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Flexor Pronator Strain, Epicondylitis, Avulsions

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Disclosures

- I have no conflicts of interest in relation to this presentation

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Flexor Pronator Strain

- Anatomy
- Function
- Forces
- Clinical Presentation
- Imaging Studies
- Treatment

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Anatomy

- Common Flexor Tendon origin - Medial Epicondyle
  - Pronator Teres
  - FCR
  - Palmaris Longus
  - FDS
  - FCU

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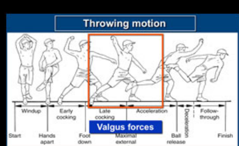
Function



- Provides dynamic support to valgus stress during throwing motion
- Contraction during early arm acceleration resists valgus and flexes wrist during ball release

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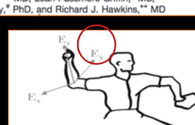
Correlation of Torque and Elbow Injury in Professional Baseball Pitchers

Adam W. Anz,[*] MD, Brandon D. Bushnell,[†‡¶] MD, Leah Passmore Griffin,[§] MS, Thomas J. Noonan,[||¶] MD, Michael R. Torry,[#] PhD, and Richard J. Hawkins,[**] MD

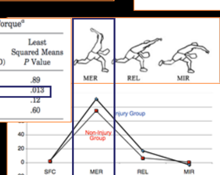
- Elbow valgus torque peaks at late cocking phase - during maximal shoulder external rotation (MER)
- Can approach torque up to 120 N·m
- Significantly higher torque in pitchers who enduring an injury



Sawbick et al. JSES, 2004

Comparison of Elbow Valgus Torque[a]

Pitch Cycle Event	Injured Group Mean Torque, N·m (SD)	Noninjured Group Mean Torque, N·m (SD)	Least Squared Means P Value
SFC	2.86 (7.84)	1.97 (7.67)	.89
MER	91.6 (23.0)	74.7 (22.4)	.013
REL	17.2 (14.5)	6.67 (16.3)	.12
MIR	−2.77 (8.62)	0.77 (13.8)	.60



Adam WA. AJSM, 2010.

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- **Fastballs** caused the greatest **torque**
- **Curveballs** produced the greatest arm **speed**
- **Predictors of increased elbow torque**
  - Increased ball velocity
  - Higher BMI
  - Decreased arm slot
- **Protectors against elbow torque**.
  - Increasing age
  - longer arm length
  - greater elbow circumference were independent

Am J Sports Med. 2018 Jul;46(9):2148-2153. doi: 10.1177/0363546518775816. Epub 2018 May 15.

Predictors of Elbow Torque Among Youth and Adolescent Baseball Pitchers.

Okoroha KR, Lizzio VA, Meta F, Ahmad CS, Moutzouros V, Makhni EC.

Author information

Abstract

BACKGROUND: There has been an increasing incidence of overuse elbow injuries among youth and adolescent pitchers. Pitch type has been implicated as a risk factor for excess torque at the medial elbow; however, this has not been definitively demonstrated.

PURPOSE: To assess predictors of torque across the medial elbow in youth and adolescent pitchers with a mobile sensor. In addition, the authors aimed to determine the differences in elbow torque produced according to pitch type (fastball, curveball, changeup) and pitcher demographics.

STUDY DESIGN: Descriptive laboratory study.

METHODS: Twenty youth and adolescent pitchers were instructed to throw 8 fastballs, 8 curveballs, and 8 changeups in a standardized but randomized sequence over a 25-minute period. Five pitchers were evaluated each day. A sensor placed at the medial elbow reported elbow torque, arm speed, arm slot, and shoulder rotation for each pitch, while a radar gun measured peak ball velocity. The primary outcome was a determination of thrower and pitch characteristics associated with elevated torque across the medial elbow. Secondary outcomes included the evaluation of differences in throwing biomechanics among different pitch types. Outcomes were assessed via a multivariable model, which controlled for possible covariates.

RESULTS: In total, 20 youth baseball pitchers with a mean age of 14.1 years (range, 12-17 years) were included in the study. On average, fastballs caused the greatest torque across the medial elbow (least squares mean ± SE, 47.3 ± 0.5 N·m) as compared with changeups (44.2 ± 0.5 N·m; P < .001) and curveballs (45.0 ± 0.5 N·m; P = .002). However, curveballs produced the greatest arm speed (917.8 rpm). Pitchers who started throwing curveballs at an older age experienced less elbow torque (P < .001). A multivariable model demonstrated that increased ball velocity and body mass index and decreased arm slot were independent predictors of increased elbow torque. Conversely, increasing age, longer arm length, and greater elbow circumference were independent protectors against elbow torque.

CONCLUSION: This study found that among youth and adolescent pitchers, fastballs generate the highest elbow torque while curveballs generated the greatest arm speed. Increased ball velocity and body mass index and decreased arm slot were predictors of elbow torque; however, increasing age and size of a pitcher's arm were protectors against elbow torque. These findings are important to better understand risk factors for overuse injury in this at-risk athletic population.

CLINICAL RELEVANCE: These findings may inform future pitching recommendations with intentions of curtailing medial elbow injuries experienced by young pitchers, such as ulnar collateral ligament injuries.

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- **VAS fatigue scores** increased 0.72 points per inning
- **Medial elbow torque** increased beyond inning 3, increase of 0.84 N·m each inning.
- **Pitch velocity** decreased (0.28 mph per inning)
- There were no differences in **arm rotation or arm speed** as the game progressed.
- **Arm slot** decreased with each successive inning (0.73° on average per inning)

***These findings signify a possible relationship between fatigue and injury risk.

Effect of Fatigue on Medial Elbow Torque in Baseball Pitchers

A Simulated Game Analysis

Kelechi R. Okoroha, MD, Jason E. Meldau, BS, Vincent A. Lizzio, BS, Fabien Meta, BS, Jeffrey P. Stephens, PhD, Vasilios Moutzouros, MD, and Eric C. Makhni, MD, MBA
Investigation performed at Henry Ford Hospital, Detroit, Michigan, USA

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Presentation

- Medial elbow pain during late cocking and/or early acceleration phase
- Tenderness just distal to medial epicondyle origin
  - Differs from UCL injury — tenderness posterior and more distal along anterior band course

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- MLB & minor league teams 2010-14
- **763** forearm flexor injuries
- Mean **time on the DL**: 117 days
- Decline in **WHIP & strike %**
- Subsequent injuries:
  - 37 % shoulder
  - 36 % elbow
  - 18 % forearm
  - **19.4 % required UCL reconstruction**


Forearm Flexor Injuries Among Major League Baseball Players

Epidemiology, Performance, and Associated Injuries

J Sports Sci. 2016 Nov;34(21):2054-62. doi: 10.1080/02640414.2016.1150600. Epub 2016 Mar 3.

Major League Baseball pace-of-play rules and their influence on predicted muscle fatigue during simulated baseball games.

Sonne MW[1], Keir PJ[1].

- 12 s pace (**Rule 8.04 from the MLB**)
- Significantly more muscle fatigue
- Elevated levels of muscle fatigue were predicted in the flexor-pronator mass
- Reduced effectiveness of the flexor-pronator mass may increase strain on the UCL

Imaging

- Plain radiographs negative
- MRI
  - High signal within the flexor-pronator muscle bellies

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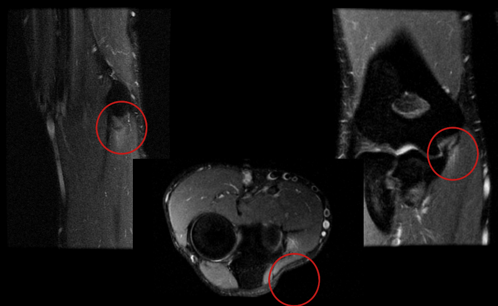
25 yo MLB player



Treatment

- Responds well to conservative management
  - Period of rest
  - Anti-inflammatories
  - Physical therapy
  - Gradual return to throwing
- Corticosteroid injection for chronic refractory symptoms
- PRP

- Pitch velocity showed a statistically significant increase (3.3%)
- Increase of 4.3° of shoulder external rotation in the experimental group.
- Injury rate was 24%

Effect of a 6-Week Weighted Baseball Throwing Program on Pitch Velocity, Pitching Arm Biomechanics, Passive Range of Motion, and Injury Rates

Michael M. Reinold, PT, DPT, SCS, ATC, CSCS,*† Leonard C. Macrina, MSPT, SCS, CSCS,† Glenn S. Fleisig, PhD,‡ Kyle Aune, MPH,‡ and James R. Andrews, MD§||

Background: Emphasis on enhancing baseball pitch velocity has become popular, especially through weighted-ball throwing. However, little is known about the physical effects or safety of these programs. The purpose of this study was to examine the effects of training with weighted baseballs on pitch velocity, passive range of motion (PROM), muscle strength, elbow torque, and injury rates.

Hypothesis: A 6-week weighted ball training program would result in a change in pitching biomechanical and physical characteristics.

Study Design: Randomized controlled trial.

Level of Evidence: Level 1.

Methods: During the baseball offseason, 38 healthy baseball pitchers were randomized into a control group and an experimental group. Pitch velocity, shoulder and elbow PROM, shoulder strength, elbow varus torque, and shoulder internal rotation velocity were measured in both groups. The experimental group then performed a 6-week weighted ball throwing program 3 times per week using balls ranging from 2 to 32 ounces while the control group only used a 5-ounce regulation baseball. Both groups performed a strength training program. Measurements were then repeated after the 6-week period. Injuries were tracked over the 6-week training program and the subsequent baseball season. The effect of training with a weighted ball program was assessed using 2-way repeated-measures analysis of variance at an a priori significance level of $P < 0.05$.

Results: Mean age, height, mass, and pretesting throwing velocity were 15.3 ± 1.2 years (range, 13-18 years), 1.73 ± 0.28 m, 68.3 ± 11 kg, and 30.3 ± 0.7 m/s, respectively. Pitch velocity showed a statistically significant increase (3.3%) in the experimental group ($P < 0.001$). There was a statistically significant increase of 4.3° of shoulder external rotation in the experimental group. The overall injury rate was 24% in the experimental group. Four participants in the experimental group suffered elbow injuries, 2 during the training program and 2 in the season after training. No pitchers in the control group were injured at any time during the study.

Conclusion: Performing a 6-week weighted ball throwing program increased pitch velocity. However, the program resulted in increased shoulder external rotation PROM and increased injury rate.

Clinical Relevance: Although weighted-ball training may increase pitch velocity, caution is warranted because of the notable increase in injuries and physical changes observed in this cohort.

- As the throw distance increased, arm speed and shoulder ER increased
- Arm slot decreased for each distance.
- Elbow Varus torque increased with each distance up to 37 m and then remained the same at 46 m.

Changes in Throwing Arm Mechanics at Increased Throwing Distances During Structured Long-Toss

Brittany Dowling,*† MS, Michael P. McNally,‡ MS, Walter A. Laughlin,† MS, and James A. Onate,‡ PhD
Investigation performed at Motus Global, Rockville Centre, New York, USA

Background: Elbow injuries among adolescent baseball players have been outpacing those of college and professional players. In attempts to prevent injuries and maximize return-to-play potential following injury, attention has been focused on "return to throw" programs, which include long-toss throws. Because the few studies that were conducted on long-toss throwing focused primarily on college-aged athletes, it is not known what type of load is incurred at the elbow during interval throwing progression among high school baseball players.

Purpose: To quantify the change in arm slot, arm speed, shoulder external rotation, and elbow varus torque across increasing throwing distances within a given athlete.

Study Design: Descriptive laboratory study.

Methods: Ninety-five high school baseball players performed a long-toss protocol while wearing an inertial sensor and sleeve. Each participant was tested for 5 throws at distances of 9 m, 18 m, 27 m, 37 m, and 46 m. Linear mixed-effects models and likelihood ratio tests were used to estimate the within-participant relationship between throw distance and arm slot, arm speed, shoulder external rotation, and elbow varus torque.

Results: Arm slot ($P < .01$), arm speed ($P < .01$), shoulder external rotation ($P < .01$), and elbow varus torque ($P < .01$) were significantly associated with long-toss throw distance. As the throw distance increased, there was an increase in arm speed and shoulder external rotation and a decrease in arm slot for each distance. However, elbow varus torque increased with each distance up to 37 m and then remained the same at 46 m.

Conclusion: The use of longer distances for conditioning and rehabilitation may be beneficial in increasing shoulder range of motion and arm speed; however, precaution needs to be taken, as throwing longer distances are accompanied by an increase in arm rotation, arm speed, and elbow torque, with a decrease in arm slot.

Clinical Relevance: Return-to-throw programs have been utilized by sports medicine clinicians and coaches to help guide a player during rehabilitation. These programs involve throwing at increased efforts through increased distances with no immediate feedback on elbow stress. This investigation describes arm biomechanical changes during submaximum interval throwing and demonstrates a tool that can be utilized to measure arm stress in real time for clinicians and athletes progressing through an interval throwing program.

Keywords: elbow; shoulder; interval throwing program; kinetics; IMU

Shoulder and elbow injuries among baseball players have been on the rise for some time, with days on the disabled list as a result of upper extremity injury increasing at a mean rate of 85.4 additional days per year since 2008.[4,18] Although most research has focused on these injuries at the professional level, national and statewide epidemiologic reports showed a 3-fold increase in the rate of ulnar collateral ligament reconstructions over the past decade, with injuries to adolescents outpacing those of college and professional players.[7,13] In attempts to prevent injuries and maximize return-to-play potential following injury, increased attention is now being paid to "return to throw" programs. These comprehensive programs generally include range of motion and flexibility exercises, strengthening exercises, plyometrics, stabilization techniques, and concentric and eccentric exercises.[22-25] These exercises cannot completely reproduce the speed and stress of actually throwing a baseball, so an interval throwing program is regularly incorporated.[5,19] Most of these programs are designed according to the principle of introducing the arm to gradually increasing loads, and they have generally been effective in conditioning players during the off-season and returning pitchers and position players to play after injury.[25] However, these programs have been developed largely on the basis of conventional wisdom and coaches' opinions

The American Journal of Sports Medicine
2018;46(12):3002–3006
DOI: 10.1177/0363546518795892

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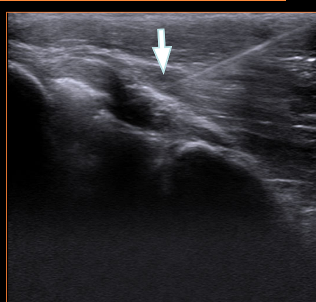
PRP Injection



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Ongoing Positive Effect of Platelet-Rich Plasma Versus Corticosteroid Injection in Lateral Epicondylitis

A Double-Blind Randomized Controlled Trial With 2-year Follow-up

Taco Gosens,*† MD, PhD, Joost C. Peerbooms,‡ MD, Wilbert van Laar,‡ and Brenda L. den Oudsten,† PhD
Investigation performed at St Elisabeth Hospital, Tilburg, the Netherlands, and Haga Hospital, The Hague, the Netherlands

The Role of Platelet-Rich Plasma in Inducing Musculoskeletal Tissue Healing

Brian C. Halpern, MD · Salma Chaudhury, MD, PhD · Scott A. Rodeo, MD

Received: 19 August 2011/Accepted: 1 November 2011 /Published online: 18 January 2012

Positive Effect of an Autologous Platelet Concentrate in Lateral Epicondylitis in a Double-Blind Randomized Controlled Trial

Platelet-Rich Plasma Versus Corticosteroid Injection With a 1-Year Follow-up

Joost C. Peerbooms,* MD, Jordi Sluimer,† MD, Daniël J. Bruijn,* PhD, and Taco Gosens,†‡ PhD
*From the *Department of Orthopaedic Surgery, HAGA Hospital, The Hague, Netherlands, and †Department of Orthopaedic Surgery, St Elisabeth Hospital, Tilburg, Netherlands*

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Platelet rich plasma versus steroid on lateral epicondylitis: meta-analysis of randomized clinical trials.

- 8 (RCTs) that involved 511 patients.
- Meta-analysis showed
  - Steroid exhibited a better efficacy of function in the short-term
  - PRP is more effective in relieving pain and improving function in the intermediate-term (12 weeks) and long-term (half year and one year).

Objectives: Lateral epicondylitis (LE) is a common tendinopathy for which an effective treatment is still unknown. The purpose of this meta-analysis was to compare the effectiveness of platelet rich plasma (PRP) vs steroid in reducing pain and improving function of the elbow in the treatment of LE.

Methods: A systematic search of the literature was conducted to identify related articles published from January 1980 to September 2016 in Pubmed, Embase, the Cochrane Library and SpringerLink. All studies that compared PRP with steroid administration on LE were included. Main outcomes were collected and analyzed by the Review Manager 5.1.

Results: Eight randomized controlled trials (RCTs) that involved 511 patients met the criteria. This meta-analysis showed that there was no significant difference in pain relief in the short-term (2 to 4 weeks: SMD = 1.02, P = .03; 6 to 8 weeks: SMD = .73, P = .24) and the intermediate-term (12 weeks: SMD = −0.28, P = .35). Steroid exhibited a better efficacy of function in the short-term (2 to 4 weeks: SMD = .61, P < .001; 6 to 8 weeks: SMD = .53, P < .001). However, PRP was superior to steroid for pain relief in the long-term (half year: SMD = −1.6, P < .001; one year: SMD = −1.45, P < .001), and also for function improving in the intermediate-term (12 weeks: SMD = −0.53, P < .001) and the long-term (half year: SMD = −0.56, P < .001; one year: SMD = −0.7, P < .001). No serious adverse effects of treatment were observed in the two groups.

Conclusion: Treatment of patients with LE by steroid could slightly relieve pain and significantly improve function of elbow in the short-term (2 to 4 weeks, 6 to 8 weeks). PRP appears to be more effective in relieving pain and improving function in the intermediate-term (12 weeks) and long-term (half year and one year). Considering the long-term effectiveness of PRP, we recommend PRP as the preferred option for LE.

Mi B[1], Liu G[1], Zhou W[1], Lv H[2], Liu Y[1], Wu Q[1], Liu J[1].

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Flexor-Pronator Strain + UCL

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- 187 players undergoing UCL reconstruction (2002 to 2007)
  - 8 (4.3%) with combined flexor-pronator mass injury
  - Age difference statistically significant between two groups
  - Isolated UCL (20.1 yrs) vs Combined UCL/FPM (33.4 yrs)
  - Age > 30 years predicts combined injury (88%) vs isolated UCL (1%); P < 0.001
- 12.5% with combined injury returned to sport

Combined Flexor-Pronator Mass and Ulnar Collateral Ligament Injuries in the Elbows of Older Baseball Players

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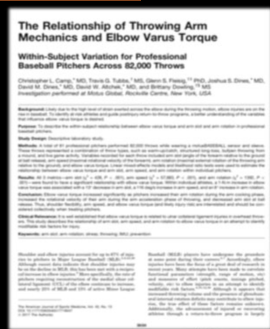
- **Elbow Varus torque** increased as pitchers
  - increased arm rotation during the cocking phase
  - increased the rotational velocity during the acceleration phase
  - decreased arm slot at ball release.
- Elbow Varus torque is related to **UCL injuries** in overhead throwers.


The Relationship of Throwing Arm Mechanics and Elbow Varus Torque

Within-Subject Variation for Professional Baseball Pitchers Across 82,000 Throws

Christopher L. Camp, MD, Travis G. Tubbs, MS, Glenn S. Fleisig, PhD, Joshua S. Dines, MD, David M. Dines, MD, David W. Altchek, MD, and Brittany Dowling, MS

Investigation performed at Motus Global, Rockville Centre, New York, USA

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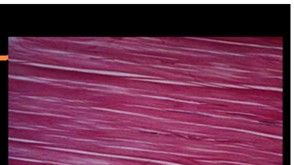
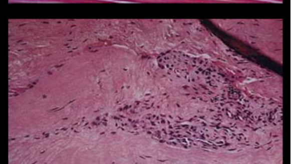
Medial Epicondylitis

- Pathology
- Presentation
- Physical Exam
- Imaging
- Treatment

Medial Epicondylitis

- Pathologic inflammatory changes the flexor-pronator mass origin
- Often begins as micro-tearing between Pronator teres and FCR
- Develops into fibrotic and inflammatory granulation tissue - Angiofibroblastic hyperplasia
- 20% with concomitant ulnar neuritis





Kraushar BS et al. JBJS, 1999

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Presentation

- Insidious onset medial elbow pain
- Exacerbated during throwing
- Tenderness distal and anterior to medial epicondyle
- Reproducible with resisted wrist flexion and forearm pronation (most sensitive)
- +/- Tinel's sign

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Imaging

- Plain radiographs often negative
- MRI
  - Increased signal intensity within common flexor tendon on both T1 & T2 sequences
  - Common flexor tendon thickening
  - Best seen on axial and coronal

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MRI

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Treatment

- Initial conservative management - Up to 90% success rates[*]
  - Pain relief - Rest, Ice, Anti-inflammatories
  - Physical therapy - stretching and progressive isometric exercises
    - Followed by eccentric and concentric resistive exercises[**]

[*]Gabel GT & Morrey BF. JBJS, 1995
[**]Baker CL et al. Clin Sports Med, 2010

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Surgical Treatment

- Reserved for refractory cases
  - 6 months of failed therapy program*
- Technique
  - -Care to avoid medial antebrachial cutaneous n.
  - -Debridement of inflamed/pathologic tissue
  - -Secure tendinous repair
  - -Plus or minus suture anchor to epicondyle

**Han SH et al, JSES, 2016

*Jobe FW & Ciccotti MG. JAAOS, 1994

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Post-Operative Plan

- Brief immobilization (7-10 days)
- Gentle passive and active range of motion
- 4 to 6 weeks - resisted wrist flexion and forearm pronation
- Return to play by 4 months

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The result of surgical treatment of medial epicondylitis: analysis with more than a 5-year follow-up

JSES 2016

- Retrospective analysis of 63 elbows treated surgically
- Minimum 1 year conservative management
- 13/63 with ulnar neuritis - All received ulnar neurolysis
- Mean pain score improvement 8.4 to 2.4 (p:0.001)
- 94% (59/63) with excellent or good results
- Return to work 2.8 months
- Return to exercise 4.8 months
- 1 complicated with heterotrophic ossification

Background

Angiofibroblastic changes of a musculotendinous origin at the medial epicondyle characterize medial epicondylitis of the elbow. Although nonsurgical treatment is the primary approach for medial epicondylitis, surgical treatment should be considered when conservative therapy fails. This study reports the results of surgical treatment of medial epicondylitis monitored for more than 5 years.

Methods

This study included 55 patients with 63 cases of medial epicondylitis between 2000 and 2010. The conservative treatment periods lasted for a minimum of 1 year, and steroid injections were administered more than twice before surgery. One surgeon conducted the surgical procedures. The Nirschl and Pettrone grades, visual analog scale (VAS) scores, Disabilities of the Arm, Shoulder and Hand (DASH) scores, Mayo Elbow Performance scores, and grip strengths were analyzed. Statistical analyses were performed using paired *t* tests.

Results

The mean VAS score improved from 8.5 to 2.4 (P<.001). Nirschl and Pettrone grades rated 43% (27 elbows) as excellent and 51% (32 elbows) as good. The Mayo Elbow Performance scores improved from 72 to 88 (P<.001) and DASH scores from 57 to 23 (P<.001). The mean grip strength of the affected side improved from 30 to 43lb (P<.001). The mean time required to return to work and exercise was 2.8 months and 4.8 months, respectively. One case of heterotrophic ossification, which had no functional instability afterward, was seen.

Conclusion

The results indicate that surgical treatment of medial epicondylitis could be an effective and safe treatment when conservative treatment fails.

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Soo-Hong Han, MD, PhD*, Jun-Ku Lee, MD, Hyeong-Jong Kim, MD, Soo-Hyun Lee, MD, Ji-Woong Kim, MD, Tae-Seob Kim, MD

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- Retrospective analysis 60 patients treated surgically
- Minimum 4 months conservative management (Avg. 144 weeks)
- 20% with concomitant ulnar neurolysis
- Results after 1 year follow up:
  - MEPS (Mayo Elbow Performance Scores) improved post-op from 58 to 88 ($p < 0.02$)
  - Pain levels (Scale 0-3) decreases 2.2 to 0.6 ($p < 0.0001$)
  - 1 re-operation in competitive swimmer

J Shoulder Elbow Surg (2015) 24, 1172-1177

An effective approach to diagnosis and surgical repair of refractory medial epicondylitis

Amrit V. Vinod, BA[a], Glen Ross, MD[b,*]

[a]University of Massachusetts Medical School, Worcester, MA, USA
[b]New England Baptist Hospital, Pro Sports Orthopedics, Boston, MA, USA

Clinical Outcomes After Suture Anchor Repair of Recalcitrant Medial Epicondylitis

Brian M. Grawe, MD; Peter D. Fabricant, MD, MPH; Christopher S. Chin, BA; Answorth A. Allen, MD; Brian J. DePalma, BS; David M. Dines, MD; David W. Altchek, MD; Joshua S. Dines, MD

Orthopedics. 2016;39(1):e104-e107 https://doi.org/10.3928/01477447-20151222-09

- **Most patients returned to premorbid sporting activities at a median of 4.5 months**
- Older age at the time of surgery was predictive of better Quick DASH score and OES
- Patients who underwent surgery after a shorter duration of symptoms had better outcomes, but the difference did not reach statistical significance

- The incidence of failure requiring revision (1.5%).
- Risk factors for revision:
  - younger age
  - male gender
  - morbid obesity
  - tobacco use
  - inflammatory arthritis
  - The most significant risk factor for revision surgery is having ≥3 ipsilateral preop injections

J Shoulder Elbow Surg (2017) 26, 704-709

Three or more preoperative injections is the most significant risk factor for revision surgery after operative treatment of lateral epicondylitis: an analysis of 3863 patients

Ryan M. Degen, MD[a], Jourdan M. Cancienne, MD[b], Christopher L. Camp, MD[a], David W. Altchek, MD[a], Joshua S. Dines, MD[a], Brian C. Werner, MD[b,*]

[a]Sports Medicine and Shoulder Service, Hospital for Special Surgery, New York, NY, USA
[b]Sports Medicine and Shoulder Surgery, University of Virginia Health System, Charlottesville, VA, USA

Avulsions

- Skeletally immature athletes
- Direct trauma, dislocation, chronic valgus or extension overloading
- *Medial epicondyle* (most common) - last to fuse
  - Sublime tubercle, olecranon avulsion

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- Retrospective review of 33 UCL injuries
- 8 with avulsion of sublime tubercle - all treated non-op
- Age 16.9 yrs. - 5 HS, 2 Collegiate, 1 MLB
  - Treatment
    - Brief immobilization (7-10 days at 90°)
    - 6 weeks of functional bracing
    - Throwing program at 8 weeks
    - Return to play at 12 weeks

Avulsion Fracture of the Ulnar Sublime Tubercle in Overhead Throwing Athletes

John P. Salvo, MD, Louis Rizzo III, MD, John E. Zvijac, MD, John W. Uribe, MD, and Keith S. Hechtman, MD

From the Uribe-Hechtman-Zvijac Sports Medicine Institute, Coral Gables, Florida

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Presentation

- Reports sudden pain or audible "pop"
- Local soft-tissue swelling
- Loss of elbow motion
- Point tenderness along medial epicondyle

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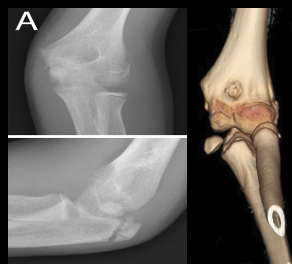
Imaging

- Plain radiographs - 3 views
  - Medial epicondyle fragment displaced anteriorly and distally
  - May be incarcerated intra-articularly (cases of dislocation)
- Advanced imaging usually unnecessary
  - CT - determine displacement
  - MRI - evaluate incarcerated fragment



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Treatment

- Non-operative
  - Less than 2mm displacement
- Operative Indications (Lower threshold in competitive athletes)
  - Greater than 5mm displacement
  - Incarcerated fragment in joint
  - Open fracture
  - Gross instability
  - Ulnar nerve compression

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Redler LH & Dines JS. Hand Cl, 2015

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- Arthroscopic treatment: debridement of posteromedial synovitis, fragment removal, and olecranon spur excision.
- Mean age 15.7 (range 14-17) years.
- Time from onset of symptoms to surgery was 4.9 (3-18) mo.
- Intraoperative findings:
  - posteromedial synovitis
  - olecranon spurs in all patients
  - fragments in 10.
- Elbow outcome score: excellent in 11 patients and good in 2, mean score of 92 points (maximum 100 points).
- Mean postoperative ROM was 5° to 139.7° of flexion.
- All return to their previous level of play at an avg of 3.4 mo.
- No patient developed medial instability

Clinical Outcome of Arthroscopic Treatment for Posteromedial Elbow Impingement in Adolescent Baseball Players

Tetsuya Matsuura, M.D., Toshiyuki Iwame, M.D., Naoto Suzue, M.D., Jyoji Iwase, M.D., Shunsuke Tamaki, M.D., Kenji Yokoyama, M.D., and Koichi Sairyo, M.D.

See commentary on page 111

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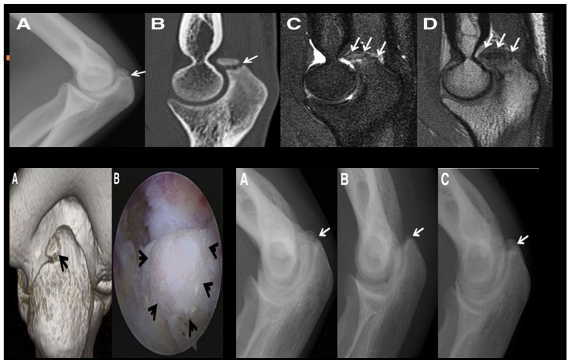
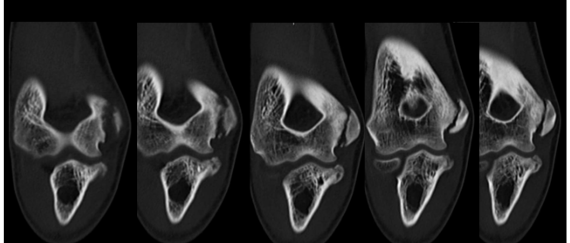
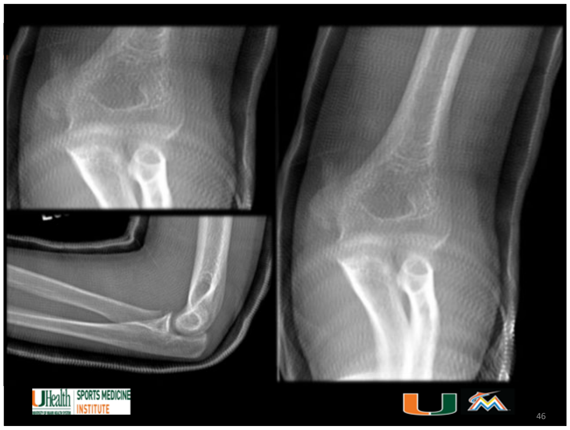


Case

- 15 yr. old LHD high school pitcher felt "pop" in medial elbow while pitching
  - 4/10 dull pain, no numbness
  - PE: ROM 30-120, Pronation 70, Supination 60 4/5 strength. Tender medially. NVI

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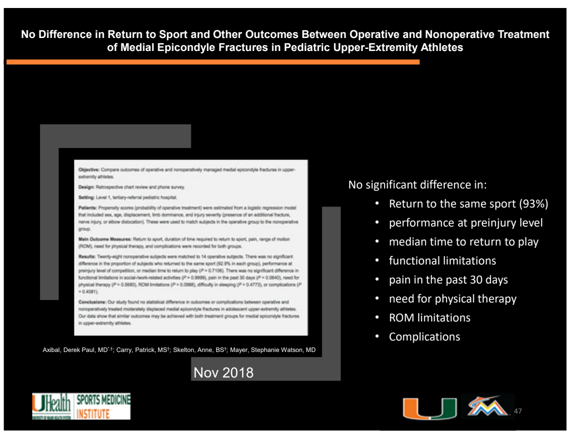
No Difference in Return to Sport and Other Outcomes Between Operative and Nonoperative Treatment of Medial Epicondyle Fractures in Pediatric Upper-Extremity Athletes
Objective: Compare outcomes of operative and nonoperatively managed medial epicondyle fractures in upper-extremity athletes.
Design: Retrospective chart review and phone survey.
Setting: Level 1, tertiary-referral pediatric hospital.
Patients: Propensity scores (probability of operative treatment) were estimated from a logistic regression model that included sex, age, displacement, limb dominance, and injury severity (presence of an additional fracture, nerve injury, or elbow dislocation). These were used to match subjects in the operative group to the nonoperative group.
Main Outcome Measures: Return to sport, duration of time required to return to sport, pain, range of motion (ROM), need for physical therapy, and complications were recorded for both groups.
Results: Twenty-eight nonoperative subjects were matched to 14 operative subjects. There was no significant difference in the proportion of subjects who returned to the same sport (92.9% in each group), performance at preinjury level of competition, or median time to return to play (P = 0.7106). There was no significant difference in functional limitations in social-/work-related activities (P > 0.9999), pain in the past 30 days (P = 0.0640), need for physical therapy (P = 0.5680), ROM limitations (P = 0.0988), difficulty in sleeping (P = 0.4773), or complications (P = 0.4081).
Conclusions: Our study found no statistical difference in outcomes or complications between operative and nonoperatively treated moderately displaced medial epicondyle fractures in adolescent upper-extremity athletes. Our data show that similar outcomes may be achieved with both treatment groups for medial epicondyle fractures in upper-extremity athletes.
Axibal, Derek Paul, MD*,†; Carry, Patrick, MS†; Skelton, Anne, BS†; Mayer, Stephanie Watson, MD
Nov 2018
No significant difference in:
• Return to the same sport (93%)
• performance at preinjury level
• median time to return to play
• functional limitations
• pain in the past 30 days
• need for physical therapy
• ROM limitations
• Complications
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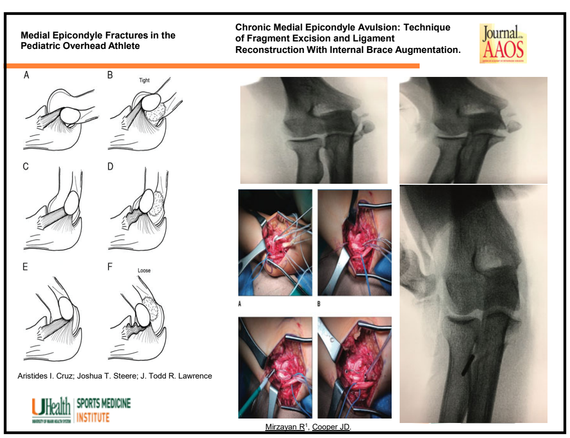
Medial Epicondyle Fractures in the Pediatric Overhead Athlete
Chronic Medial Epicondyle Avulsion: Technique of Fragment Excision and Ligament Reconstruction With Internal Brace Augmentation.
A
B
Tight
C
D
E
F
Loose
Aristides I. Cruz; Joshua T. Steere; J. Todd R. Lawrence
Mirzayan R[1], Cooper JD.

References

J Shoulder Elbow Surg. 2007 Nov-Dec;16(6):795-802. Epub 2007 Nov 1. Muscle contribution to elbow joint valgus stability. Lin F1, Kohli N, Perlmutter S, Lim D, Nuber GW, Makhsous M.

Am J Sports Med. 2003 Jul-Aug;31(4):621-35. Elbow injuries in throwing athletes: a current concepts review. Cain EL Jr1, Dugas JR, Wolf RS, Andrews JR.

Radiol Clin North Am. 2013 Mar;51(2):195-213. doi: 10.1016/j.rcl.2012.09.013. Epub 2013 Jan 12.MR imaging of the elbow in the injured athlete. Wenzke DR1.

Top Magn Reson Imaging. 2003 Feb;14(1):69-86. Magnetic resonance imaging of sports injuries of the elbow. Thornton R1, Riley GM, Steinbach LS.

J Am Acad Orthop Surg. 2001 Mar-Apr;9(2):99-113. Medial elbow problems in the overhead-throwing athlete. Chen FS1, Rokito AS, Jobe FW.

J Shoulder Elbow Surg. 2016 Oct;25(10):1704-9. doi: 10.1016/j.jse.2016.05.010. Epub 2016 Aug 1. The result of surgical treatment of medial epicondylitis: analysis with more than a 5-year follow-up. Han SH1, Lee JK2, Kim HJ2, Lee SH2, Kim JW2, Kim TS2.

J Shoulder Elbow Surg. 2015 Aug;24(8):1172-7. doi: 10.1016/j.jse.2015.03.017. An effective approach to diagnosis and surgical repair of refractory medial epicondylitis. Vinod AV1, Ross G2.

J Am Acad Orthop Surg. 2015 Jun;23(6):348-55. doi: 10.5435/JAAOS-D-14-00145. Medial epicondylitis: evaluation and management.
Amin NH, Kumar NS, Schickendantz MS.

J Hand Surg Eur Vol. 2015 Sep;40(7):744-5. doi: 10.1177/1753193414567012. Epub 2015 Jan 19. Efficacy of platelet-rich plasma injections for chronic medial epicondylitis. Glanzmann MC1, Audigé L2.

Clin Sports Med. 2010 Oct;29(4):577-97. doi: 10.1016/j.csm.2010.06.009. Epicondylitis in the athlete's elbow. Van Hofwegen C1, Baker CL 3rd, Baker CL Jr.

Hand Clin. 2015 Nov;31(4):663-81. doi: 10.1016/j.hcl.2015.07.002. Epub 2015 Aug 25. Elbow Trauma in the Athlete. Redler LH1, Dines JS2.

Am J Sports Med. 2013 May;41(5):1152-7. doi: 10.1177/0363546513480797. Epub 2013 Mar 18. Return to competitive sports after medial epicondyle fractures in adolescent athletes: results of operative and nonoperative treatment. Lawrence JT1, Patel NM, Macknin J, Flynn JM, Cameron D, Wolfgruber HC, Ganley TJ.

J Shoulder Elbow Surg. 2010 Oct;19(7):951-7. doi: 10.1016/j.jse.2010.04.038. Epub 2010 Aug 5. Acute, avulsion fractures of the medial epicondyle while throwing in youth baseball players: a variant of Little League elbow. Osbahr DC1, Chalmers PN, Frank JS, Williams RJ 3rd, Widmann RF, Green DW.

Sabick MB, Torry MR, Lawton RL, Hawkins RJ. Valgus torque in youth baseball pitchers: a biomechanical study. J Shoulder Elbow Surg. 2004;13(3):349-355

Adam W. Anz, Brandon D. Bushnell, Leah Passmore Griffin, Thomas J. Noonan, Michael R. Torry and Richard J.Hawkins. Correlation of Torque and Elbow Injury in Professional Baseball Pitchers. Am J Sports Med. 2010; 38;1368.

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