

Platelet Rich Plasma Treatment in Collegiate Baseball Players Who Suffered Partial Ulnar Collateral Ligament Tears: A Case Series from a Single Center's Experience in Return to Play and Performance

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Introduction: Elbow ulnar collateral ligament (UCL) injuries can cause pain and decreased performance for the overhead athlete. Platelet-rich plasma (PRP) therapy is becoming more common to avoid surgery in partial UCL tears and improve return to play, but the literature is sparse regarding functional outcomes. This study aimed to characterize elbow UCL injuries among 5 collegiate baseball pitchers describe their return to play after PRP treatment, and compare dynamometry assessments before injury and after treatment.

Methods: Data from 5 Division 1 baseball pitchers who sustained low- to intermediate-grade UCL injuries determined by ultrasonography and/or magnetic resonance imaging were retrospectively reviewed. All athletes underwent one PRP injection, physical therapy, and a standardized return to play protocol as part of their treatment. Dynamometry measures were taken prior to injury (pre-season) as well as at the conclusion of the return-to-play protocol.

Results: Five consecutive baseball players with UCL injuries were evaluated. Pre-season dynamometry testing was performed on all players prior to the seasons and when they first arrived to the team. Players received PRP injections on average 36 days after their injury and started a standardized rehab program on average about 48 days after PRP. Players were cleared to full return to play at a mean 174 days post-injury. Follow-up examination at that time demonstrated full range of motion of the elbow without tenderness to palpation over the UCL for all athletes. All athletes were able to continue to play at the same level of competition as before the injury occurred without any complaints. No players had repeat injuries during the same or following seasons. Comparing pre-injury to clearance dynamometry, external rotation measures on average slightly decreased from 194 to 190 Newtons while grip strength increased from 586 to 646 Newtons, on average.

Conclusion: Successful return to play was possible in 5 collegiate baseball pitchers after nonoperative treatment including injection of PRP at a mean 174 days following injury. PRP treatment gives promising results in low and intermediate partial UCL injury. Performance metrics including external rotation and grip strength were consistent pre-injury and upon clearance.

Keywords: ulnar collateral ligament, elbow, baseball, platelet rich plasma, nonoperative management results, return to play

Introduction

Millions of overhead athletes compete in baseball in the United States and pitchers are at particular risk for shoulder and elbow injuries based upon velocity and volume of throws.¹ Elbow UCL injury is a particular throwing-related elbow injury that garners significant media attention both due to the increasing incidence of injury, career ending potential, as well as the numerous high-profile cases in elite athletes.² In collegiate baseball players, the incidence of UCL injury was noted to be 1.12 per 10,000 athletic encounters, with the injury being season-ending in 15% of athletes.³ Moreover,

pitchers, and players who are older, are more likely to require surgery than position players for elbow UCL injury.^{2,4} As a result, measures such as pitch counts have been initiated to identify position players that may be at risk for overuse injuries; however, the rate of UCL tears has continued to rise.⁵

Nonoperative management is the typical treatment of choice for partial tears and includes rest, therapy, pain control, and subsequent strengthening with a focus on proper biomechanics of the entire kinetic chain from core strength to the rotator cuff. However, high grade partial-thickness tears, tears that are more distal, or those that do not respond to conservative management are often managed operatively.^{2,4,6} While surgery may be considered more definitive, it does have downsides. Complications of repair and reconstruction can include ulnar neuropathy, heterotopic ossification, stiffness, and re-tear.⁷ While no large randomized studies have compared nonoperative vs operative management of UCL injuries, return to play may be expected between 12 and 15 months after reconstruction as compared to between 4 and 6 months with nonoperative management which includes PRP, time and rehab.⁸

Orthobiologics are thought to enhance soft tissue healing and facilitate recovery, typically through the introduction of growth factors.⁹ Of the various orthobiologics, PRP has been extensively studied and published in the literature and has seen increasing utilization over the past few years.^{10,11} In reviewing the literature, there have been a few case series evaluating the effects of PRP in athletic populations with elbow UCL injury with similar presentations of returning to sport. Podesta et al used PRP in throwing athletes with partial-thickness UCL tears who had previously failed conservative management and noted an 88% return to sport at 12 weeks after injection while Dines et al reported a 73% return to sport after PRP.^{12,13} In terms of timelines, Deal et al initiated a protocol of 2 PRP injections 2 weeks apart, plus elbow bracing in partial UCL tears and found that 22 out of the 23 patients returned to play with the average time-to-return being approximately 12 weeks.¹⁴ Although these case series have shown benefits in using PRP as an adjuvant to treat UCL injuries, little data has been published regarding objective measurements of functional and sport-specific metrics. Furthermore, there are few publications detailing return to play expectations. We hypothesized that collegiate baseball players who received platelet-rich plasma injections for partial UCL injuries would be able to return to play without surgical intervention. Secondly, we hypothesized that these athletes would have similar grip strength and throwing dynamics to their pre-injury baselines.

Methods

Study Design

Upon approval from the institutional review board, a retrospective analysis of existing Division 1 baseball players with UCL tears at a single academic institution was performed. Patients were included for review if they were treated for a partial elbow UCL injury with a PRP injection between 2021 and 2024. Diagnosis was made with dynamic ultrasound and/or MRI. Data was obtained directly from routine clinic and training room encounters as well as routine imaging in the electronic medical record. Extracted data included: shoulder range of motion, grip strength, return to play, and grade of injury or healing on MRI and/or ultrasound. Athletes had baseline dynamometry parameters collected prior to each season, and these tests were repeated after injury and intervention.

The PRP was prepared using a point-of-care system (PurePRP; EmCyte Corporation). Fifty to 60 cc of blood was drawn from the antecubital fossa using a syringe preloaded with 10mL of sodium citrate anticoagulant. It was then spun in the centrifuge at 3800 RPM for 1.5 min to produce a platelet plasma suspension above a red cell layer. The platelet plasma suspension on top was removed and centrifuged at 3800 RPM for 5 minutes. This yielded a platelet buffy coat below platelet-poor plasma. The buffy coat was then resuspended into the platelet-poor plasma to create platelet-rich plasma. Typically, 3–5 ccs of platelet-rich plasma was injected. The PRP was then injected directly into the UCL with ultrasound guidance. Patients were advised not to take nonsteroidal anti-inflammatory drugs, antiplatelet drugs, or corticosteroids five days prior to and two weeks post PRP injection.

Rehabilitation consisted of a staged return-to-sport protocol consisting of seven stages, each lasting about one week. The initial phase consisted of light range of motion exercises and adjunctive modalities as described in most rehabilitation protocols. This was followed by a specifically tailored active range of motion, strengthening, double-arm plyometrics, single-arm plyometrics, and finally, initiation of a throwing program. Athletes begin with a flat-ground regimen and eventually progress to the mound before returning to live play.

Results

Five consecutive baseball pitchers with elbow injuries were evaluated at our institution from 2021 to 2024 who were treated nonoperatively with PRP. The charts of the players were reviewed, and they had no other medical issues though 3 of the players (1, 3, and 5) had previous incomplete UCL injuries from high school, which were all managed conservatively and without orthobiologic adjuncts. All of these players had complete recovery prior to starting the season at our institution. [Table 1](#) describes their overall demographics where there was an average age of 20 years old.

There was no history of any direct blow or trauma to the elbow for any of the players and it is assumed injuries were all sustained from repetitive valgus stress to their elbow. Following concerns for an injury, players underwent MRI of the area, and then a dynamic ultrasound typically around the time of their PRP injection as well ([Table 2](#)). The dynamic ultrasound was performed by a single operator, who also injected the PRP, and valgus stress would be applied by the operator to test for gapping.

Most players received PRP injections between 4 and 14 days following their injury, however, there was one outlier in our data set who received his PRP 122 days following the injury for personal reasons related to the player seeking second opinions and when the injury was disclosed. Thus, with the inclusion of the outlier player who received treatment at day 122, on average, most players received PRP within 36 days of their injury. After which, all players were allowed to be in a sling for less than 24 hours for comfort, but started immediately into a 7-week throwing rehab protocol. In the first week players began light range of motion with focused exercises on shoulder isometrics. Within the second week there is an increased focus on active range of motion and in weeks 3–4 the focus shifts to strengthening. This continues into week 5–6 and by week 7 pitchers return to an interval throwing program. This standardized regimen is followed strictly and managed by athletic trainers and the same for all athletes and there was no deviation. On average the players had about 90 days between rehab and clearance to play. Players were cleared to fully return to play on average 174 days post-injury. Follow-up examination by around 1 month following the PRP injection demonstrated full range of motion of the elbow without tenderness to palpation over the UCL for all athletes.

Pre-season dynamometry testing was performed on all players prior to the season and when they first arrived to the team. The measurements were then repeated before the season started on all pitchers. Following their injury and then through their recovery and rehabilitation, all players underwent repeat dynamometry testing prior to returning to full play ([Table 3](#)).

Table 1 Demographic Information Regarding Pitchers and UCL Radiographic Findings

Patient	Age (Years)	Throwing Arm	Previous UCL Injury	Ultrasound Findings	MRI Results
1	20	Right	Yes	Partial Tear Anterior UCL	Sprain of UCL
2	21	Left	No	N/A	Proximal UCL Thickening
3	19	Right	No	Hypertrophy with partial disruption of proximal anterior band	Sprain of proximal UCL
4	19	Left	Yes	No dynamic instability	Partial Injury of UCL
5	20	Right	Yes	N/A	Intermediate Grade Tear at anterior band, proximal UCL

Abbreviation: N/A, No recorded read in medical record to report.

Table 2 Overall Time Progression of Players Following Injury to PRP, Rehab, and Clearance

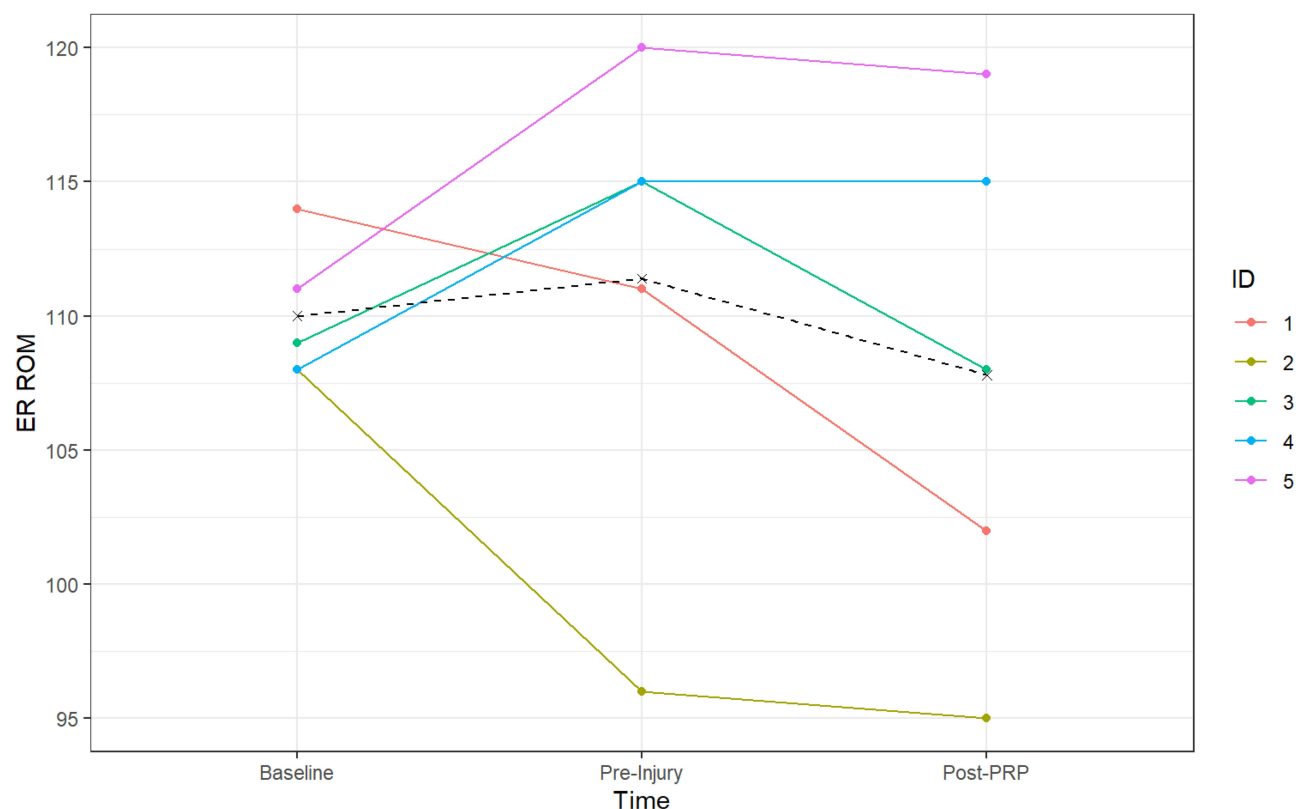
	Injury to PRP	PRP to Throwing Rehab Program	PRP to Clearance	Injury to Clearance
Days (SD)	35.6 (48.6)	48.2 (5.81)	138.40 (20.66)	174 (37.87)

Table 3 Dynamometry Average Results with (Standard Deviation) for All Pitchers from Their Baseline When They Joined the Team Followed by the Start of the Season and Then Return to Play

	IR ROM	ER ROM	Iso I	Iso Y	IR	ER	Grip (N)
Baseline	86.20 (16.48)	110.00 (2.55)	135.20 (34.40)	111.20 (24.19)	185.20 (57.01)	184.20 (57.01)	580.40 (50.49)
Pre-Injury	62.40 (11.84)	111.40 (9.18)	148.00 (39.33)	141.00 (20.87)	192.00 (21.31)	193.60 (33.98)	585.80 (98.15)
Post-PRP	69.80 (10.89)	107.80 (9.68)	176.80 (33.62)	140.80 (19.85)	222.60 (60.77)	189.60 (41.87)	646.40 (59.40)

The most pertinent aspects of a pitcher from Table 3 are delineated in Figure 1 (ER ROM) and Figure 2 (grip strength) which describe the players overall values and changes from their pre-injury to post-PRP values.

All athletes were able to continue to play at the same level of competition as before the injury occurred without any complaints. When comparing pre-injury to clearance dynamometry results, the most relevant performance metrics for pitchers are external rotation and grip strength. As the forearm flexor strength is thought to be the main dynamic stabilizer of elbow valgus stress during the throwing motion, the grip strength is an indirect measurement of this.¹⁵ The thought is that a strong forearm flexor will reduce some of the load on the elbow UCL and limit medial joint space gapping while throwing. The grip strength is one of the metrics that most rapidly falls following injury and as such is a measurement of recovery.¹⁶ In our series, we report that grip strength increased from 586 (SD 98) to 646 (SD 59) Newtons, on average. External rotation strength has been a predictor of both elbow and shoulder injuries in baseball players and following periods of rest from throwing, these values have been found to decrease. Documented decreases in both internal and external rotation are thought to be a predictor of injury and thus re-injury. While external rotation is not likely to decrease immediately post injury, it may have been a contributor to the injury itself.^{15,16} What we found in our

**Figure 1** Graphical representation of all 5 pitchers in terms of their Shoulder ER ROM from their baseline, pre-injury and then returning to play.

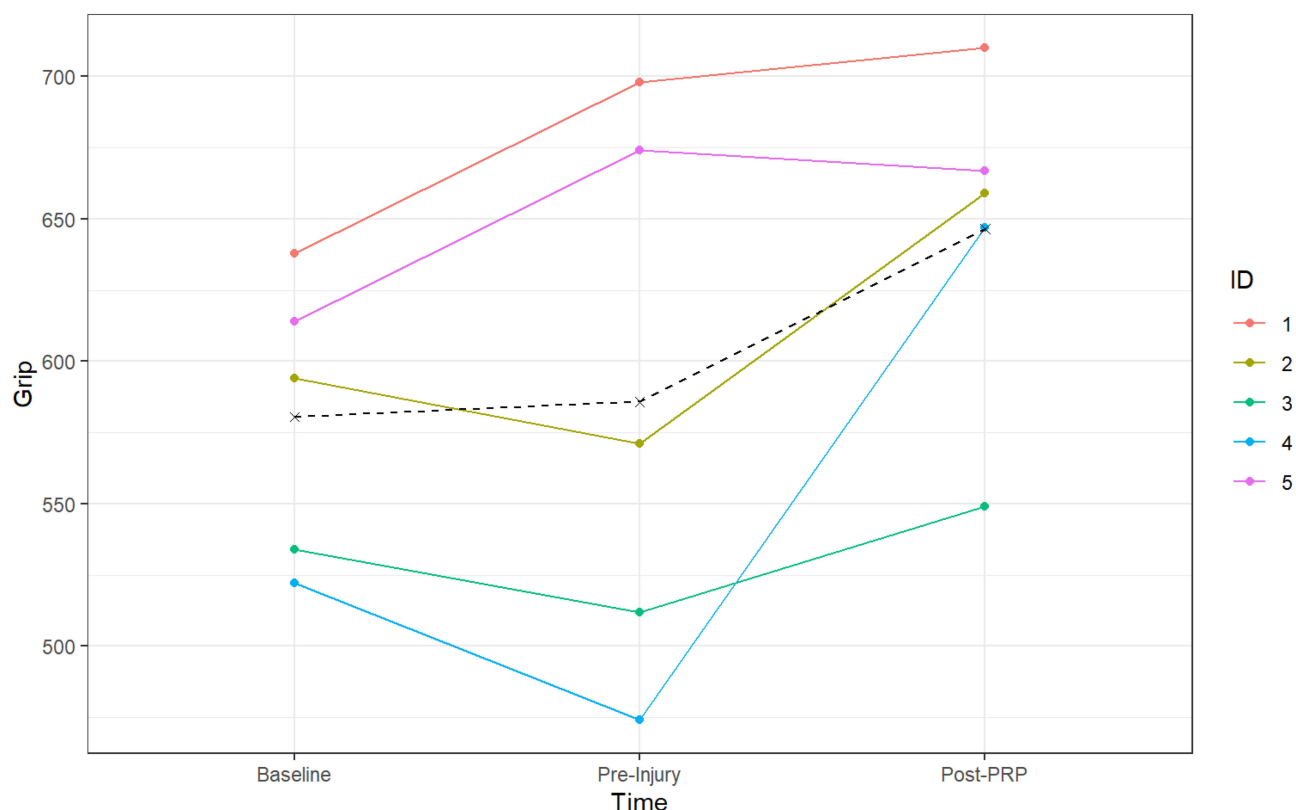


Figure 2 Graphical representation of all 5 pitchers in terms of their Grip strength from their baseline, pre-injury and then returning to play.

case series was that pre-injury external rotation was on average 111 degrees and post PRP was 108 on average. In terms of strength, external rotation decreased from 194 N (34 SD) to 190 N (42 SD).

Pitch metrics were available to review for 4 of the pitchers which demonstrated a return to their pre-injury level of play in terms of their strike percentage, average velocity and spin rate.

Discussion

Medial elbow ulnar collateral ligament injuries are an increasingly common source of significant morbidity in collegiate baseball players. As such it is worthwhile to determine the optimal treatment to get patients back to sport at the highest level of play as well as minimize the risk of reinjury. Surgical management of partial UCL injuries has had excellent return to play; however, it has limitations such as extended time away from sport, nerve injury, and fracture. In this study, nonoperative management of Division 1 baseball players receiving PRP injections in addition to the standard rehabilitation had 100% return to sport. However, in reviewing the literature, a player's responsiveness to PRP also depends on the degree of injury with all of our pitchers having less severe, low grade injuries. It is found that those with more severe or complete tears do not respond as well to nonoperative management.¹⁷

All five athletes received PRP injections from a single physician, in addition to a standardized UCL injury rehabilitation regimen, and were able to return to play at the same level of competition. There were no reinjuries or other complaints which is similar to what has been published previously. The case series that have been published regarding return to play by Podesta et al and Deal et al found an 88% return to the same level of play with an average return in 12 weeks, while another assessing high school and college baseball and softball players found a return to play of 96% with an average return in about 12 weeks. In contrast, McCrum et al reported that three elite hockey players returned to play in only 36 days, on average, indicating that between sports even though the injury pattern can be the same there may be different practice patterns and rehab protocols in different sports.¹⁸ Differences in return to play and overall functional outcomes can also vary by the type and nature of the PRP injected and the studies are certainly heterogenous from that standpoint.¹⁹ Although the return to sport took longer in our study,

this is likely due to timing of the injection with regard to the season. Data is mixed for baseball players with incomplete UCL injuries who do not receive PRP or surgery.

In our study, baseball players who received PRP were found to have a 10% higher post-intervention grip strength and similar range of motion as before their injury. Moreover, for the four pitchers with available data, pitch velocity and spin rate did not significantly differ with pre-injury levels. These qualities are widely regarded as measurements of pitching quality.¹⁶ Pitching performance appears to have recovered with the metrics available after rehabilitation and one PRP injection from their pre-injury metrics.

There are some limitations of this study worth noting. This study solely used an intervention group without a comparison group. It is thus difficult to discern how much of a benefit was obtained from the PRP injection as opposed to the standard rehabilitation alone, even if the outcomes are promising. All players had MRI and/or dynamic ultrasound findings consistent with an incomplete injury to the UCL, but there were minor differences in the degree of tearing or degeneration as well as dynamic laxity; however, all the injuries were low-intermediate grade elbow UCL injuries that involved both proximal and distal ends. This is inherent in studies of sports related injuries in that injury patterns are rarely uniform. While some players had previous UCL injuries it would be challenging to find the details of their injury prior to their arrival into collegiate careers. Performance metrics were available for only 4/5 players secondary to collection methods and their return to play data for one player was an outlier. This was a small single institution retrospective study though demonstrates a similar high return to play percentage along with favorable clinical outcomes as seen in systemic reviews and meta-analysis on topic.^{20,21} A strength of this study includes a uniform, standardized rehabilitation protocol and level of play which provides a level of consistency. Additionally, all PRP injections were performed with the same preparation by the same high-volume physician, which can be considered a strength.

Conclusion

All five D1 collegiate baseball pitchers with partial elbow UCL injuries were able to return to sport after receiving PRP and a standard rehabilitation regimen with similar dynamometry values from prior to their injury.

Ethics Approval

Ethical approval for this study was obtained from the Vanderbilt University Medical Center Institutional Review Board #241703. Patient consent was not required as information collected for this study was deemed in accordance with standard of care, low risk and meet the highest standards to ensure patient data confidentiality and compliance with the Declaration of Helsinki.

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Disclosure

The authors report no conflicts of interest in this work.

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