

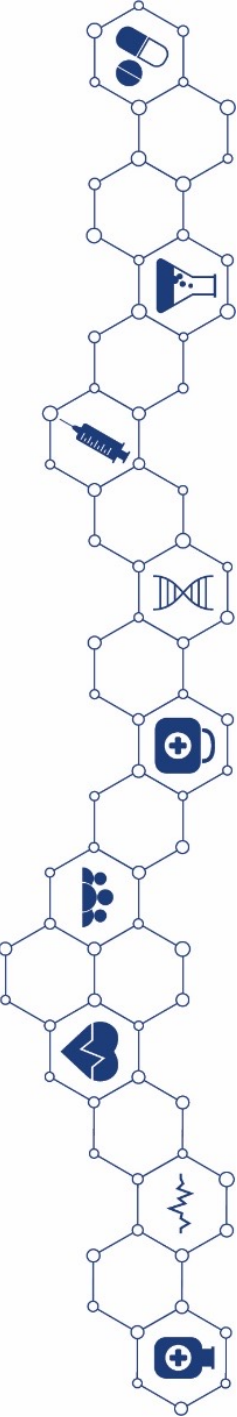
Advances in the Treatment of Elbow Ulna Collateral Ligament Repair

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Corvallis, OR



Disclosures

- No conflict of interest to disclose.



Introduction

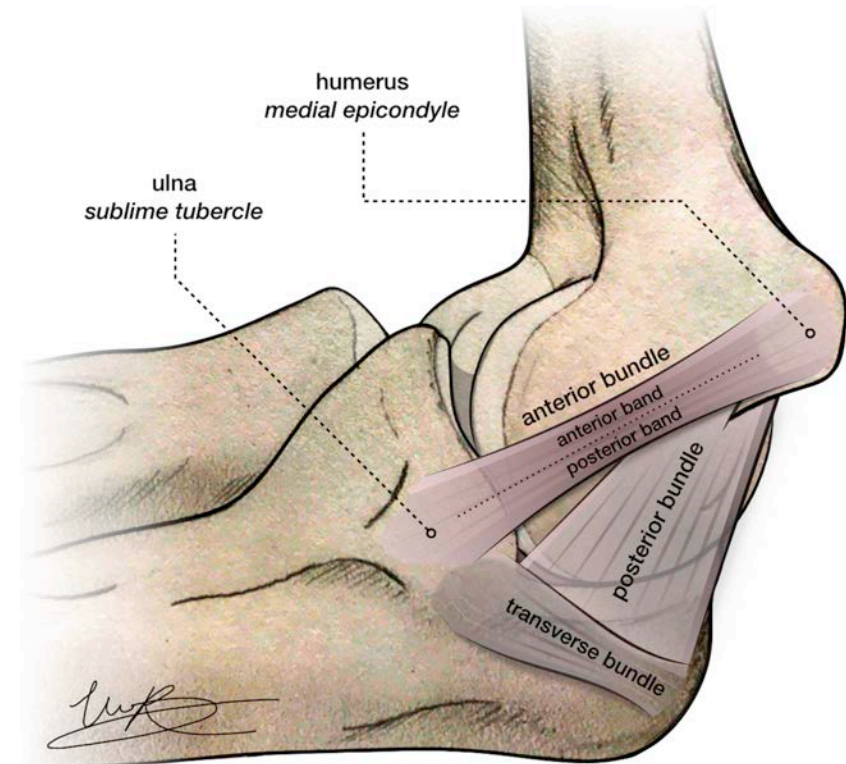
- Overhead throwing athlete
 - Significant stress during throwing motion
 - Transmitted to bone and soft tissues of elbow joint
 - Attritional damage
 - Produces specific injuries and conditions
- Increasing number of UCL injuries
- 15-25% of MLB players will develop UCL injuries

- Specific constellation of injuries
 - Baseball
 - Softball
 - Football
 - Tennis
 - Javelin



Elbow stability

- Functional arc of motion
 - 20-120 degrees
 - Ligaments are primary stabilizers
 - Medial UCL
 - Anterior bundle
 - Anterior band 0-90
 - Posterior band >60
 - Posterior bundle
 - Weaker
 - Adds stability >90
 - LUCL
 - Anterior joint capsule
 - Radial head
 - Secondary stabilizer
 - 30 degrees



Elbow UCL injuries

- Overhead throwing athlete
 - Medial elbow pain
 - Decreased performance
 - Positive imaging
- Treatment options:
 - Non-operative
 - Operative
 - UCL reconstruction
 - UCL repair

Imaging

- CT
 - Excellent osseous detail
 - CT arthrography useful for associated ligament injury
- MRI
 - Excellent for soft tissue
 - Ligaments, muscle, nerve
 - Highly sensitive and specific for UCL tears
 - Grade of tear
 - Location of tear
 - Quality of ligament
- Ultrasound
 - Dynamic
 - Examiner dependent

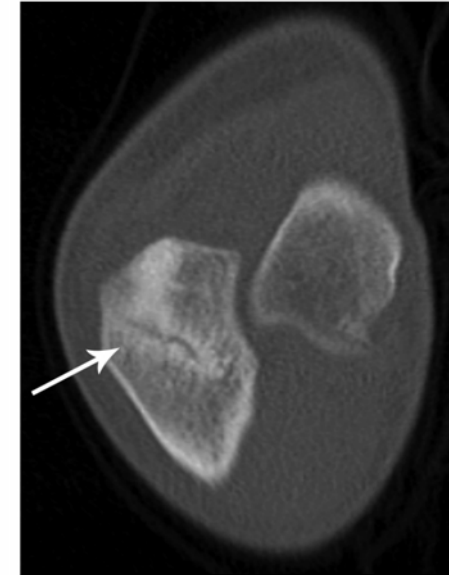
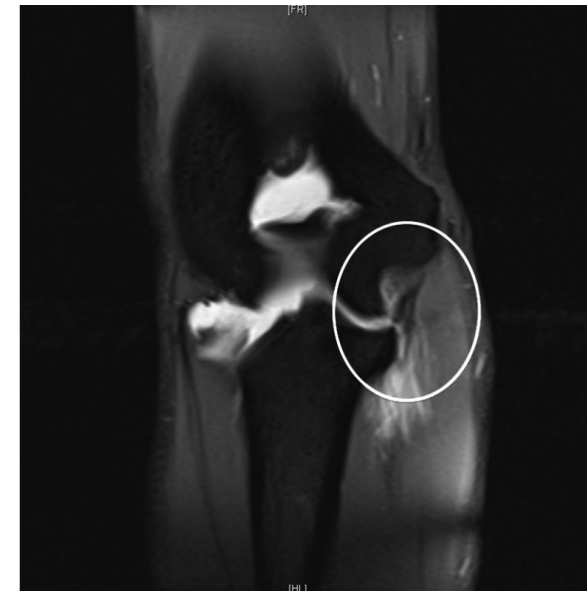


Fig. 5. Axial slice of a CT scan of a professional pitcher demonstrating a stress fracture of the olecranon (arrow).



Imaging

Check for updates

Clinical Sports Medicine Update

Diagnostic Imaging of Ulnar Collateral Ligament Injury CME

A Systematic Review

Richard E. Campbell,* MD, Alexa N. McGhee,* Kevin B. Freedman,* MD,
and Fotios P. Tjoumakaris,** MD

Investigation performed at Rothman Orthopaedic Institute,
Thomas Jefferson University, Philadelphia, Pennsylvania, USA

The American Journal of Sports Medicine
2020;48(11):2819–2827
DOI: 10.1177/0363546520937302
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	sensitivity	specificity
Conventional Ultrasound	81%	91%
Stress Ultrasound	81%	96%
CT arthrography	86%	91%
MRI	57-100%	87-100%
MRI arthrography	81-100%	91-100%

Non-operative treatment

- 1 week of complete rest
 - Modalities
 - Cryotherapy
 - Pain modalities
 - NSAID
 - Strengthening
 - RTC
 - Focus on medial dynamic stabilizers
 - Isometric to isotonic
 - 6 week start throwing program
 - RTP in 3-6 months
- Can we predict who responds well to non-operative treatment?

Predictor of failure of non-operative treatment

Magnetic Resonance Imaging Predictors of Failure in the Nonoperative Management of Ulnar Collateral Ligament Injuries in Professional Baseball Pitchers

Salvatore J. Frangiamore,* MD, MS, T. Sean Lynch,† MD, Michael D. Vaughn,* MD, Lonnie Soloff,‡ MS, Michael Forney,§ MD, Joseph F. Styron,* MD, PhD, and Mark S. Schickendantz,||* MD
Investigation performed at the Sports Health Center, Department of Orthopaedic Surgery, Cleveland Clinic, Garfield Heights, Ohio, USA

The American Journal of Sports Medicine
Volume 45, Issue 8, July 2017, Pages 1783-1789
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<https://doi.org/10.1177/0363546517699832>

- 32 pitchers with partial thickness tears
 - Included partial and high-grade tears
 - 35% failed non-operative treatment
 - Distal tears were 12.4 x more likely to fail non-operative treatment
 - 88% failure rate



Tear location more important than grade of tear

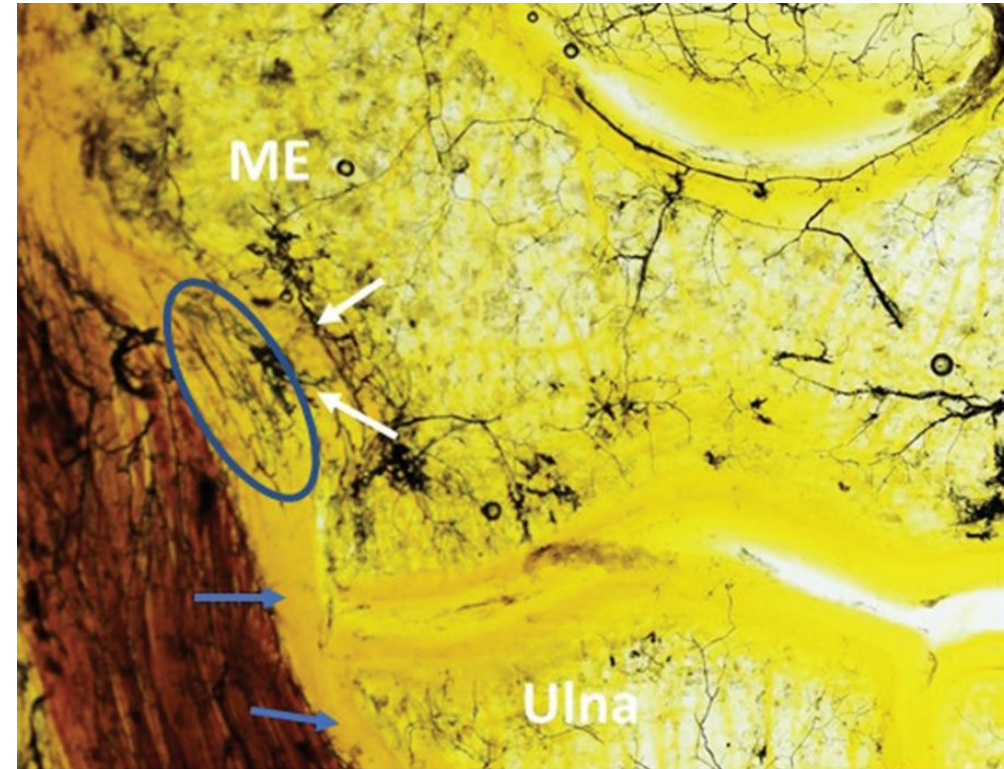
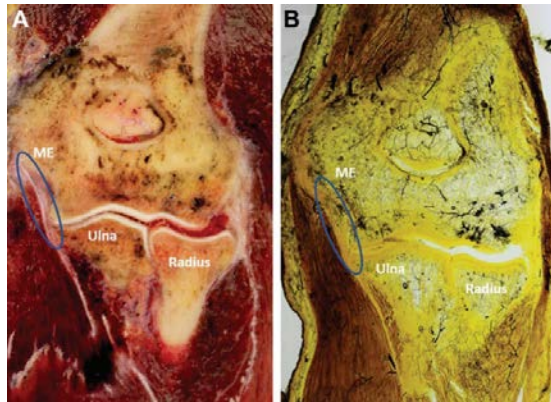
Why are distal tears at higher risk for failure?

Variations in Blood Supply From Proximal to Distal in the Ulnar Collateral Ligament of the Elbow

A Qualitative Descriptive Cadaveric Study

Patrick S. Buckley,^{*†} MD, Elizabeth R. Morris,[†] BA, Colin M. Robbins,[†] BA, Bryson R. Kemler,[†] MS, Salvatore J. Frangiamore,[‡] MD, Michael G. Ciccotti,[§] MD, Johnny Huard,[†] PhD, Robert F. LaPrade,^{*†} MD, PhD, and Thomas R. Hackett,^{*†||} MD
Investigation performed at the Steadman Philippon Research Institute, Vail, Colorado, USA

The American Journal of Sports Medicine
2019;47(5):1117-1123
DOI: 10.1177/0363546519831693
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Flexor pronator mass injury associated with distal tears

Sites of flexor-pronator muscle injury and relationship between ulnar collateral ligament injury and flexor-pronator muscle injury in baseball players: a retrospective cohort study



Masahiro Ikezu, MS, PT^{a,b,*}, Shintarou Kudo, PhD, PT^{b,c},
Mitsuaki Edama, PhD, PT, JSP0-AT^d, Mizuho Ueda, MD^e, Takanori Kubo, MD^f,
Masazumi Hirata, PhD, MD^f, Makoto Watanuki, PhD, MD^f, Hiroki Takeuchi, MS, PT^{a,c},
Jumpei Kaneiwa, MS, PT^{a,c}, Yasuhiko Iizuka, RT^g, Hidetoshi Hayashi, PhD, MD^f

J Shoulder Elbow Surg (2022) 31, 1588–1594

- 99 baseball players with UCL injuries
 - 45 combined FPM and UCL injury
 - 89% FDS muscle belly
 - Significant association with distal tears
 - No association with tear severity
- FPM injury may be a contributing factor to lower healing rates in distal tears

Tear location and elbow instability

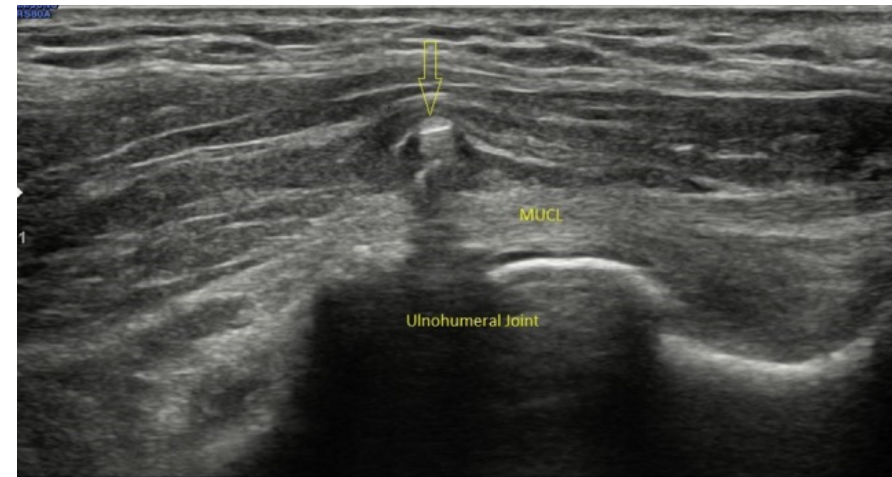
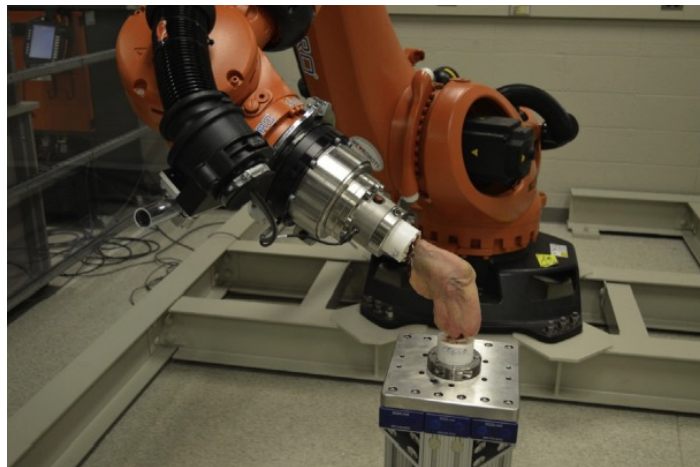
Does proximal versus distal injury location of the medial ulnar collateral ligament of the elbow differentially impact elbow stability? An ultrasound-guided and robot-assisted biomechanical study



Thomas H. Rogers, MD^a, Alexander W. Hooke, MA^{a,b}, Daniel S. Jacobson, BSEE^{a,b}, James S. Fitzsimmons, BSc^{a,b}, Daniel C. Austin, MD^a, Jacob L. Sellon, MD^c, Shelby E. Johnson, MD^c, Mark E. Morrey, MD^a, Joaquin Sanchez-Sotelo, MD, PhD^a, Shawn W. O'Driscoll, MD, PhD^a, Christopher L. Camp, MD^{a,*}

J Shoulder Elbow Surg (2022) 31, 1993–2000

- Proximal release resulted in greater valgus instability
- Conclusion:
 - Lower healing rates of distal tears are not due to greater instability



PRP injection for UCL injuries

Nonoperative Treatment of Elbow Ulnar Collateral Ligament Injuries With and Without Platelet-Rich Plasma in Professional Baseball Players

A Comparative and Matched Cohort Analysis

Aakash Chauhan,* MD, MBA, Peter McQueen, MD, Peter N. Chalmers, MD, Michael G. Ciccotti, MD, Christopher L. Camp, MD, John D'Angelo, BA, Hollis G. Potter, MD, Stephen A. Fealy, MD, Brandon J. Erickson, MD, Heinz R. Hoenecke, MD, Daniel Keefe, MD, and Jan Fronek, MD

Investigation performed at Division of Sports Medicine, Department of Orthopaedic Surgery, Scripps Clinic, La Jolla, California, USA

The American Journal of Sports Medicine
2019;47(13):3107-3119
DOI: 10.1177/0363546519876305
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- 544 baseball players with UCL injuries
 - 133 treated with PRP
 - 411 without PRP
- RTP rate overall 54%
 - PRP group 46% RTP
 - Significantly increased time RTT and RTP



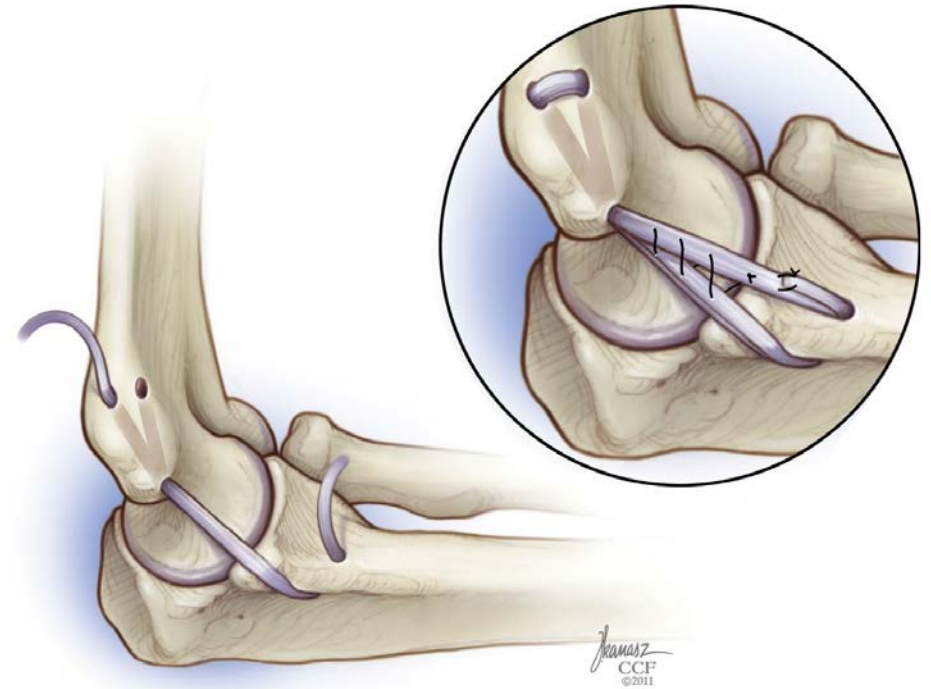
Conclusion

- Non-operative treatment
 - Proximal tears
 - Absence of associated injuries
- Operative treatment
 - Distal tears
 - High grade acute tears with associated instability
 - Associated FPM injury
 - Failed non-operative treatment

Operative treatment

- Direct repair
 - Distal or proximal tears
 - well preserved ligament
- Reconstruction

The Thrower's Elbow



UCL Repair vs. Reconstruction

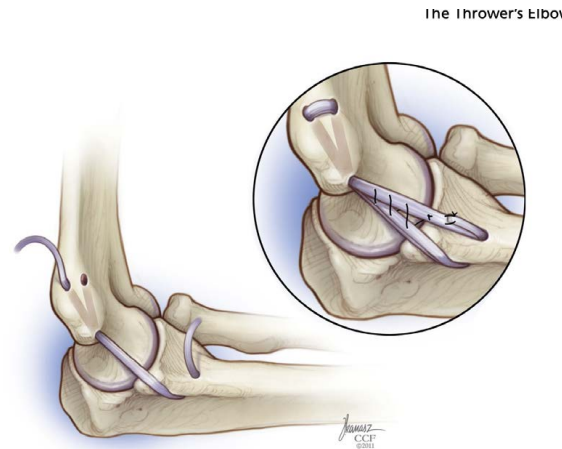
Medial instability of the elbow in throwing athletes. Treatment by repair or reconstruction of the ulnar collateral ligament.

Conway, J E; Jobe, F W; Glousman, R E; Pink, M

[Author Information](#)

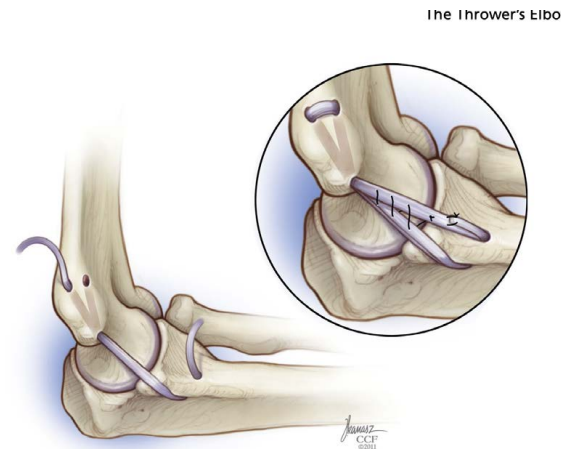
The Journal of Bone & Joint Surgery 74(1):p 67-83, Jan 1992.

- 50% RTP in repair group
 - Vs. 68% in the reconstruction group



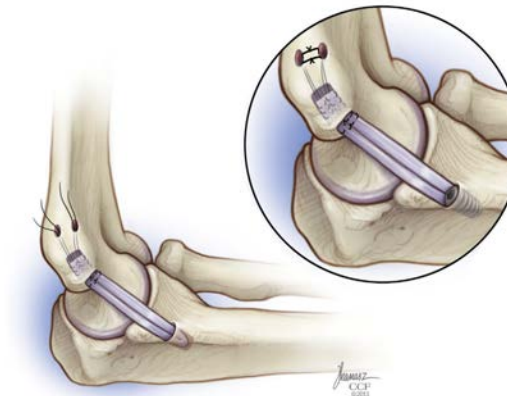
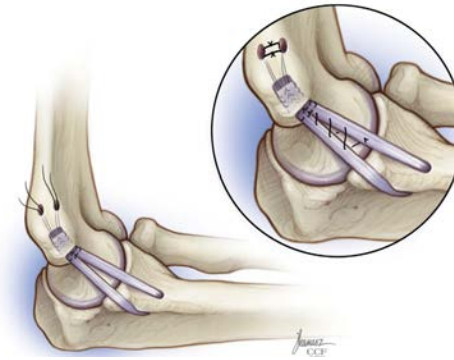
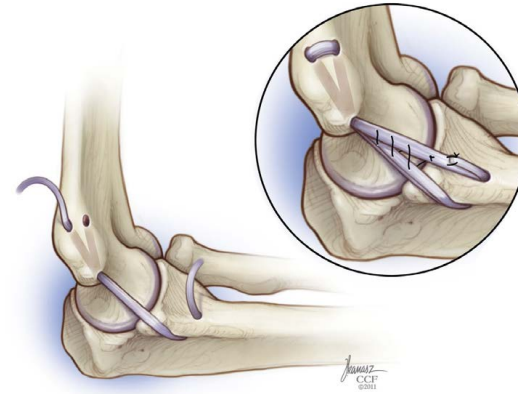
Evolution of the technique

- Original procedure
 - Reflection of flexor pronator mass
 - Submuscular ulna nerve transposition
 - 3 ply ligament reconstruction
 - High incidence of ulna neuropathy
 - up to 31 %
- Newer approaches
 - Muscle splitting
 - Muscle reflecting
 - Ulna nerve transposition only for pre-existing ulna neuropathy



UCL reconstruction

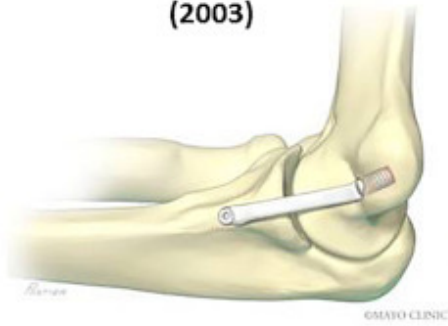
- UCL reconstruction
 - Jobe 3-ply technique
 - Proximal docking technique
 - Distal bone tunnels
 - Distal interference screw
 - Distal docking with button
 - Graft option
 - Palmaris longus
 - Gracilis
 - allograft



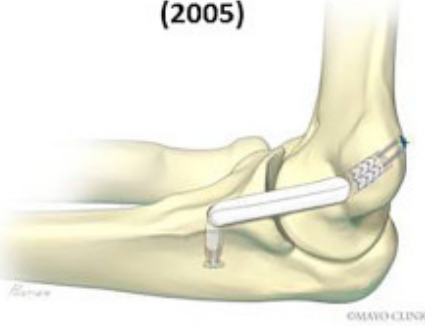
Other fixation techniques

Linear Constructs

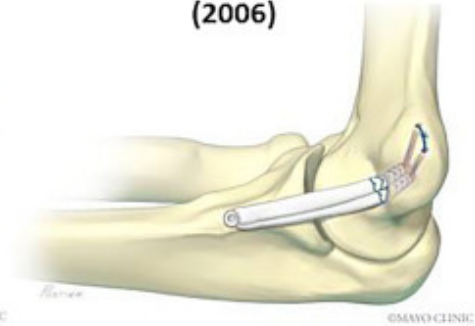
Dual Interference Screw
(2003)



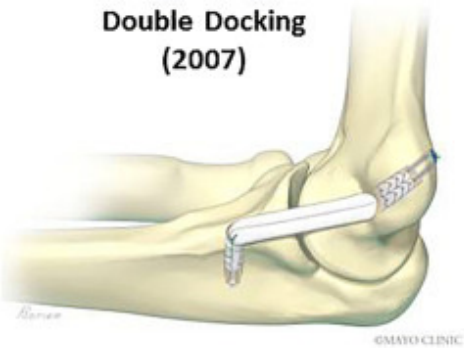
EndoButton
(2005)



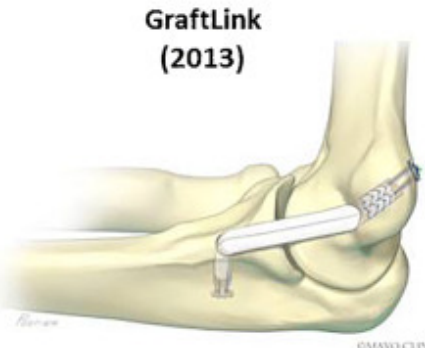
DANE TJ
(2006)



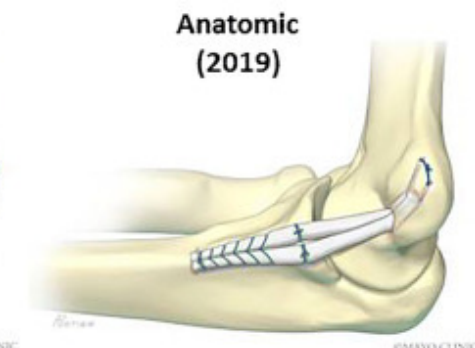
Double Docking
(2007)



GraftLink
(2013)



Anatomic
(2019)



Does UCL reconstruction technique influence outcome?

Modified Jobe Versus Docking Technique for Elbow Ulnar Collateral Ligament Reconstruction

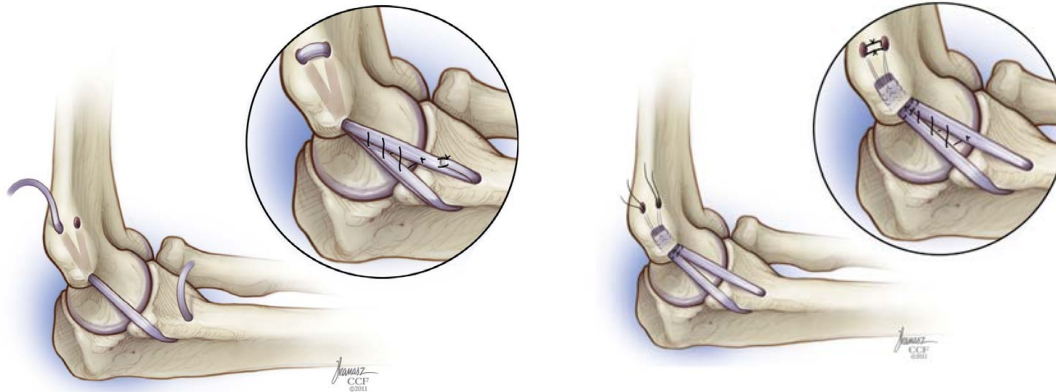
CME

A Systematic Review and Meta-analysis of Clinical Outcomes

Austin M. Looney,* MD, David X. Wang,* BA, Christine M. Conroy,* BS, Jake E. Israel,* BA, Blake M. Bodendorfer,* MD, Caroline M. Fryar,[†] MS, Mark A. Pianka,* BA, Nathan P. Fackler,* MS, Michael G. Ciccotti,[‡] MD, and Edward S. Chang,^{†§} MD
Investigation performed at Inova Sports Medicine, Fairfax Inova Hospital, Falls Church, Virginia, USA

The American Journal of Sports Medicine
2021;49(1):236–248
DOI: 10.1177/0363546520921160
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The Thrower's Elbow





- Meta-analysis
 - Systematic review – 21 articles
 - Modified Jobe vs Docking technique
 - Controlled for flexor-pronator detachment
- Results:
 - No significant difference in outcomes
 - Worse outcomes for Jobe reconstruction with submuscular ulna nerve transposition

UCL reconstruction technique and complications?

No Difference in Complications Between Elbow Ulnar Collateral Ligament Reconstruction With the Docking and Modified Jobe Techniques



A Systematic Review and Meta-analysis

Austin M. Looney,^{*†‡} MD , Nathan P. Fackler,[§] MS, Mark A. Pianka,[§] BA, Blake M. Bodendorfer,^{||} MD , Caroline M. Fryar,[¶] MD, Christine M. Conroy,[#] MD, Jacob E. Israel,[§] BA, David X. Wang,^{**} MD, Michael G. Ciccotti,[‡] MD, and Edward S. Chang,^{††} MD

Investigation performed at Inova Sports Medicine, Inova Fairfax Hospital, Falls Church, Virginia, USA

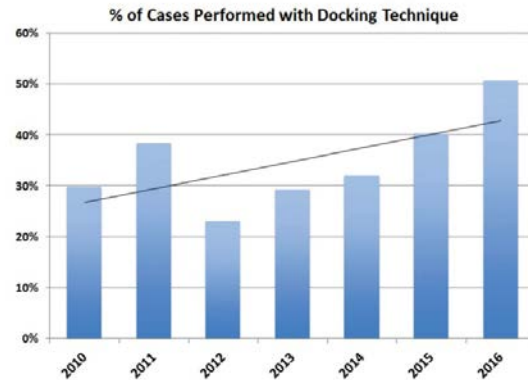
- No significant difference of complication between the two reconstruction techniques
 - 18% overall
 - Nerve related
 - Graft failure
 - Arthrofibrosis
 - Heterotopic ossification

Influence of Graft type and tunnel configuration

Comparison of Outcomes Based on Graft Type and Tunnel Configuration for Primary Ulnar Collateral Ligament Reconstruction in Professional Baseball Pitchers

Timothy B. Griffith,^{*†} MD, Christopher S. Ahmad,[‡] MD, Prakash Gorroochurn,[‡] PhD, John D'Angelo,[§] BA, Michael G. Ciccotti,^{||} MD, Joshua S. Dines,[¶] MD, David W. Altchek,[¶] MD, and Christopher L. Camp,[#] MD
Investigation performed at Peachtree Orthopedics, Atlanta, Georgia, USA, and the Mayo Clinic, Rochester, Minnesota, USA

The American Journal of Sports Medicine
2019;47(5):1103-1110
DOI: 10.1177/0363546519831705
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- Cohort study 566 pro baseball pitchers

- Outcomes:
 - 80 % RTP irrespective of graft choice or reconstruction technique
 - Slightly higher reoperation rate for modified Jobe technique
 - Higher rate of subsequent elbow or forearm injuries in MLB
- Increasing use of palmaris longus graft and docking technique

What about UCL repair? Should it be done?

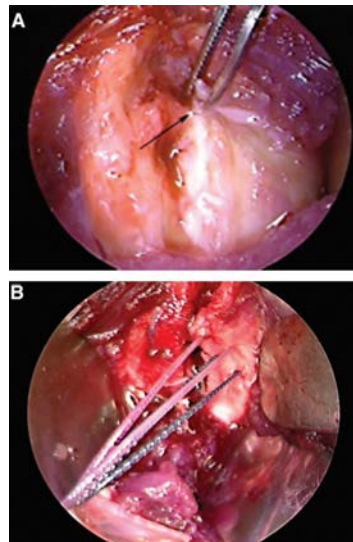
Primary Repair of Ulnar Collateral Ligament Injuries of the Elbow in Young Athletes

A Case Series of Injuries to the Proximal and Distal Ends of the Ligament

Felix H. Savoie III,^{*†} MD, Scott W. Trenhaile,[‡] MD, John Roberts,[†] Larry D. Field,^{§¶} MD, and J. Randall Ramsey,[§] MD

From the [†]Department of Orthopaedic Surgery, Tulane University School of Medicine, New Orleans, Louisiana, [‡]Rockford Orthopaedic Associates, Rockford, Illinois, [§]Mississippi Sports Medicine and Orthopaedic Center, Jackson, Mississippi, and [¶]Department of Orthopaedic Surgery, University of Mississippi School of Medicine, Jackson, Mississippi

The American Journal of Sports Medicine, Vol. 36, No. 6
DOI: 10.1177/0363546508315201
© 2008 American Orthopaedic Society for Sports Medicine



- 60 patients with UCL injuries
 - High school and collegiate athletes
 - mean age 17.2 years
- 93% excellent and good outcomes
- RTP within 6 months
- Conclusion:
 - Ligament reconstruction with grafts may not be required in the younger athlete

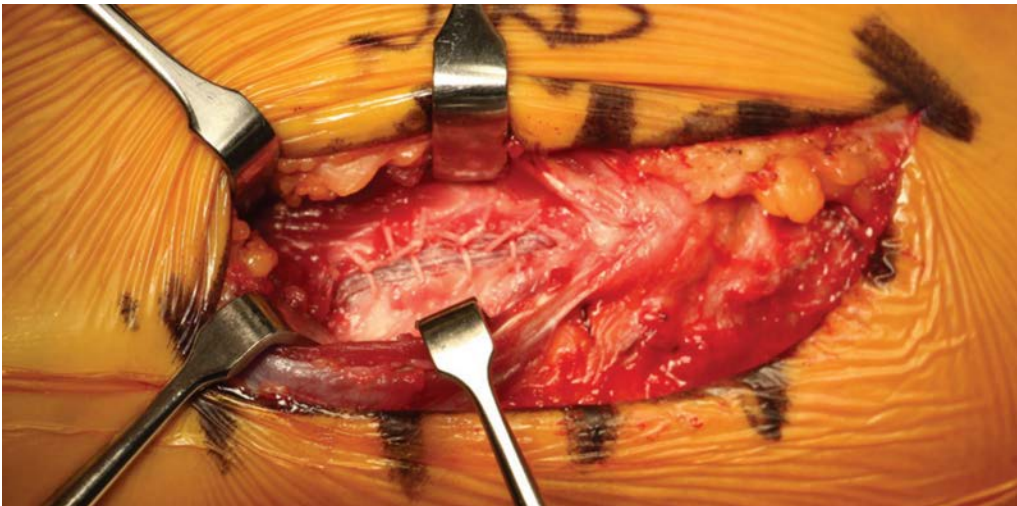
Clinical Outcomes after UCL repair

Ulnar Collateral Ligament Repair With Collagen-Dipped FiberTape Augmentation in Overhead-Throwing Athletes

Jeffrey R. Dugas,* MD, Christopher A. Looze,^{†‡} MD, Brian Capogna,[§] MD,
Brian L. Walters,^{||} MD, Christopher M. Jones,^{*†} MD, Marcus A. Rothermich,[#] MD,
Glenn S. Fleisig,^{*†} PhD, Kyle T. Aune,^{*†} MPH, Monika Drogosz,^{*†} MPH, Kevin E. Wilk,^{*†} DPT,
Benton A. Emblom,^{*†} MD, and E. Lyle Cain Jr.,^{*†} MD
Investigation performed at the American Sports Medicine Institute, Birmingham, Alabama, USA

The American Journal of Sports Medicine
2019;47(5):1096–1102
DOI: 10.1177/0363546519833684
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- Prospective Case series:
 - 111 overhead athletes
 - UCL avulsions
 - Distal avulsions
 - Proximal avulsion
- Results:
 - 92% RTP at mean of 6.7 months
- Conclusion:
 - Compares favorably to reconstruction with quicker RTP
 - Maybe a good alternative in situation where historically a reconstruction is considered



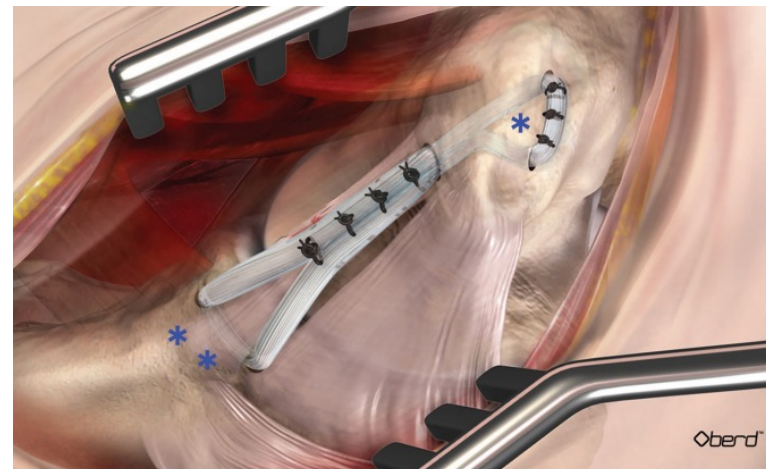
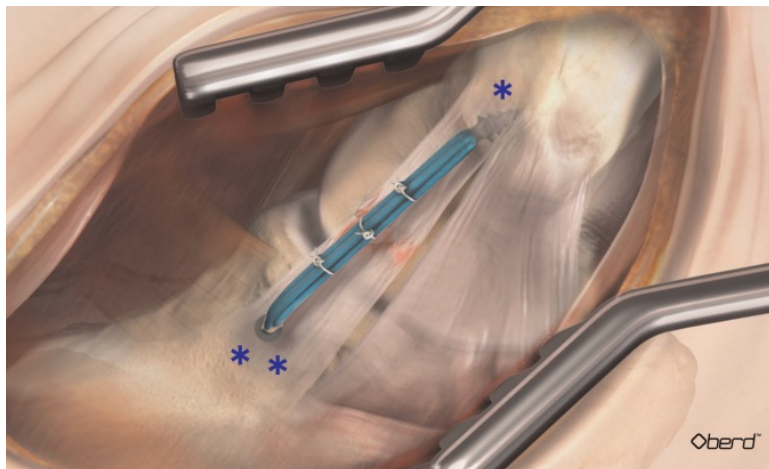
Biomechanical strength of UCL repairs

Biomechanical Comparison of Ulnar Collateral Ligament Repair With Internal Bracing Versus Modified Jobe Reconstruction

Jeffrey R. Dugas,* MD, Brian L. Walters,* MD, David P. Beason,** MS, Glenn S. Fleisig,* PhD, and Justin E. Chronister,* MD
Investigation conducted at the American Sports Medicine Institute, Birmingham, Alabama, USA

The American Journal of Sports Medicine, Vol. 44, No. 3
DOI: 10.1177/0363546515620390
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- Biomechanical cadaver study
 - Augmented repair vs. Reconstruction
 - Subjected to cyclical valgus load
- Results:
 - Less gap formation after augmented repair at low loads
 - Same failure strength



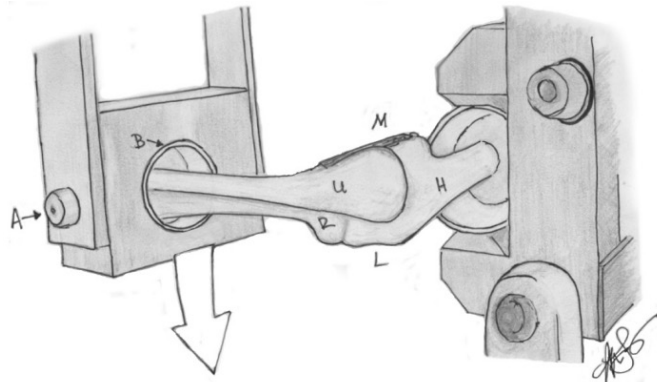
Biomechanical strength of repairs

Biomechanical Comparison of Ulnar Collateral Ligament Reconstruction With the Docking Technique Versus Repair With Internal Bracing

Blake M. Bodendorfer,* MD, Austin M. Looney,* MD, Sloane L. Lipkin,[†] BA, Esther C. Nolton,[†] MEd, LAT, ATC, CSCS, Jihui Li,[†] PhD, Robert G. Najarian,[†] MD, and Edward S. Chang,^{†‡} MD
Investigation performed at Inova Fairfax Hospital, Falls Church, Virginia, USA

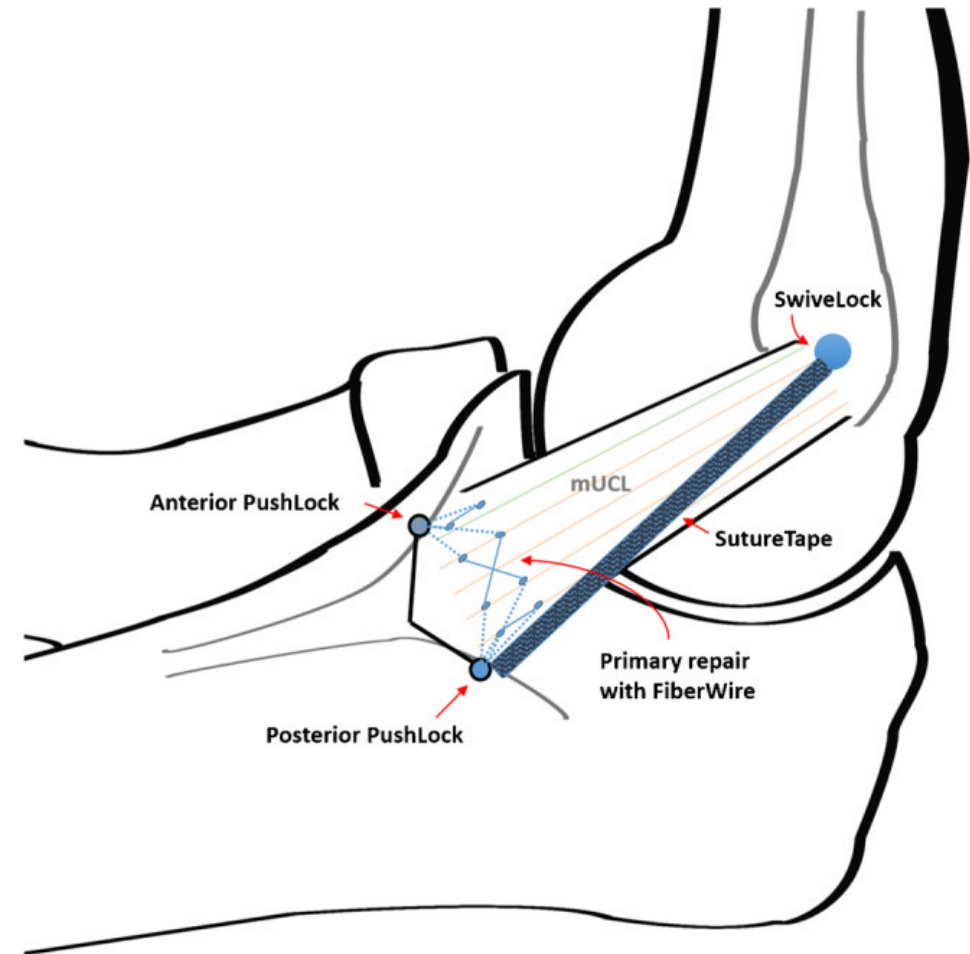
The American Journal of Sports Medicine
2018;46(14):3495–3501
DOI: 10.1177/0363546518803771
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- Biomechanical cadaver study
 - 9 pairs of matched cadaver specimens
 - Assessed gapping and load to failure
- Results:
 - No difference in gapping and load of failure



UCL repair - Conclusion

- Recent literature shows >90% RTP
 - Much improved compared to historical data
 - Conway et al 92 – 50% RTP
 - Savoie 2008 – 97% RTP
 - Dugas 2019 – 92% RTP
 - Better repair technique
 - Internal brace with collagen dipped suture tape
 - Compares favorably to reconstruction in biomechanical studies



Thank you