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Ulnar Collateral Ligament Repair: A Review of Internal Bracing Versus Modified Jobe Reconstruction

Ramon C. Ylanan^{a,b,d}, Tracy Ray^{a,c}

Level of Evidence: VI (Controlled Laboratory study)

Introduction: In overhead throwing athletes, specifically baseball players, there has been a dramatic increase in UCL (ulnar collateral ligament) injuries and the resulting surgical interventions. Dugas et al, in a controlled biomechanical laboratory study, set out to compare the novel technique of UCL repair/augmentation using the Arthrex Inc. "Internal Brace" to the current modified Jobe UCL reconstruction technique. They hypothesized that the augmented UCL repair would have less gap formation on load testing and would return more normal gap values when compared to the reconstruction group.

Methods: The investigators had 9 matched pairs of cadaveric elbows (2M, 7F, age range 55-71, mean age 63). Each elbow was dissected, mounted in the custom testing apparatus at 90° of elbow flexion, then cyclically valgus and rotationally stressed. After initial stressing, the distal UCL insertion of each cadaver was dissected off the sublime tubercle,

simulating a distal UCL tear, and randomly selected into either the repair/augmentation or tradition reconstruction group. After the surgical procedures were complete, the elbows were again cyclically valgus and rotationally stressed. In addition, a static valgus phase and load to failure phase were also performed. Measurements were taken at each step, including gap measurements.

Results: Statistically significant results showed that gap formation in the torn state was higher than the gap formation in the post-augmented/repared UCL state ($P = .04$), and that the augment/repair group was more resistant to gapping ($P = 0.3$) than the reconstruction group. When comparing the UCL repair to the UCL reconstruction group in the load to failure test, there was no significant statistical significance.

Strengths: This was a well-designed biomechanical study comparing the traditional modified Jobe UCL reconstruction to the novel UCL augmentation/repair technique. There is recognition of increasing rates in UCL injury, current reconstruction options, and the lengthy time to full recovery and level of play.

Weaknesses: Weaknesses, addressed as well by the authors, revolve around the age of cadavers, low sample size, surgical attempts to recreate distal UCL tears and low loading forces post-intervention. The age of the cadavers does not correspond to the age group of athletes for which the procedure would be

^aRamon C. Ylanan, MD and Tracy Ray, MD reviewing Dugas et al. Biomechanical Comparison of Ulnar Collateral Ligament Repair With Internal Bracing Versus Modified Jobe Reconstruction. Am J Sports Med 2016 Mar; 44(3):735-41

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used and bone stock may be the reason for the modes of failures noted. The low sample size may have limited statistical differences between the two groups. The attempt to recreate a distal UCL tear (not specified whether it was an attempt to simulate partial or complete distal UCL tear) by sharp dissection of the UCL off the sublime tubercle may have modified the biomechanics altering measurements pre and post-procedure. The relatively low cyclic loading force (2-5 N·m) does not correlate to the repetitive loading forces of throwers, which have been calculated to be ~ 35 N·m; however, load to failure measurement did fall within previously published acceptable measurements.

Conclusion: Though limited due to the cadaveric nature of the study, Dugas et al. set out to show that the UCL augmentation/repair technique using the Arthrex Inc. "Internal Brace" was a viable option compared to the current modified Jobe technique. The augmentation/repair procedure provided similar biomechanical properties to traditional reconstruction, including ultimate load failure measurements, but with more similar gapping to native intact UCL at earlier/lower loads which may allow earlier more aggressive therapy for potential earlier return to play. The "gap" measurements between the repair and the reconstruction groups were different to start, however by using ANOVA and the Student t test, Dugas et al. showed that there was statistical difference post-procedure within each group.

Practice Pearl: In overhead throwing athletes with distal UCL injuries, the UCL augmentation/repair technique may be an option in a select population of athletes (distal UCL tears) in lieu of traditional modified Jobe reconstruction with the addition of

potential earlier aggressive therapy and thus earlier return to play, though I am unsure if the "gap" data is clinically significant. I believe the next step to further identify and link tear-type with procedure-type, is to study the difference between these surgical techniques on distal vs proximal tears and between partial vs complete tears.

References:

- (1) Dugas JR et al. Biomechanical Comparison of Ulnar Collateral Ligament Repair With Internal Bracing Versus Modified Jobe Reconstruction. *Am J Sports Med* 2016 Mar; 44(3):735-41: doi: 10.1177/0363546515620390

UCL Reconstruction Revision in Major League Baseball Pitchers: Cause for Concern?

Ryan Scully^{a,b,d}, Jason L. Zaremski^{a,c}

Level of Evidence: Level III, retrospective cohort study

Introduction: Ulnar collateral ligament reconstruction (UCL), otherwise known as Tommy John surgery, has been performed at an increasing rate over the past decade amongst Major League Baseball (MLB) pitchers. The authors sought to characterize the incidence of revision surgery and athlete performance after revision surgery. The group hypothesized a higher than previously established rate of revision surgery and that overall athlete performance and longevity would decline after revision surgery.

Methods: A retrospective review was performed using publically available databases. All MLB pitchers undergoing surgery before 1999 were excluded from the study to account for improved surgical technique and to best portray the modern rate of revision. All revision procedures on MLB pitchers from 1999 to 2014 were analyzed. For the return-to-play and

performance analyses, only procedures through 2012 were including to account for post-operative rehabilitation. The authors defined return to active play as pitching in one or more MLB game after revision surgery, while an established return was defined as 10 or more games pitched in 1 season after revision. Personal performance data, based on publically available statistics, was reviewed in the 3 seasons before and after revision surgery.

Results: The number of both UCL constructions and revision procedures increased from 1999 to 2014. By the year 2014, approximately one-third of all UCL procedures on MLB pitchers were revisions. Overall, the revision rate was 13.2% (31/235) and more than one-third (37%) of revision surgeries were performed within 3 years of the initial procedure.

A majority of pitchers (65.4%) returned to pitch in at least one MLB game, while only 42.3% of pitchers returned to established play and only 29% continued to play for more than two seasons. No statistically significant difference was identified between the average number of seasons pitched at the MLB level before revision surgery, pitcher age, or fastball velocity in those patients who were and were not able to return to play. Percentage of fastball pitches was found to be statistically significant, with a lesser amount being thrown by those able to return to play (56.2% vs 67.3%, $p=0.027$). After reviewing the three seasons before and after revision surgery, statistically

^aRyan Scully, MD and Jason L. Zaremski, MD reviewing Liu et al. Outcomes in revision Tommy John surgery in Major League Baseball pitchers. *J Shoulder Elbow Surg.* 2016;25(1):90-97.

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significant decreases in innings and total pitches pitched per season were found. Compared to controls, pitchers undergoing UCL revision also pitched in fewer seasons compared to matched controls.

Strengths: The study was well-designed to address the questions posed by the authors. It should be noted that the use of publicly available databases is not without its limitations but no viable alternative exists to our knowledge for conducting studies in this population. Excluding data before 1999 was appropriate to limit the effect of surgical technique, which was evolving at this time.

Weaknesses: The data was extracted from publicly available databases, which the authors acknowledge could be subject to information bias due to statistic inaccuracies or exclusion of players. Additionally, not all players requiring revision surgery in the later years of the cohort were available for performance analysis due to ongoing rehabilitation; this analysis requiring shrinking the cohort to patients having surgery before 2012. Additionally, the conclusions drawn from this cohort of MLB baseball pitchers may not be applicable to athletes of another sport or level of competition.

Conclusion: The authors determined the revision rate in Tommy John surgery to be 13.2%. Performance analysis revealed that revision surgery decreases return to play and overall career longevity.

Practice Pearl: Primary UCL reconstruction in the competitive overhead throwing athlete is a successful procedure in the appropriately selected patient.²⁻⁴ Patients should be advised that the success seen in primary reconstructions cannot be guaranteed for revision procedures. The findings in this study may be

narrowly applicable considering the resources available to this elite population.

References:

- (1) Liu et al. Outcomes in revision Tommy John surgery in Major League Baseball pitchers. *J Shoulder Elbow Surg.* 2016;25(1):90-97. doi:10.1016/j.jse.2015.08.040.
- (2) Cain et al. Outcome of ulnar collateral ligament reconstruction of the elbow in 1281 athletes: Results in 743 athletes with minimum 2-year follow-up. *Am J Sports Med.* 2010;38(12):2426-2434. doi:10.1177/0363546510378100.
- (3) Erickson et al. Rate of return to pitching and performance after Tommy John surgery in Major League Baseball pitchers. *Am J Sports Med.* 2014;42(3):536-543. doi:10.1177/0363546513510890.
- (4) Gibson et al. Ulnar collateral ligament reconstruction in major league baseball pitchers. *Am J Sports Med.* 2007;35(4):575-581. doi:10.1177/0363546506296737.

A Major League Predictor of UCL Reconstruction: Throwing Faster or Throwing Fast Often?

Neil Droppers^{a,b,d}, Tracy Ray^{a,c}

Level of Evidence: Level III (Case-Control Design; Epidemiology Study)

Introduction: Ulnar Collateral Ligament (UCL) injuries are a common occurrence among Major League Baseball (MLB) pitchers, with many ultimately requiring UCL reconstruction (UCL-R). Prior to this study by Robert Keller et al., other studies have linked increased pitch velocity with risk of UCL injury and various pitch types with increased torque across the elbow, but no prior studies have investigated velocity and percentage of pitch type thrown as potential predictors of UCL-R in MLB pitchers.

Methods: 83 MLB pitchers who underwent UCL-R were compared with 83 MLB controls, matched for size, age, pitching role (starter vs. reliever), MLB experience, and innings pitched. Statistics were collected retrospectively, two years prior to UCL injury and two years after UCL-R. For controls, statistics were collected at two years prior to and after a specified index year, matched to the season prior to

UCL-R in the case group.

Results: Pitch type percentage was found to be a statistically significant predictor of UCL-R, with those undergoing reconstruction throwing more fastballs compared to controls (46.8% vs. 39.7%, $P = .03$). Interestingly, all pitchers included in the study who threw 48% or more fastballs required UCL-R. Though pitch type pattern was found to be predictive of UCL-R in this analysis, pitch speed was not. Comparing the fastball ($P = .69$), slider ($P = .88$), curveball ($P = .92$), and change-up ($P = .96$) between groups showed no significant differences in velocity.

Strengths: This case control study analyzed pitching statistics from 166 MLB pitchers over four years of their individual careers, resulting in a moderately robust set of data. The authors approached the challenge of creating a control group in this analysis by matching for numerous variables, and were successful in creating two groups with no statistical differences between selected demographics.

Weaknesses: One of the potential weaknesses of this analysis is that pitchers with injuries to the elbow were included in the control group, as long as they did not require UCL-R. The article does not address those players who may have sustained UCL injury but did not undergo surgery. It seems implied by the article that all MLB pitchers who have a UCL injury will undergo UCL reconstruction, but justification for this assumption is not provided. More importantly, the primary aim listed was to investigate predictors

^aNeil Droppers, DO and Tracy Ray, MD reviewing Keller et al. Major League Baseball pitch velocity and pitch type associated with risk of ulnar collateral ligament injury. *Journal of Shoulder and Elbow Surgery* 2016; 25, 671-675.

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of UCL injury, but if anything, the analysis should only be used as a predictor of UCL reconstruction, as pitchers with elbow injuries not requiring surgery were included in the control group based on provided information. Another potential weakness is that controls were matched for innings pitched instead of pitch counts, leaving the possibility for significant differences between groups in terms of total pitches thrown. Also, the fact that all information was extracted from numerous non-standardized internet sources potentially calls the validity of the data and subsequently the conclusions of the analysis into question. Lastly, this analysis was performed exclusively on MLB pitchers, and the results may not translate to pitchers at lower levels of competition.

Conclusion: This analysis of MLB pitchers found a 2% increase in the risk of UCL reconstruction for every 1% increase in fastballs thrown. Every pitcher included who threw 48% or more fastballs underwent UCL-R. While previous studies suggested that pitch velocity may predict UCL injury, this article suggests that the more a pitcher throws his fastest pitch, in proportion to other pitch types, the greater the risk of requiring UCL reconstruction.

Practice Pearl: This study suggests that in counseling MLB pitchers, throwing faster may not be a predictor of ultimately requiring UCL reconstruction, but throwing your fastest pitch more frequently may be. More studies are required before extrapolating to other pitching populations.

References:

- (1) Keller, RA et al. Major League Baseball pitch velocity and pitch type associated with risk of ulnar collateral ligament injury. *Journal of Shoulder and Elbow Surgery* 2016; 25, 671-675.

MRI Grading of Ulnar Collateral Ligament Tears of the Elbow: A Management Tool and Predictor of Return-to-Play?

Cody Franzen^{a,b,d}, Jeffrey Manning^{a,b}, Jason L. Zaremski^{a,c}

Level of Evidence: Level IV (Case Series)

Introduction: Overhead athletes, particularly baseball pitchers, place tremendous stress on the support structures of the medial elbow of their throwing arm. Ulnar collateral ligament (UCL) injuries of the elbow can lead to pain, decreased performance and can even potentially jeopardize the careers of throwing athletes. Little data exists on the non-operative management of such injuries and how likely these individuals are to return to high-level performance.

Methods: Ford et al reviewed UCL injuries sustained within a single professional baseball team between 2006 and 2011. Each athlete had an UCL injury diagnosed by history, physical exam, and MRI findings. MRI was interpreted based on an MRI grading system which categorized each injury as grade I (intact ligament with or without edema), grade IIa (partial tear), grade IIb (chronic healed injury) or grade III (complete tear). All grade III injuries were recommended for surgery, while first time injuries of

grade I or II were recommended for rehabilitation, which included manual therapy, modalities, rotator cuff and periscapular strengthening and an interval throwing program. The authors then determined return to play (RTP) rates (to any level of play = RTP) and same or higher level of play (RTSP) after undergoing conservative therapy, surgical reconstruction, or both.

Results: Forty-three professional baseball players (32 pitchers and 11 positional players) were included with a mean age of 23.38 ± 2.3 years. Eight pitchers were found to have grade III tears, all of which were treated surgically with RTP and RTSP rates of 75% and 63% respectively. The 35 remaining athletes had: four grade I tears, eight grade IIa tears, and twenty-three grade IIb tears. Seven athletes with incomplete UCL tears (two grade IIa and five grade IIb) went on to have surgery, but only three of these players completed a full rehabilitation protocol prior to surgery. Non-operative management was employed for the remaining 28 athletes (ten positional and eighteen pitchers) with RTP and RTSP rates of 93%. Of the players who received only non-operative management, four had grade I UCL injuries with RTSP rate of 100%, six had grade IIa tears with RTSP rate of 83% and eighteen had Grade IIb tears with RTSP rate of 94%. Overall, RTSP rate was 84% for players treated non-operatively for incomplete UCL tears whereas RTSP rates for all athletes (surgical and non-operative

^aCody Franzen, MD, Jeffrey Manning, MD and Jason L. Zaremski, MD reviewing Gregory Ford, MD et al. Return-to-Play Outcomes in Professional Baseball Players After Medial Ulnar Collateral Ligament Injuries Comparison of Operative Versus Nonoperative Treatment Based on Magnetic Resonance Imaging Findings. *Am J Sports Med.* 2016; 44(3): 723-728.

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management combined), were 100% for Grade I, 88% for Grade IIa, 91% for Grade IIb and 63% for Grade III tears.

Strengths: This is the first study to compare surgical and non-operative management outcomes for UCL injuries among professional baseball players utilizing a MRI grading system. It also reports on the large number of baseball players with UCL injuries who were treated non-operatively.

Weaknesses: This study has a retrospective design and lacks statistical power. It also had a relatively short follow up period, thus potentially missing those individuals that were initially treated successfully non-operatively who went on to undergo surgical reconstruction. A selection bias affected the treatment of twenty percent of players with incomplete injuries as they opted for surgery prior to completion of their rehabilitation program. Finally, a significant limitation was that type II tears were not differentiated by severity or location (low grade partial versus high grade partial) or location (proximal, distal, or mid).

Conclusion: Incomplete UCL injuries can be treated non-operatively with a high rate of RTP and RTSP. MRI grading of UCL tears may be helpful in predicting need for surgical intervention and return to play rates.

Practice Pearl: Some baseball players with incomplete UCL tears can be treated with a multidisciplinary rehabilitation program and return to previous level of performance. MRI can assist in predicting whether a baseball player will have success with conservative management or require surgical intervention.

References:

- (1) Ford et al. Return-to-Play Outcomes in Professional Baseball Players After Medial Ulnar Collateral Ligament Injuries Comparison of Operative Versus Nonoperative Treatment Based on Magnetic Resonance Imaging Findings. *Am J Sports Med.* 2016; 44(3): 723-728. doi: 10.1177/0363546515621756

Platelet-Rich Plasma for Elbow Ulnar Collateral Ligament Insufficiency: A Successful Option between Conservative Management and Surgery

Ronan Cahill^{a,b,e}, Adam M. Pourcho^{a,c}, Jason L. Zaremski^{a,d}

Level of Evidence: Level IV (Retrospective Case Series)

Introduction: Elbow ulnar collateral ligament (UCL) injuries can cause pain and disability for overhead athletes, resulting in medial elbow pain and loss of overhead throwing velocity and control. Athletes who have failed conservative management often proceed with surgical reconstruction. In this retrospective case series, athletes with confirmed UCL injuries who failed conservative management were treated with injections of platelet-rich-plasma (PRP).

Methods: This study included 44 baseball players, mean age 17.3 years, with MRI confirmed UCL injury. All athletes had failed a trial of conservative therapy prior to inclusion. Participants received 1, 2, or 3 palpation guided 3 mL PRP injections. Results were followed with the modified Conway Scale. Post-injection, athletes were instructed to remain off NSAIDs and proceed with relative rest for 2 weeks followed by progressive stretching and strengthening

until return to throwing.

Results: Of study participants, 29 had partial thickness tears (22 proximal, 7 distal), and 15 had diffuse signal in the UCL without tear. There were 15 excellent, 17 good, 2 fair, and 10 poor outcomes. All 7 of the distal tears and 3 of the proximal tears demonstrated poor outcomes. Overall, there were 6 excellent, 7 good, and 2 fair outcomes in the partial-tear group. Nine out of 15 patients with diffuse signal without tear reported excellent outcomes. The mean time to return to throwing after PRP injection was 12 weeks (range 5-24 weeks). There was no correlation between duration of symptoms and outcomes.

Strengths: This manuscript has several strengths including, 100% follow-up, breakdown of tear location and type, the use of a validated follow up scale and a range of high school through professional athletes.

Weaknesses: This study has several weaknesses which warrant further consideration. Firstly, this is a retrospective study without case controls. Prior to the intervention, the conservative treatment was not well defined or controlled and there was no mention of control of NSAIDs, which could have affected the outcomes. There is no mention of the type of PRP used (leukocyte rich vs leukocyte poor), the concentrations of the PRP injected, or if local anesthetic was used prior to injection. Furthermore, the 3ml volume is a large volume to place within the

^aRonan Cahill, MD, Adam Pourcho, DO, and Jason Zaremski, MD reviewing Dines et al. Platelet-Rich Plasma Can Be Used to Successfully Treat Elbow Ulnar Collateral Ligament Insufficiency in High-Level Throwers. *Am J Orthop.* 2016; 45(5): 296-300.

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UCL itself and without the use of image guidance there is a question as to where the entire injectate went or if it was accurate in all cases. While tear location was mentioned, the degree of partial tearing was not included and what constituted a proximal or a distal tear was not defined. It is well established that PRP injections are painful in the first 1-4 weeks. Therefore, the decision to re-inject patients who still had pain at 3 weeks may have affected outcomes. Lastly, the manuscript fails to define the post-procedure protocol well, possibly affecting results.

Also notable is that this is not the first case series to report on PRP for the treatment of UCL injuries. Podesta, et al., published their prospective case series of 34 athletes with partial UCL injuries treated with PRP in 2013.²

Conclusion: To our knowledge, this is the first manuscript on PRP for UCL tears that includes location of the tear and results of PRP. Results indicate that patients with proximal tears or diffuse signal without tear may benefit more from regenerative therapies than patients with distal tears which may require earlier surgical referral. Further research with prospective randomized controlled trials that control for pre-procedure conservative rehabilitation, pre-procedure NSAID use, PRP type and concentration, image guidance for procedure, and post-procedure rehabilitation are needed to validate these results.

Practice Pearl: Patients with proximal partial thickness UCL injuries or those with diffuse MRI signal without tear who have not improved with conservative management may improve following interventional management with PRP. The results

of this study further confirm recent publications suggesting that distal UCL tears are more likely to undergo surgical reconstruction.³

References:

- (1) Dines et al. Platelet-Rich Plasma Can Be Used to Successfully Treat Elbow Ulnar Collateral Ligament Insufficiency in High-Level Throwers. *Am J Orthop* (Belle Mead NJ). 2016;45(5):296-300.
- (2) Podesta et al. Treatment of partial ulnar collateral ligament tears in the elbow with platelet-rich plasma. *Am J Sports Med*. 2013;41(7):1689-1694.
- (3) Lynch et al. MRI Predictors of Failure in Non-operative Management of Ulnar Collateral Ligament Injuries in Professional Baseball Pitchers. *Orthop J Sports Med*. 2016;4(7 suppl4).

Rotator Cuff Strength: Are Deficits a Result of or a Precursor to Ulnar Collateral Ligament Injuries?

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Level of Evidence: Level IV (Case-control study)

Introduction: Ulnar collateral ligament (UCL) injuries are common in the overhead athletic population, particularly in baseball players. Studies have demonstrated an increased risk for UCL injuries in athletes producing significant force in both internal rotation (IR) and external rotation (ER) of the glenohumeral joint. Rotational imbalances have been speculated to play a role in UCL injuries; however, prior to this research, no study had specifically examined the relationship of rotational forces in UCL injuries. J. Craig Garrison et al. proposed a case-control study to analyze the strength differences in a matched population of high school and collegiate level baseball players, with the anticipation of finding clinically significant decreases in internal and external rotational forces of the glenohumeral joints of UCL injured athletes when compared to a matched, healthy population.

Methods: A case population of high school and

collegiate level baseball players between the ages of 13 to 25 years old (mean 19.3 ± 1.6 y/o) were included on a voluntary basis after diagnosis of a UCL injury was made based upon a clinical diagnosis by a fellowship trained orthopedic surgeon in addition to MRI findings consistent with a UCL tear. Additionally, patients were required to have a diminished ability to throw, inability to participate at the pre-injury level of play, and a desire to return to competitive play to be included in the study. Athletes were excluded from the study if they had a failure of a previous UCL reconstruction, previous shoulder surgery for labral or rotator cuff pathology, or if the athlete did not plan to return to competitive baseball participation post-injury. Measurements were obtained on an average of 4.5 weeks after symptom onset. An uninjured control population was matched based upon position, age, and activity level. There were no clinically significant differences noted between age, years of experience, hand dominance, position, height, or weight between the study and control groups. Bilateral IR and ER isometric strength measurements were collected in a standardized method by one researcher to ensure consistency amongst the data collection. Measurements were obtained using a dynamometer placed at the dorsal and volar aspects of the wrist for ER and IR, respectively, with the patient seated, the upper extremity in 0° of abduction, and the elbow in 90° of flexion. An average of two trials was used for

^aJohn T. Nickless, MD and Tracy Ray, MD reviewing Garrison et al. Baseball Players with Ulnar Collateral Ligament Tears Demonstrate Decreased Rotator Cuff Strength Compared to Healthy Controls. *Int J Sports Phys Ther.* 2015;10(4):476-481.

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final measurements. A visual analog scale (VAS) was used during testing, and any measurements obtained with a VAS pain level $> 2/10$ during testing was excluded from the study.

Results: Statistically significant differences were noted in ER (86.4 ± 18.3 N; $p < 0.001$) and IR (131.3 ± 31.6 N; $p < 0.001$) strength in the UCL-injured throwing extremity when compared to the healthy, matched subject's throwing arm IR (122.3 ± 18.3 N; $p < 0.001$) and ER (174.9 ± 20.7 ; $p < 0.001$) strength. Interestingly, the data also demonstrated significant weakness in the non-throwing arm of the UCL-injured athlete in IR (135.0 ± 31.1 N; $p < 0.001$) and ER (93.4 ± 22.8 N; $p < 0.001$) when compared to the control group (IR = 172.1 ± 24.1 N; $p < 0.001$ and ER = 122.3 ± 19.1 N; $p < 0.001$).

Strengths: The authors of this study implemented a standard testing protocol for testing internal and external rotation of the glenohumeral joint. This was performed by the same researcher, which ensured consistent testing throughout the study. The authors were also able to match age, position, and stature across the two groups without significant statistical difference in these categories. Statistically significant findings were obtained from the population of 66 individuals divided evenly amongst the study and control groups.

Weaknesses: Although the procedural protocol used in this study allowed for consistent strength measurements, the study position varies greatly from that of a throwing motion. Therefore, the findings in this study may not represent relevant, sport-specific strength differences. The method of IR strength testing in this study, with the patient's arm at the

side, allows for possible compensation using the pectoralis muscles. A better protocol for measuring strength in IR and ER may be with the patient lying prone on an exam table with the arm over the edge of the table, the shoulder abducted to 90 degrees, and elbow flexed to 90 degrees, which better represents a throwing motion. Another weakness in this study is the average time of 4.5 weeks between onset of symptoms and strength measurements, with some of the measurements being obtain beyond that time span. The decrease in IR and ER strength could very well be related to a decrease in physical activity and training after injury as opposed to the noted weakness being directly associated to the UCL injury. Additionally, the authors are unable to explain the statistically significant decrease in the injured athlete's contralateral ER and IR strength when compared to the control population, which raises questions in regards to the UCL-injured athlete's ER and IR strength in both extremities prior to injury. A prospective study may be able to shed light on these strength differences by obtaining pre-injury and post-injury measurements.

Conclusion: The authors' findings have demonstrated a significant difference in internal and external rotational strength of the shoulder in UCL-injured upper extremities, as well as the contralateral side, when compared to a healthy, matched population. The results of the study are certainly valid; however, their clinical implication and applicability is unclear at this time. A prospective study documenting baseline and post-injury strength measurements in the same subjects may provide more information in regards to rotator cuff strength and its correlation to UCL

injuries.

Practice Pearl: This study notes glenohumeral joint IR and ER strength deficits in baseball players with UCL injuries compared to healthy athletes. The clinical team should be aware of these deficits which may help guide the rehabilitation of the athlete with a UCL injury.

References:

(1) Garrison et al. Baseball Players with Ulnar Collateral Ligament Tears Demonstrate Decreased Rotator Cuff Strength Compared to Healthy Controls. *Int J Sports Phys Ther.* 2015;10(4):476-481.

