
- Flexor tendons
- Ulnar nerve



Pathomechanics

Posterior side pathology

- **Valgus extension overload syndrome**
- **Posteromedial impingement**
- Inflammation
- Chondropathy
- Osteophyte / spur formation
- Loose bodies
- Olecranon stress fractures



Pathomechanics



Lateral side pathology

- OCD
- Radiocapitellar arthropathy



Ulnar collateral ligament injury

- Attenuation to complete rupture
- Medial elbow pain
- Pain during acceleration phase
- Loss of velocity, accuracy
- POP sensation in acute cases
- Ulnar nerve symptoms
- Pain w/ palpation over MCL (50°-70° flexion)



Ulnar collateral ligament injury

UCL examination

- Valgus stress test
- 30° of elbow flexion
- Opening of the medial joint space +/- pain



Ulnar collateral ligament injury

UCL examination

- Milking maneuver
- 90° elbow flexion
- Grabbing the affected thumb with the opposite hand passed under the affected arm
- Pulling to stress the medial elbow



Ulnar collateral ligament injury

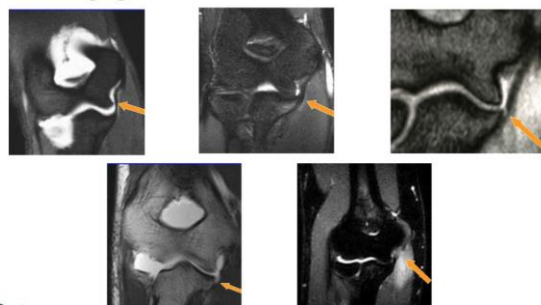
UCL examination

- Moving valgus stress test
- Shoulder in ABD and ER
- The examiner holds the thumb and supports the elbow
- Elbow flexion-extension + valgus stress
- Pain between 80° and 120° => positive test



Ulnar collateral ligament injury

UCL imaging



Ulnar collateral ligament injury

UCL injury / tear

- Usually do not respond to conservative treatment

Surgical treatment indications:

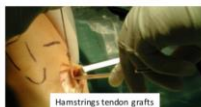
- Acute ruptures
- Instability
- Chronic pain



Ulnar collateral ligament injury

UCL reconstruction

- Jobe et al. JBJS Am 1986
Tommy John procedure
Free tendon graft
Figure-eight fashion through bone tunnels
63% return to sports (10 out of 16 athletes)
31% postop ulnar nerve complication

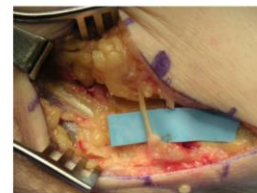


Ulnar collateral ligament reconstruction

- Surgical approach



Medial skin incision



Protect MABC

Ulnar collateral ligament reconstruction

UCL reconstruction

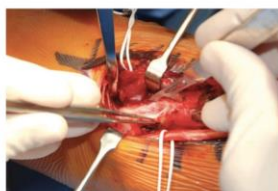
Smith, Altchek et al. AJSM 1996

- Modified Jobe Technique

No neuropathies



Release +/- transposition of UN



Muscle splitting through FCU

Ulnar collateral ligament reconstruction

Docking technique

- Altchek et al. AJSM 1996
- Rohrbough et al. AJSM 2002
95% (31 pts) return to sports
- Azar et al. AJSM 2010
79% (78 pts) return to sports



15-20 mm tunnel depth



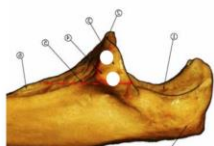
Ulnar collateral ligament reconstruction

- Bone tunnels

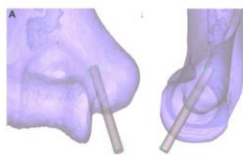
Byram, Ahmad et al. AJSM 2013

anterior and posterior aspects of the sublime tubercle

central or lateral to the midpoint of the epicondyle



bone bridge of 6 to 8 mm



15° in the coronal plane

30° in the sagittal plane

Ulnar collateral ligament reconstruction

A Systematic Review of Ulnar Collateral Ligament Reconstruction Techniques

Oct. 2014



Jonathan N. Watson,*[†] MD, Peter McQueen,[†] MD, and Mark R. Hutchinson,[†] MD
Investigation performed at the University of Illinois at Chicago, Chicago, Illinois

Results: A total of 21 studies, 7 biomechanical and 14 clinical, met the inclusion criteria. There were 1368 patients. The overall complication rate was 18.6% (255/1368), further subdivided into 21 for the Jobe technique (29.2%), 203 for the modified Jobe technique (19.1%), 2 for the interference screw technique (10.0%), 2 (4.3%) for the modified docking technique, and 10 for the docking technique (6.0%). The most common complication across all studies was ulnar nerve neuropathy in 176 patients (12.9%). The overall rate of return to play was 78.9%.

Conclusion: Ulnar collateral ligament reconstruction utilizing the docking technique results in a significantly higher rate of return to play and a lower complication rate when compared with the Jobe and modified Jobe techniques.

UCL Reconstruction- Rehab

- Splint immobilization for 1 week in 75 deg of flexion
- Transition to hinged elbow brace with initial ROM of 30 to 90 deg
- Advance to 15 – 105 deg between 3 and 5 weeks with active and passive ROM as tolerated
- DC hinged brace at 6 weeks
- 6 to 16 weeks start active ROM and strengthening of whole arm, adv as tolerated



UCL Reconstruction- Rehab

- 16 weeks start throwing at 45 foot distance on flat ground
- No pain and able to throw 180 feet on flat ground
- At 7 months and start mound throwing
- Advance speed and endurance over the next 3 months
- Return to play at 1 year



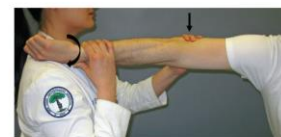
Valgus Extension Overload Syndrome

- Posteromedial impingement
- Chondropathy
- Osteophyte formation
- Loose bodies



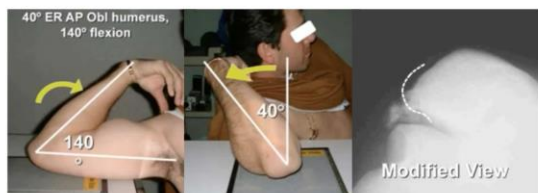
Valgus Extension Overload Syndrome

- Posterior elbow pain
- Loss of full extension
- Crepitus / locking
- Arm bar test



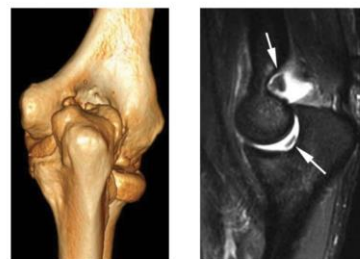
Valgus Extension Overload Syndrome

Imaging



Valgus Extension Overload Syndrome

Imaging



VEO -Treatment

- Rest, NSAIDs
- Therapy regimens
 - Flexor pronator mass strengthening
 - Pitching instruction, focus on proper mechanics and improve poor technique
 - Inverted 'W'



Valgus Extension Overload Syndrome

VEO Syndrome Treatment

- Open vs. arthroscopic debridement
- Reddy et al. Arthroscopy 2000
85% return to sports (55 athletes)
- Blonna et al. AJSM 2010
91% return to sports (24 athletes)



VEO - Rehab

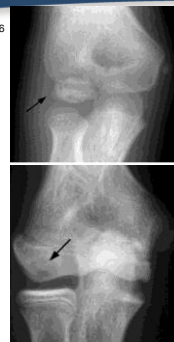
- Splint immobilization for 1 week in 75 deg of flexion
- DC splint and start active and passive ROM as tolerated at follow up
- 6 weeks start active ROM and strengthening of whole arm, adv as tolerated
- Return to throwing as pain and strength allow



Etiology of OCD in the elbow

- Adolescent athletes ages 11-21
- Differentiate from Panner disease
 - Boys age less than 10, osteonecrosis of entire capitellum
- Male >> female
- Sports including baseball, gymnastics, weightlifting, ???rock-climbing
- Usually dominant arm, occasionally bilateral

Boy age 6



Boy age 14



Etiology of OCD in the elbow

- Typically overhead throwing athlete
- Repetitive trauma
- Poor throwing mechanics
- Compression of the lateral condylar blood supply in late cocking phase of throw
- Axial twisting load across the elbow in gymnasts



Etiology of OCD in the elbow

- Vascular anatomy of the distal humerus supports ischemia as a possible cause of OCD.
- Capitellum
 - supplied by posterior end arteries that traverse the epiphyseal articular cartilage
 - no metaphyseal collateral contribution
- Repetitive compression of may result in subchondral ischemia and the characteristic osteonecrosis
- Loss of subchondral - articular cartilage fragmentation and loose body formation



Etiology of OCD in the elbow

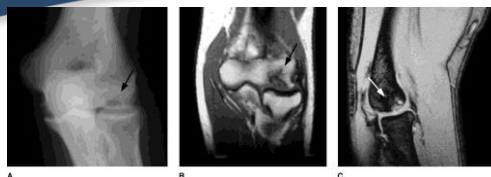
- Insidious onset of lateral elbow pain
- Worse with and after use
- Improves with rest
- May have small effusion
- Lack of 10-20 deg of terminal extension
- Pain with palpation over radial head, lateral epicondyle
- Occasional locking, catching of elbow
- Passive pronation/supination with axial load exacerbates lateral pain



Ruchelsman, et al, Am Acad Orthop Surg
2010



Imaging of OCD in the elbow



Plain radiography
CT
MRI +/- gadolinium

Ruchelsman, et al, Am Acad Orthop Surg
2010



Grading/Classification of OCD in the elbow

Minami Xray:

- Grade I: Translucent cystic shadow
- Grade II: clear zone or split line between lesion and underlying bone
- Grade III: loose bodies

MRI grading of lesions of talus/knee developed by Nelson can be used for the elbow

Grade	Description
0	Normal
1	Intact cartilage with signal changes
2	High signal breach of the cartilage
3	Thin rim of high signal intensity extending behind the osteochondral fragment, indicating synovial fluid around the fragment
4	Mixed or low signal loose body, either in the center of the lesion or free within the joint

Ruchelsman, et al, Am Acad Orthop Surg
2010



Grading/Classification of OCD in the elbow

Arthroscopic (Baumgarten, ICRS)

- Grade I stable with a continuous softened area covered by intact cartilage.
- Grade II stable on probing but exhibit partial discontinuity
- Grade III complete discontinuity but are not dislocated
- Grade IV lesions have an empty defect or a dislocated fragment lying within the bed.

"Gestalt" classification

- Stable
- Unstable but attached
- Detached

Grade	Description
0	Normal
1	Intact cartilage with signal changes
2	High signal breach of the cartilage
3	Thin rim of high signal intensity extending behind the osteochondral fragment, indicating synovial fluid around the fragment
4	Mixed or low signal loose body, either in the center of the lesion or free within the joint

Ruchelsman, et al, Am Acad Orthop Surg. 2010



Treatment of OCD in the elbow

Nonoperative

Takahara et al (*Am J Sports Med* 1999)

- 24 patients who were treated nonsurgically
- mean follow-up of 5.2 years.
- Found poor subjective outcome to be independent of lesion grade
- Radiographic healing and improvement not associated with the status of growth plate
- Poor prognosis - large, advanced lesions, degenerative changes

Mihara et al (*Am J Sports Med* 2009)

- 39 baseball players, mean age of 12.8 years, mean follow-up of 14.4 months
- 25 of 30 early lesions were healed, only 1 of 9 advanced lesions
- Healing in 16 of 17 with open physes, only 11 of 22 closed



Treatment of OCD in the elbow

Operative

- Open Debridement and Fragment Excision
- Arthroscopic Debridement and Marrow Stimulation
- Fragment Fixation
- Osteotomy
- Osteochondral Transplantation
 - Autograft or allograft



Autograft for OCD in the elbow

Autograft

- Indications include large Baumgarten grade 4 and 5 lesions, ICRS grade IV lesions
- Lesions involving >50% of the articular surface area
- Disruption of the lateral buttress
- Radial head engagement
 - Technically demanding
 - Donor site morbidity, donor site pain
 - Curvature best fit
 - Multiple plugs for large lesions
 - Limited donor area

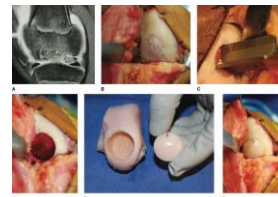


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Takahara, JBJS, 2007

Fresh Allograft for OCD in the elbow

Allograft

- Reports in the knee show:
 - 90% survival at 10 years - pediatric
 - 82% survival at 10 years - adults
- Indicated in knee for large >2cm² lesions - similar in elbow
- Match radius of curvature
- One stage operation

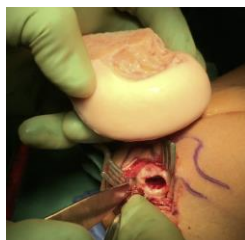


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Levy YD, Clin Orthop Relat Res 2015

Fresh Allograft for OCD in the elbow

Mirzayan, JSES, 2016

- 9 male baseball players, age 15.3 years (14-18)
- 7 used 1 plug, 2 used 2 plugs
- 11mm in diameter avg (8 – 18mm)
- 5 plugs press fit, 4 used fixation
- Follow up 48.4 mo (11-90 mo)
- All returned to throwing



Mirzayan R, JSES, 2016

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Case example

- 12 yo female, right elbow dx with OCD at 10.5 years
- Gymnast but not high level
- Treated with fragment debridement
- Continued pain / stiffness
- ROM 30 to 110
- Bilateral involvement



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Case example

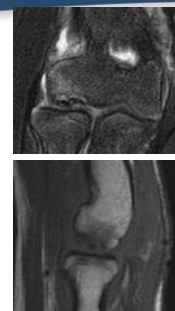
- Left elbow asymptomatic



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Case example

- R elbow OCD, 11 diameter
- Joint effusion, no obvious loose bodies
- ICRS Grade III
- Large lesion, failed previous operation
- Did not want to use knee, donor site morbidity
- Match radius of curvature



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Case example

- Kocher interval
- Posterior to it
- Elevate anconeus off ulna
- Hyperflex elbow



Case example

- Size - 15 mm
- 1.76 cm² graft



Case example

- Size - 15 mm, reamer



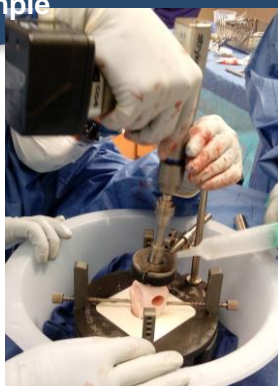
Case example

- Graft harvest



Case example

- Graft harvest



Case example

- Graft preparation



Case example

- Insetting
- Press fit
- Rehab:
 - Soft dressing
 - Immediate gentle ROM
 - PT/OT stretching at first post op visit
 - NWB for 6 weeks
 - Strengthening at 6 weeks
 - Repetitive WB at 3 months
 - CT scan



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Case example

- CT scan at 3 months
- Pain free
- Nearly Full ROM
- Lacking extension 10 deg
- Begin light gymnastics
- Full arm weight bearing at 6 mo

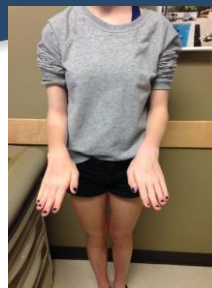


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Case example



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Discussion

- Thank you

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