

8-18-2021

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

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

**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.<sup>3,6,15</sup> 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.<sup>8,11,14</sup> Furthermore, the performance of baseball players after UCLR is comparable with the preinjury level, regardless of the technique or the graft utilized.<sup>4,5,8,12,14</sup>

Currently, the majority of the data regarding RTP and subjective outcomes after UCLR come from studies evaluating professional athletes. Furthermore, there is a paucity

of data regarding the advancement of nonprofessional players after undergoing UCLR. Given that ulnar collateral ligament injuries can be treated nonoperatively in some athletes who plan to discontinue baseball or decide to transition to a sport that does not require overhead throwing, counseling is a significant undertaking in this population. At this time, surgical recommendations are clouded with uncertainty regarding long-term sports participation and patient satisfaction.

Long-term patient-reported outcomes (PROs) in the nonprofessional patient population are needed to support these surgical decision-making conversations. Despite the large amount of literature on RTP after UCLR, data regarding long-term satisfaction after 5 years is sparse. Osbahr et al<sup>17</sup> achieved the longest UCLR follow-up period for baseball playing athletes, which was at a minimum of 10 years.<sup>17</sup> Three additional groups have evaluated athletes who

The Orthopaedic Journal of Sports Medicine, 9(8), 23259671211027551

DOI: 10.1177/23259671211027551

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required UCLR for  $\geq 5$  years; however, none have specifically investigated outcomes of nonprofessional players.<sup>1,7,13</sup>

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  $25.6 \pm 2.9$  (range, 19.5–36.6) and a mean follow-up of  $8.9 \pm 2.4$  years (range, 5.5–13.9 years). The mean age at the time of surgery was  $18.9 \pm$

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Final revision submitted December 29, 2020; accepted February 15, 2021.

One or more of the authors has declared the following potential conflict of interest or source of funding: R.A.J. has received education payments from Liberty Surgical and hospitality payments from Pacira. T.D. has received education payments from Liberty Surgical and Medical Device Business Services. C.C.D. has received consulting fees from Arthrex and DePuy and speaking fees from Arthrex. S.B.C. has received research support from Arthrex and Major League Baseball; consulting fees from Conmed Linvatec and Zimmer; speaking fees from Zimmer; and royalties from Slack and Zimmer. M.G.C. has received grant support from DJO and education payments from Liberty Surgical. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

Ethical approval for this study was obtained from Philadelphia University and Thomas Jefferson University.

TABLE 1  
RTP Rates in Players Who Returned vs Those Who Did Not (N = 67)<sup>a</sup>

	Returned to Play (n = 57; 85%)	Did Not Return to Play (n = 10; 15%)
Position at the time of injury, n (%)		
Pitcher (n = 55)	48 (84)	7 (16)
Position player (n = 12)	9 (75)	3 (25)
Catcher (n = 4)	3 (75)	1 (25)
Infielder (n = 5)	4 (80)	1 (20)
Outfielder (n = 3)	2 (67)	1 (33)
Level at the time of injury		
High school (n = 22)	19 (86)	3 (14)
Freshman (n = 3)	3 (100)	0 (0)
Sophomore (n = 2)	1 (50)	1 (50)
Junior (n = 8)	7 (88)	1 (12)
Senior (n = 9)	8 (89)	1 (11)
College (n = 45)	38 (84)	7 (16)
Freshman (n = 16)	15 (94)	1 (6)
Sophomore (n = 14)	12 (86)	2 (14)
Junior (n = 5)	3 (60)	2 (40)
Senior (n = 10)	8 (80)	2 (20)

<sup>a</sup>RTP, return to play.

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 went on to play in an independent league, and 14 played in the MiLB. Of the 19 high school players who returned, 1 returned to play recreationally, 10 went on to play in college, and 2 played in an independent league.

The mean time from surgery to initiation of throwing was 5.7 months (range, 1.5-14 months) and the mean time from surgery to full competition was 12.6 months (range, 6.5-23 months). Of those 10 players who were not able to return to play, only 5 reported that their elbow was the reason for not returning: 3 reported having no desire to continue, 1 was injured in high school and did not get recruited to college, and 1 was injured his senior year of college and was not recruited to play professionally. The mean baseball career length of those players who were able to return to play nonprofessionally after UCLR was 2.8 ± 1.7, whereas

TABLE 2  
RTP Rates in Players Returning as Professionals and Nonprofessionals (n = 57)<sup>a</sup>

	Returned to Play as a Professional (n = 22; 39%)	Returned to Play as a Nonprofessional (n = 35; 61%)
Position at the time of injury, n (%)		
Pitcher (n = 48)	18 (38)	30 (62)
Position player (n = 9)	4 (44)	5 (56)
Catcher (n = 3)	1 (33)	2 (67)
Infielder (n = 4)	1 (25)	3 (75)
Outfielder (n = 2)	2 (100)	0 (0)
Level at the time of injury, n (%)		
High school (n = 19)	2 (11)	17 (89)
Freshman (n = 3)	0 (0)	3 (100)
Sophomore (n = 1)	0 (0)	1 (100)
Junior (n = 7)	1 (14)	6 (86)
Senior (n = 8)	1 (13)	7 (87)
College (n = 38)	20 (53)	18 (47)
Freshman (n = 15)	6 (40)	9 (60)
Sophomore (n = 12)	5 (42)	7 (58)
Junior (n = 3)	1 (33)	2 (67)
Senior (n = 8)	8 (100)	0 (0)

<sup>a</sup>RTP, return to play.

the mean career of those who returned to play professionally was 5 ± 3.3 years. Overall career longevity was 3.8 ± 2.6 years.

Overall, 47.8% of the entire cohort (32/67) was able to RTP at the next level of competition—either high school to college or college to professional status. In addition, 32.8% of the players (22/67; 2 high school and 20 college players) eventually progressed to play professionally. As noted in Table 2, no significant differences were found between those who 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 ( $P = .04$ ).

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 ( $11.3 \pm 1.2$  vs  $12.9 \pm 3.5$  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 ( $86.6 \pm 14.7$  vs  $61.3 \pm 23.9$ ;  $P = .009$ ). All other measures of subjective outcome were not statistically significant between these 2 groups (Table 6).

TABLE 3  
Comparison of PROs in Players Returning as Professionals vs Nonprofessionals (n = 57)<sup>a</sup>

	Returned to Play as a Professional (n = 22)	Returned to Play as a Nonprofessional (n = 35)	P Value
KJOC	86.4 ± 13.8	86.7 ± 15.5	.93
MEPS	96.8 ± 7.6	97.3 ± 5.6	.81
T-A	93.4 ± 9.7	92.7 ± 9.8	.79
SANE	90.5 ± 19.1	89.1 ± 19.3	.80
Pain at rest	2.1 ± 12.7	4.8 ± 15.3	.34
Pain when throwing	12.7 ± 21.6	11 ± 22.2	.78
Overall satisfaction	98.2 ± 6.4	91.8 ± 19.4	<b>.04</b>

<sup>a</sup>Data 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.

TABLE 4  
Comparison Between Pitchers and Position Players (N = 67)<sup>a</sup>

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

<sup>a</sup>Data are reported as n or 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.”

TABLE 5  
Comparison of PROs Between Pitchers and Position Players (N = 67)<sup>a</sup>

	Pitcher (n = 55)	Position Player (n = 12)	P Value
KJOC	81.7 ± 19.5	87.9 ± 13.5	.18
MEPS	96.5 ± 6.8	97.5 ± 6.7	.64
T-A	91.9 ± 11.8	91.7 ± 10	.94
SANE	88.6 ± 20.3	89.5 ± 18.1	.88
Pain at rest	3.1 ± 10.5	7.4 ± 19	.43
Pain when throwing	11.6 ± 20.6	12.9 ± 27.3	.86
Overall satisfaction	90.5 ± 21.7	95.3 ± 15.6	.35

<sup>a</sup>Data are reported as mean ± SD. 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.

TABLE 6  
Comparison of PROs Between Players Who Returned and Those Who Did Not (N = 67)<sup>a</sup>

	Returned to Play (n = 57)	Did Not Return to Play (n = 10)	P Value
KJOC	86.6 ± 14.7	61.3 ± 23.9	<b>.009</b>
MEPS	97.1 ± 6.4	94.5 ± 7.9	.35
T-A	92.9 ± 9.7	85.5 ± 17.9	.23
SANE	89.7 ± 19	83.8 ± 23.2	.47
Pain at rest	3.7 ± 12.4	4.5 ± 9.6	.83
Pain when throwing	11.7 ± 21.8	13.1 ± 19.4	.85
Overall satisfaction	94.3 ± 16	74.5 ± 33.7	.11

<sup>a</sup>Data 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.

TABLE 7  
PROs Between Those Who Had a Concomitant UNT and Those Who Did Not (N = 67)<sup>a</sup>

	Concomitant UNT (n = 12)	No UNT (n = 55)	P Value
KJOC	75.9 ± 19.6	84.3 ± 18.1	<b>.04</b>
MEPS	93.3 ± 8.1	97.5 ± 6.2	<b>.03</b>
T-A	84.6 ± 14.5	93.5 ± 10.1	<b>.04</b>
SANE	82.9 ± 15.8	90.1 ± 20.3	<b>.01</b>
Pain at rest	14.7 ± 24.5	1.5 ± 4.7	<b>&lt;.01</b>
Pain when throwing	23.2 ± 30.6	9.5 ± 18.5	.06
Overall satisfaction	77.6 ± 30.2	93.4 ± 18.2	<b>.01</b>

<sup>a</sup>Data are reported as mean ± SD. Bolded *P* values indicate statistically significant differences 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; UNT, ulnar nerve transposition.

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 superior labrum 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,  $90.6 \pm 21.5$ ); 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.<sup>2</sup> Collegiate baseball players have a 9.9% chance of playing professionally. Given these numbers, the large majority of baseball players who undergo UCLR do not continue to advance their level of play after surgery. Compared with this study,<sup>2</sup> 85.1% of players returned to sport, 47.8% progressed to a higher level of play, and 32.8% progressed to professional play. The RTP rate (85.1%) in this study population is similar to what is currently reported in the literature.<sup>11,14</sup> However, the rate of professional advancement in this study was found to be higher than reported in other similar studies.<sup>18,20</sup>

This discrepancy in career advancement rates may be attributed to any number of factors, including selection bias; naturally, those who performed better and progressed further were likely more willing to respond to our long-term surveys. Beyond this however, this study was also

performed at a practice that historically receives a large number of referrals from surrounding metropolitan areas, which may add yet another layer of selection bias. Typically, these referrals were often previously high-performing young athletes who were willing to come to our practice with a strong desire to not only return to play but also progress to professional status. Thus, for these reasons, it is not recommended that the treating surgeon counsel injured players on who will be able to progress to professional play at a rate of 32.8%. This number and the overall RTP 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,<sup>16</sup> but they were found to be similar to what is reported in adolescent baseball players after undergoing UCLR.<sup>18</sup> 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 ( $94.3 \pm 16.0$  out of 100) and were similar to findings in another long-term study of baseball athletes.<sup>17</sup> In contrast to the study by Osbahr et al,<sup>17</sup> 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 ( $3.8 \pm 2.6$  years) was also similar to a more elite-level cohort.<sup>17</sup> 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 do 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.<sup>9,19</sup> 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.<sup>10</sup> 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 (eg, 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.

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

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