8-18-2021

Long-Term Sports Participation and Satisfaction After UCL Reconstruction in Amateur Baseball Players.

Robert A Jack  
*Houston Methodist Orthopedic and Sports Medicine*

Somnath Rao  
*Thomas Jefferson University*

Taylor D'Amore

Donald Willier III  
*Thomas Jefferson University*

Robert Gallivan  
*Thomas Jefferson University*

Follow this and additional works at: [https://jdc.jefferson.edu/rothman_institute](https://jdc.jefferson.edu/rothman_institute)

Part of the [Orthopedics Commons](https://jdc.jefferson.edu/rothman_institute) and the [Sports Medicine Commons](https://jdc.jefferson.edu/rothman_institute)

*Let us know how access to this document benefits you*

**Recommended Citation**

Jack, Robert A; Rao, Somnath; D'Amore, Taylor; Willier, Donald III; Gallivan, Robert; Cohen, Steven B.; Dodson, Christopher C; and Ciccotti, Michael G., "Long-Term Sports Participation and Satisfaction After UCL Reconstruction in Amateur Baseball Players." (2021). *Rothman Institute Faculty Papers*. Paper 147.  
[https://jdc.jefferson.edu/rothman_institute/147](https://jdc.jefferson.edu/rothman_institute/147)

This Article is brought to you for free and open access by the Jefferson Digital Commons. The Jefferson Digital Commons is a service of Thomas Jefferson University's Center for Teaching and Learning (CTL). The Commons is a showcase for Jefferson books and journals, peer-reviewed scholarly publications, unique historical collections from the University archives, and teaching tools. The Jefferson Digital Commons allows researchers and interested readers anywhere in the world to learn about and keep up to date with Jefferson scholarship. This article has been accepted for inclusion in Rothman Institute Faculty Papers by an authorized administrator of the Jefferson Digital Commons. For more information, please contact: JeffersonDigitalCommons@jefferson.edu.
Authors
Robert A Jack, Somnath Rao, Taylor D'Amore, Donald Willier III, Robert Gallivan, Steven B. Cohen, Christopher C Dodson, and Michael G. Ciccotti
Long-Term Sports Participation and Satisfaction After UCL Reconstruction in Amateur Baseball Players

Robert A. Jack II,* MD, Somnath Rao,† MD, Taylor D’Amore,† MD, Donald P. Willier III,‡ MS, Robert Gallivan,‡ BS, Steven B. Cohen,† MD, Christopher C. Dodson,† MD, and Michael G. Ciccotti,†§ MD

Investigation performed at Rothman Orthopaedic Institute, Philadelphia, Pennsylvania, USA

Original Research

Background: While the incidence of ulnar collateral ligament reconstruction (UCLR) has increased across all levels of play, few studies have investigated the long-term outcomes in nonprofessional athletes.

Purpose: To determine the rate of progression to higher levels of play, long-term patient-reported outcomes (PROs), and long-term patient satisfaction in nonprofessional baseball players after UCLR.

Study Design: Case series; Level of evidence, 4.

Methods: We evaluated UCLR patients who were nonprofessional baseball athletes aged <25 years at a minimum of 5 years postoperatively. Patients were assessed with the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score (KJOC), the Timmerman-Andrews (T-A) Elbow score, the Mayo Elbow Performance Score (MEPS), and a custom return-to-play questionnaire.

Results: A total of 91 baseball players met the inclusion criteria, and 67 (74%) patients were available to complete the follow-up surveys at a mean follow-up of 8.9 years (range, 5.5-13.9 years). At the time of the surgery, the mean age was 18.9 ± 1.9 years (range, 15-24 years). Return to play at any level was achieved in 57 (85%) players at a mean time of 12.6 months. Twenty-two (32.8%) of the initial cohort returned to play at the professional level. Also, 43 (79.1%) patients who initially returned to play after surgery reported not playing baseball at the final follow-up; of those patients, 12 reported their elbow as the main reason for eventual retirement. The overall KJOC, MEPS, and T-A scores were 82.8 ± 18.5 (range, 36-100), 96.7 ± 6.7 (range, 75-100), and 91.9 ± 11.4 (range, 50-100), respectively. There was an overall satisfaction score of 90.6 ± 21.5 out of 100, and 64 (95.5%) patients reported that they would undergo UCLR again.

Conclusion: In nonprofessional baseball players after UCLR, there was a high rate of progression to higher levels of play. Long-term PRO scores and patient satisfaction were high. The large majority of patients who underwent UCLR would undergo surgery again at long-term follow-up, regardless of career advancement.

Keywords: ulnar collateral ligament reconstruction; Tommy John; nonprofessional athletes; patient satisfaction; baseball

Since the introduction of ulnar collateral ligament (UCL) reconstruction (UCLR) into the literature in 1986 by Dr Frank Jobe, the rates of UCLR in professional athletes have steadily increased. The return-to-play (RTP) rate for athletes after UCLR continues to be over 84% throughout various levels of competition, ranging from high school to the professional level. Furthermore, the performance of baseball players after UCLR is comparable with the preinjury level, regardless of the technique or the graft utilized. The Orthopaedic Journal of Sports Medicine, 9(8), 23259671211027551 DOI: 10.1177/23259671211027551 © The Author(s) 2021 This open-access article is published and distributed under the Creative Commons Attribution - NonCommercial - No Derivatives License (https://creativecommons.org/licenses/by-nc-nd/4.0/), which permits the noncommercial use, distribution, and reproduction of the article in any medium, provided the original author and source are credited. You may not alter, transform, or build upon this article without the permission of the Author(s). For article reuse guidelines, please visit SAGE's website at http://www.sagepub.com/journals-permissions.
required UCLR for ≥5 years; however, none have specifically investigated outcomes of nonprofessional players.1,7,13

The purpose of the study was to determine the long-term RTP outcomes after UCLR in high school and collegiate baseball players. A long-term understanding of future play, level of play, and satisfaction will provide future patients a better understanding of the risks and benefits before undergoing surgery and give clinicians additional information for counseling. Additionally, the purpose of this study was to determine the rate of progression to higher levels of play, long-term PROs, and long-term patient satisfaction and willingness to undergo surgery again in nonprofessional baseball players after UCLR. We hypothesized that nonprofessional baseball players who underwent UCLR would progress at a high rate to subsequent levels of play, have good to excellent long-term PROs, and have a high (>80%) rate of long-term satisfaction.

METHODS

After institutional review board approval, a retrospective chart review was performed to identify patients who had undergone UCLR at our institution over a 10-year period (2004-2014) by 1 of 3 sports medicine fellowship-trained surgeons (M.G.C., C.C.D., S.B.C.) experienced in the care of overhead-throwing athletes. All patients underwent a preoperative physical examination as well as magnetic resonance imaging (MRI) to confirm the presence of a UCL tear. If the MRI for a tear of the UCL was inconclusive, a dynamic stress ultrasound was performed to evaluate for functional elbow instability. Functional instability was defined as stress ultrasound showing >1 mm gapping on the injured elbow compared with the uninjured elbow or >2 mm gapping in the injured arm when stressed compared with at rest. All patients with a partial tear underwent a trial of nonoperative treatment, which included a period of throwing cessation, activity modification, physical therapy, anti-inflammatory medication, and an interval throwing program once symptoms resolved and before return to competitive gameplay. If symptoms of pain and instability persisted, surgical treatment was offered. Patients with a complete tear of the UCL underwent surgical management. The method for fixation and graft choice was left to the discretion of the surgeon.

An initial query of the institution’s surgical database was performed by using the Current Procedural Terminology code 24346. From this preliminary list, patients aged <25 years and identified as baseball athletes were selected. Patients who were nonbaseball athletes or were competing professionally at the time of their surgery were excluded from the cohort. For the purposes of this study, professional status was defined as anyone playing baseball in an independent league, Minor League Baseball (MiLB), or Major League Baseball before their operation. Additionally, to isolate a cohort of athletes interested in potentially progressing to professional play, players who preoperatively reported playing only recreationally were excluded from the initial cohort.

Patients were included in the analysis if they had a minimum of 5 years of postoperative follow-up and were available to complete the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score (KJOC), the Timmerman-Andrews (T-A) Elbow score, the Mayo Elbow Performance score (MEPS), the Single Assessment Numeric Evaluation (SANE) score, and a custom RTP survey. Within the RTP survey, patients were asked about their current elbow status, level of competitive play before/after surgery, their ability to return, and time to return to throwing/competition. The full surveys are provided separately as Supplemental Material. In addition, patients were asked to rate pain at rest/throwing (100-point scale; 100 being the most pain) and satisfaction (100-point scale; 100 being the most satisfied). A thorough chart review of patients’ clinical notes and imaging was performed to gather patient characteristics and surgical details, including graft fixation technique, ulnar nerve handling, and graft type.

Continuous variable data were reported as means with standard deviations, and categorical data were reported as frequencies with percentages. Continuous variables compared between the 2 groups were assessed with the Mann-Whitney U test, while categorical variables between the 2 or more groups were assessed with the chi-square or Fisher exact tests. Statistical significance was set at P < .05. All statistical analyses were performed with SPSS Statistics software 26 (IBM Corp.).

RESULTS

A total of 91 baseball players met the inclusion criteria for this study, and 67 (74%) patients were able to be contacted to complete the follow-up surveys. All patients were male, with a mean body mass index of 25.6 ± 2.9 (range, 19.5-36.6) and a mean follow-up of 8.9 ± 2.4 years (range, 5.5-13.9 years). The mean age at the time of surgery was 18.9 ±
1.9 years (range, 15-24 years). At the time of injury, there were 55 (82%) pitchers, 4 (6%) catchers, 5 (8%) infielders, and 3 (4%) outfielders. All players reported that they were competing on an amateur team at the time of their injury; there were 22 players (33%) competing in high school and 45 players (67%) competing in college. Overall, 43 (64.2%) players underwent a modified Jobe reconstruction and 24 (35.8%) underwent a docking reconstruction. There were 49 palmaris longus grafts, 6 gracilis grafts, 6 semitendinosus grafts, and 6 medial Achilles strip grafts.

The RTP rates of the study cohort are shown in Table 1. The overall RTP rate was 85% (57/67). Of the 57 players who returned to sport, there were 4 players who were originally pitchers before their injury and had to switch to a different position: 3 became infielders and 1 eventually became an outfielder. Of the 38 college players who eventually returned to sport, 18 returned at the same level, 6 eventually became professional players and those who retired as nonprofessional players (ie, they never achieved professional status) with respect to time to throwing or return to competitive games (P = .845 and .741, respectively). Additionally, pitchers were not found to be more or less likely to play professionally after UCLR as compared with position players (P = .181). As noted in Table 3, no significant differences were found between the 2 groups when comparing PROs and pain at rest or with throwing. The overall satisfaction score of professional players was found to be significantly higher than that of the nonprofessional group (P = .014).

As reported in Table 4, when comparing pitchers with position players, position players were able to return to games sooner than pitchers; however, this finding was not significant (11.3 ± 1.2 vs 12.9 ± 3.5 months; P = .06). All other clinical findings, including presentation of injury and PROs, were not found to be significantly different between these 2 groups (Table 5).

When comparing players who were able to RTP compared with those who were not, there was only a significant difference in KJOC scores between the 2 groups (86.6 ± 14.7 vs 61.3 ± 23.9; P = .009). All other measures of subjective outcome were not statistically significant between these 2 groups (Table 6).
Comparison of PROs in Players Returning as Professionals vs Nonprofessionals (n = 57)

<table>
<thead>
<tr>
<th></th>
<th>Returned to Play as a Professional</th>
<th>Returned to Play as a Nonprofessional</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KJOC</td>
<td>86.4 ± 13.8</td>
<td>86.7 ± 15.5</td>
<td>.93</td>
</tr>
<tr>
<td>MEPS</td>
<td>96.8 ± 7.6</td>
<td>97.3 ± 5.6</td>
<td>.81</td>
</tr>
<tr>
<td>T-A</td>
<td>93.4 ± 9.7</td>
<td>92.7 ± 9.8</td>
<td>.79</td>
</tr>
<tr>
<td>SANE</td>
<td>90.5 ± 19.1</td>
<td>89.1 ± 19.3</td>
<td>.80</td>
</tr>
<tr>
<td>Pain at rest</td>
<td>2.1 ± 12.7</td>
<td>4.8 ± 15.3</td>
<td>.34</td>
</tr>
<tr>
<td>Pain when throwing</td>
<td>12.7 ± 21.6</td>
<td>11 ± 22.2</td>
<td>.78</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>98.2 ± 6.4</td>
<td>91.8 ± 19.4</td>
<td>.04</td>
</tr>
</tbody>
</table>

aData are reported as mean ± SD. The bolded P value indicates a statistically significant difference between groups (P < .05). KJOC, Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score; MEPS, Mayo Elbow Performance Score; PRO, patient-reported outcome; SANE, Single Assessment Numeric Evaluation; T-A, Timmerman-Andrews.

Comparison Between Pitchers and Position Players (N = 67)

<table>
<thead>
<tr>
<th></th>
<th>Pitcher (n = 55)</th>
<th>Position Player (n = 12)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective assessment</td>
<td>70</td>
<td>.70</td>
<td></td>
</tr>
<tr>
<td>Resolved or improved</td>
<td>52</td>
<td>11</td>
<td>.28</td>
</tr>
<tr>
<td>No change or worsened</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Symptom presentation</td>
<td>73</td>
<td>.73</td>
<td></td>
</tr>
<tr>
<td>During a game</td>
<td>35</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Returned to play?</td>
<td>48</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>9</td>
<td></td>
<td>.35</td>
</tr>
<tr>
<td>Changed position to RTP?</td>
<td>4</td>
<td>0</td>
<td>.23</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
<td>3</td>
<td>.47</td>
</tr>
<tr>
<td>Return to throwing, mo</td>
<td>5.7 ± 2.2</td>
<td>5.2 ± 1.1</td>
<td>.53</td>
</tr>
<tr>
<td>Return to game, mo</td>
<td>12.9 ± 3.5</td>
<td>11.3 ± 1.2</td>
<td>.06</td>
</tr>
<tr>
<td>Reasons for no RTP</td>
<td></td>
<td></td>
<td>.90</td>
</tr>
<tr>
<td>Elbow related</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Played professionally?</td>
<td></td>
<td></td>
<td>.70</td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>37</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Competitive play after surgery, y</td>
<td>3.7 ± 2.6</td>
<td>3.9 ± 2.9</td>
<td>.947</td>
</tr>
</tbody>
</table>

aData are reported as mean ± SD. RTP, return to play.

At the 5-year follow-up, 53 players reported that they had discontinued competitive play, including the 10 who had never returned to play. When assessing the reason for eventual discontinuation of play for those 43 players (79.1%) who initially did return, 17 reported they were not recruited to the next level of competitive play, 13 reported they lost the desire to continue playing, 12 cited their continued elbow issues, and 4 stated it was for “other injuries or reasons.”
Overall, there were no significant differences in clinical outcomes with respect to surgical technique (modified Jobe or docking) or different graft types. Twelve players underwent a concomitant ulnar nerve transposition (UNT) with their UCLR for the treatment of persistent ulnar neuritis symptoms. While RTP rates were found to be lower in patients who underwent a concomitant UNT, this difference was not found to be significant (75% vs 87%; P = .28). However, as summarized in Table 7, subjective clinical outcome scores, including the KJOC, MEPS, T-A, SANE, pain at rest, and overall satisfaction, were found to be significantly lower in the UNT group as compared with the no-UNT group.

Complications occurred in 8 (11.9%) of patients. Seven patients reported minor to moderate ulnar nerve neuropathy, which is positionally-dependent and appears intermittently. One patient reported experiencing an infection of the elbow, which resolved with a course of oral antibiotics. Seven patients (10.4%) underwent subsequent surgery, ranging from 6 to 48 months after UCLR. Five patients reported having surgery on the ipsilateral throwing arm, including 1 having a supraspinatus tear and anterior to posterior (SLAP) repair, 2 undergoing osteophyte removal, 1 undergoing a rotator cuff repair, and 1 patient who reported having surgery on the ulnar nerve. Overall, at the final follow-up, patients reported a high satisfaction score (mean, 90.6 ± 21.5); and 64 (95.5%) reported that they would undergo UCLR again.

**DISCUSSION**

The purpose of this study was to determine the rate of progression to higher levels of play, long-term PROs, and long-term patient satisfaction and willingness to undergo surgery again in nonprofessional baseball players after UCLR. Our hypotheses were all confirmed, as nonprofessional baseball players who underwent UCLR progressed at a high rate to subsequent levels of play and had good to excellent long-term PROs, high rates of long-term satisfaction, and willingness to undergo the procedure again.

The National Collegiate Athletic Association estimates that high school baseball players have a 7.3% chance of playing at the college level and a 0.5% chance of playing professionally. College baseball players have a 9.9% chance of playing at the college level and a 0.5% chance of playing professionally. Given these numbers, the long-term PRO data (85.1%) elucidate the importance of shared decision making in this patient population. Given a properly indicated patient who is motivated to continue to play at a high level, a high rate of return and progression should be expected. Only in this circumstance should these findings be referenced, as a player who is not considering advancement may be advised to not undergo UCLR because it is not necessary for activities of daily living outside of overhead throwing.

The long-term PROs and satisfaction scores were high in this study. The PRO scores were lower than what an asymptomatic baseball player would report, but they were found to be similar to what is reported in adolescent baseball players after undergoing UCLR. Importantly, all of the PRO scores were found to be similar between pitchers and position players. Additionally, it appears that the KJOC score was best able to discriminate between those who returned to play and those who did not. Patient satisfaction after baseball career was high (94.3 ± 16.0 out of 100) and were similar to findings in another long-term study of baseball athletes. In contrast to the study by Osbahr et al., the reason for retirement in this adolescent population was largely because of lack of interest in continuing to play or lack of recruitment for the next level, not because of elbow symptoms. The career longevity in this population (3.8 ± 2.6 years) was also similar to a more elite-level cohort. Both of these factors emphasize the importance of preoperative counseling and clearly defined career aspirations.

Interestingly, patients with a concomitant UNT had lower long-term KJOC, MEPS, T-A, SANE, pain at rest, and satisfaction scores compared with patients who did not have a concomitant transposition. The surgeons in the current study did not routinely transpose the ulnar nerve during a UCLR. UNT is most often performed when the patient has preoperative symptoms attributable to the ulnar nerve. The inferior results in the UNT subset may be because of a direct result of these patients experiencing more symptoms before their surgery, necessitating additional surgery, and increasing their potential for postoperative symptoms. However, these results should guide preoperative counseling for the treating surgeon, and the patient should be advised that long-term negative effects may remain, even with an indicated UNT, because of their concomitant ulnar nerve symptoms preoperatively. These results are supported by prior studies evaluating professional athletes. However, in a large cohort study of amateur athletes at a single institution, there were no clinical differences for patients undergoing UNT in addition to UCLR. We therefore cannot recommend for or
against a concomitant UNT during UCLR based on the findings of this study.

In this study, patients had a high willingness to undergo surgery again given their result at final follow-up. Despite the cohort’s only having played on average an additional 4 years of competitive play after surgery, the high satisfaction score (90.6 out of 100) and willingness to proceed with surgery again (95.5%) suggests that these patients were properly indicated for a successful and overall beneficial surgery. More importantly, it reveals that in the patient’s mind, the correct decision was made even with often overwhelming external factors, such as teammates, coaches, parents, and potential scholarships. The large majority of the UCLR literature is focused on professional or elite-level athletes, in which a decision to proceed with surgery is almost compulsory. This study represents a cohort who at long-term follow-up still felt that the surgery was worth their time, recovery, and continued or discontinued play, even with many compounding external factors.

This study is not without limitations. First, while the study comprised 67 patients, representing a moderately sized sample with respect to other UCLR literature, this may still have been too small to detect statistically significant differences. Also, given the retrospective and long-term nature of the study, recall and selection bias may have occurred. Patients who perceived both good and poor outcomes were likely to be more motivated to participate in this study. Given this limitation, it is possible that additional “average” outcomes were missed in this patient population, which may have inflated the results of some metrics. In addition, recall bias was likely present, given that it had been over 10 years since the surgery in a proportion of these patients. This recall bias may have affected the RTP data, yet would likely not have influenced the long-term PRO scores, patient satisfaction, and patient willingness to undergo surgery again now that their careers have progressed or ended. Furthermore, this investigation was performed by using the patients of 3 different surgeons using their preferred selection for graft fixation and graft types; thus, while protocols for rehabilitation and return to play were standardized between the groups, this ultimately presents as another limitation. In addition, conclusions for patients who underwent a UNT are likely limited, as the preoperative symptomatology (e.g., numbness, paresthesia, and/or instability of the nerve) was unknown. There were also no preoperative PROs measured that precluded comparisons for improvement from time of injury. Last, no performance metrics were used in this study; however, general conclusions can be made on performance based on progression to subsequent level of play.

CONCLUSION

In nonprofessional baseball players, there was a high rate of career advancement after UCLR. Long-term PRO scores and patient satisfaction were high. The large majority of patients who underwent UCLR would undergo surgery again at long-term follow-up, regardless of career advancement. These findings provide valuable information for surgeons on future level of play, potential for athletic progression, and long-term functional outcome when counseling patients playing nonprofessional baseball who are considering undergoing UCLR.

### REFERENCES


Supplemental Material for this article is available at http://journals.sagepub.com/doi/suppl/10.1177/23259671211027551


