

## [ Physical Therapy ]



# Return to Sports for Professional Baseball Players After Surgery of the Shoulder or Elbow

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**Background:** The purpose of this study was to assess major and minor league baseball players' return to professional baseball at a preinjury level or higher after surgery of the shoulder or elbow.

**Hypothesis:** The majority of athletes will be able to return to their preinjury level after surgery.

**Study Design:** Case series.

**Methods:** Over a 4-season period, prospective injury and surgery records were reviewed for one professional baseball club. Forty-four players underwent 51 procedures (28 shoulder and 23 elbow) by multiple experienced surgeons; 7 players underwent more than 1 procedure.

**Results:** Twenty-eight shoulder surgeries were performed on 27 players: 19 pitchers and 8 position players. The majority of the procedures were labral repairs (n = 21). Nine players returned to their preoperative level; 2 advanced to a higher level; 5 returned to a lower level; and 11 retired from professional baseball. Only 2 of the 12 players at the high professional level (Major League Baseball, triple-A, double-A) returned to the same level. Twenty-three elbow surgeries were performed on 21 players (20 pitchers). The majority of the procedures were ulnar collateral ligament reconstructions (n = 12). Seven players returned to their preoperative level; 4 advanced to a higher level; 4 returned to a lower level; and 6 retired from professional baseball. Of the 12 players at the high professional level, 3 returned to the same or higher level.

**Conclusion:** Following surgery, 21 of 44 players (48%) returned to the same or higher level of professional baseball. For those players performing at a high professional level, 5 of 22 (23%) returned to the same or higher level. Return to the same or higher level was more likely with elbow surgery than with shoulder surgery.

**Clinical Relevance:** Elite throwing athletes may not return to the same level at a high rate following shoulder or elbow surgery.

**Keywords:** ulnar collateral ligament; superior labral anterior posterior tear; overhead athlete; baseball injuries; shoulder surgery; elbow surgery

Injury to the shoulder or elbow requiring surgery is not uncommon in throwing athletes.<sup>4</sup> The throwing mechanism exerts significant force on the entire body—specifically, the dominant shoulder and elbow. A variety of injuries may occur through repetitive microtrauma or acute macrotrauma to the throwing arm.

Injuries to the throwing shoulder may include SLAP (superior labral anterior posterior) tears, rotator cuff pathology (tendonitis, tears), internal impingement, anterior/posterior labral tears or instability, glenohumeral internal rotation deficit,

and outlet impingement. Injuries to the throwing elbow may include ulnar collateral ligament (UCL) tears; ulnar nerve neuritis; posteromedial impingement, osteophyte formation, or valgus extension overload; flexor pronator injuries; epicondylitis (medial or lateral); posterolateral impingement from a hypertrophic synovial plica<sup>12</sup>; and loose body formation.

An elite throwing athlete's failure to respond to nonoperative treatment often leads to surgical management, in an effort to return to full participation. Return to preinjury level after surgery is the primary goal, although return can vary. Given

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the results of previous literature reporting high success rates for return to throwing sports regardless of shoulder or elbow surgery,<sup>1,3,5-14,16-21</sup> we hypothesized that the majority of athletes would be able to return to the same or higher preinjury level after surgery.

## METHODS

Over a 4-season period (2003-2006), data were collected prospectively; injury and surgery records were reviewed for one professional baseball club; and players were followed for a minimum of 2 years after their operation. During this period, 44 players had 51 surgeries (28 shoulder and 23 elbow), performed by 9 surgeons, including surgeons outside the organization. All the surgeons were fellowship trained in sports medicine, with extensive experience in treating elite baseball players (as major and minor league team physicians). The players ranged from the highest level (major league) through triple-A, double-A, and single-A. Thirty-five players were pitchers. Seven players (6 pitchers) underwent more than 1 operation: Of these, 1 required 3 elbow surgeries, and 1 required 2; furthermore, 1 had 2 shoulder procedures, and 4 had both a shoulder procedure and an elbow procedure. Information was gathered prospectively, including age, position, preoperative and postoperative professional level (including retirement from professional baseball), type of injury and procedure performed, operative surgeon, round drafted into professional baseball, and subsequent surgery. The highest preoperative and postoperative professional levels reached were used for the analysis.

### Statistical Analysis

The parameters of age, position, preinjury level, type of injury, round drafted, surgeon, and multiple surgeries were analyzed with the *t* test and chi-square to determine their variable impact on return to play. Statistical significance was indicated by *P* value less than 0.05.

## RESULTS

### Shoulder

Twenty-eight shoulder procedures were performed on 27 players: 19 pitchers and 8 position players. The majority of players (*n* = 23) incurred labral tears, whereas 2 players had rotator cuff pathology (1 full-thickness tear and 1 partial-thickness tear), 1 had a capsular contracture, and 1 had outlet impingement. Of the 23 labral tears, 3 developed as a result of trauma; the other 20 were the result of microtrauma. All players were treated with an initial course of nonoperative treatment under the direction of certified athletic trainers and physical therapists who were experienced at caring for elite baseball players. All procedures were performed arthroscopically, and the postoperative rehabilitation was consistently performed and guided by the major league team medical staff. Twenty-three labral repairs for type II SLAP lesions were performed using standard current labral

repair techniques (suture anchors) on 22 players; 1 player underwent labral debridement of a posterior labral flap tear. Of the 2 players with rotator cuff pathology, 1 underwent an arthroscopic repair of a full-thickness tear, and 1 underwent debridement of a partial-thickness tear (<50%; this player had minor fraying of the posterior labrum consistent with internal impingement). There was no concomitant labral and rotator cuff pathology found in players in this study. One player required a posterior capsular release for recurrent capsular tightness despite a lengthy stretching program. The remaining player underwent a subacromial decompression for impingement symptoms refractory to conservative treatment.

Players undergoing shoulder operations were drafted in the 15th round on average, with 2 players being signed as undrafted free agents. The highest preinjury playing level was as follows: major league, 4 players; AAA, 3 players; AA, 5 players; and A, 15 players. After surgery, 9 players returned to their preoperative level; 2 advanced to a higher level; 5 returned to a lower level; and 11 retired from professional baseball (Table 1). The one player who required 2 procedures returned to a lower level after the first operation and retired after the second. Of the 12 players at the high professional level (Major League Baseball, AAA, AA), only 2 (17%) returned to the same or higher level. For the 22 players who underwent labral repair, 7 (32%) returned to the same or higher level, 5 returned to a lower level, and 10 retired from baseball.

### Elbow

Twenty-three elbow procedures were performed on 21 players: 20 pitchers and 1 position player. The majority of the players (*n* = 12) incurred an injury to the UCL, and they underwent UCL reconstruction based on either the modified Jobe or docking technique. Seven players had symptoms from loose bodies requiring arthroscopic or open loose-body excision. One player had a partial tear of the flexor-pronator mass requiring debridement of his tear. Three players developed ulnar neuritis, 2 of which had prior UCL reconstruction; all 3 underwent submuscular ulnar nerve transposition.

Players undergoing elbow surgery were drafted, on average, in the 17th round, with 9 being signed as undrafted free agents. The highest preinjury playing level was as follows: major league, 6 players; AAA, 3 players; AA, 3 players; and A, 9 players. After surgery, 7 players returned to their preoperative level; 4 advanced to a higher level; 4 returned to a lower level; and 6 retired from professional baseball (Table 2). One player who required 2 procedures returned to a higher level after the second procedure, whereas the player who had 3 procedures (initial UCL reconstruction, ulnar nerve transposition, and revision UCL reconstruction) returned to a lower level (from major league to AAA). Of the 12 players at the high professional level, 3 (25%) returned to the same or higher level.

For the 12 players who underwent UCL reconstruction, 6 (50%) returned to the same or higher level; 4 retired from

Table 1. Baseball players' shoulder surgery and return level.

Procedure	Return Level, n			
	Higher	Same	Lower	Retired
Labral repair	0	7	5 <sup>a</sup>	10
Labral debridement	0	1	0	0
Rotator cuff repair	1	0	0	0
Rotator cuff debridement	0	1	0	0
Acromioplasty	0	0	0	1
Capsular release	1	0	0	0
Total	2	9	5	11

<sup>a</sup>Includes player with 2 labral repairs.

Table 2. Baseball players' elbow surgery and return level.

Procedure	Return Level, n			
	Higher	Same	Lower	Retired
Ulnar collateral ligament reconstruction	2 <sup>a</sup>	4	2 <sup>a</sup>	4
Loose body excision	2	1	2	2
Ulnar nerve transposition	1 <sup>a</sup>	1	1 <sup>a</sup>	0
Flexor-pronator debridement	0	1	0	0
Total	4	7	4	6

<sup>a</sup>Includes same player that had ulnar collateral ligament reconstruction and ulnar nerve transposition.

baseball; and 2 returned to a lower level. None of the players who retired from baseball left the game as a result of failure to regain elbow motion that caused disability to their throwing motion. For the 7 players who underwent loose body excision, 3 returned to the same or higher level; 2 returned to a lower level; and 2 retired.

## Overall

In this study 35 pitchers had an operation, 5 of whom had more than 1 procedure. Following their operation, 16 (46%) returned to the same or higher level of play, whereas 7 returned at a lower level and 12 left baseball. According to chi-square analysis, the position played (pitcher vs nonpitcher) did not significantly affect the level of return ( $P = 0.96$ ).

Of the 7 players who underwent more than 1 procedure, only 1 retired from professional baseball; for the remaining, 1 returned to a higher level, 2 returned to the same level, and 3

returned to a lower level. Having multiple procedures did not significantly alter players' level of return to sport ( $P = 0.88$ ).

According to the data, the average age of the players who had an operation was  $24.7 \pm 3.65$  years. The average age of the players undergoing shoulder surgery was 25.6 years and elbow surgery was 24.0 years; however, this difference, 1.6 years, was not statistically significant ( $P = 0.12$ ). For those players who returned to the same or higher level, the average age was  $23.4 \pm 3.7$  years; for those who returned to a lower level or did not return at all, the average age was  $25.4 \pm 3.5$  years. Statistical analysis revealed that younger age at the time of surgery was significant for return to play at the same or higher level ( $P = 0.023$ ).

As mentioned, the average round drafted, by surgical group, was 15th for shoulder group and 17th for the elbow group. In addition, 11 players were signed as free agents (shoulder, 2 players; elbow, 9 players). The round drafted may be an indicator of the team's initial investment in a player's potential, which can be another variable regarding how patient the club

Table 3. Variables for return to play.

Variable	n	Return Level, n		P	
		Same/Higher	Lower/Retired	t	$\chi^2$
Age, y		23.4 ± 3.7	25.4 ± 3.5	0.02*	
Position					
Pitcher	35	16	19		0.96
Nonpitcher	9	4	5		
Preinjury level					
Major League Baseball	10	3	7		0.29
Triple-A	6	1	5		0.14
Double-A	8	1	7		0.04*
Single-A	23	16	7		<0.01*
Type of injury					
Labral tear	22	7	15		0.07
Ulnar collateral ligament tear	12	6	6		0.68
Bone spur / loose body	7	3	4		0.43
Round drafted		20.1 <sup>a</sup>	12.8 <sup>b</sup>	0.07	
Surgeon					
Inside organization	22	9	13		0.07
Outside organization	26	12	14		
Multiple surgeries	7	3	4		0.88

<sup>a</sup>Six free agents.

<sup>b</sup>Five free agents.

\*Statistically significant.

may be for retaining the player after a more significant injury. The average round drafted for those players who returned to the same or higher level was 20.1 (6 free agents), whereas it was 12.8 (5 free agents) for those who returned to a lower level or did not return at all. Of interesting note, those players who returned to the same or higher level averaged a lower draft round compared to those players who returned to a lower level or retired. Statistically, this value approached significance ( $P = 0.065$ ).

According to the data, 23 procedures were performed on 22 players by 2 experienced surgeons within the team organization who were fellowship trained in sports medicine. Of these 22 players, 9 (41%) were able to return to the same or higher level after their operation. In addition, 28 surgeries were performed on 26 players by 7 experienced surgeons outside the team organization who were fellowship trained in sports

medicine. Of these 26 players, 12 (46%) were able to return to the same or higher level. According to chi-square analysis, there was no statistically significant difference for return rate after surgery between those players who had procedures performed by surgeons inside the organization versus outside the organization ( $P = 0.066$ ).

In general, several factors did not significantly affect players' return to play, such as position played, injury type, round drafted, surgeon performing the procedure, and multiple surgeries (Table 3). However, there were significant differences for return to play for factors such as age and preinjury level, namely, AA and A (Table 3). Given that there are larger numbers of players at the A level, it may be easier for a player to return to that level versus the high professional levels, where there are fewer roster spots available.

Table 4. Shoulder procedures and return to throwing sports.<sup>a</sup>

Study	Procedure	Patients, n	Return to Preinjury Level, %
Burkhart and Morgan <sup>3</sup>	Repair SLAP tears	54	87
Ide et al <sup>10</sup>	Repair SLAP tears	40	75
Seroyer et al <sup>18</sup>	Repair type VIII SLAP tears	13	69
Ide et al <sup>9</sup>	Repair of Bankart tear	55	68
Martin and Garth <sup>14</sup>	Debridement of labral tears	24	62
Tomlinson and Glousman <sup>21</sup>	Debridement of labral tears	16	75
Mazoue and Andrews <sup>15</sup>	Repair of full-thickness rotator cuff tears	16	8
Stephens et al <sup>19</sup>	Arthroscopic acromioplasty	82	67

<sup>a</sup>SLAP, superior labral anterior posterior.

## DISCUSSION

As in this study, the rate of return to preinjury throwing has been less reliable for surgery of the shoulder (Table 4).<sup>5</sup> The most common injury to the throwing shoulder requiring operative management is a labral tear—predominantly, the superior labrum. Repair of SLAP tears has yielded variable return to throwing, ranging from 68% to 84%.<sup>3,10,18</sup> Of note, those throwers who undergo labral debridement for labral tears not requiring repair have a similar rate of return.<sup>14,21</sup> Full-thickness rotator cuff tears requiring repair occur in elite throwers less commonly. This is most likely due to the increased knowledge of the injury mechanism and the stepwise progression of injury associated with internal impingement and shoulder laxity. As a result, fewer elite throwers require repair of full-thickness tears. This is fortunate when considering that Mazoue and Andrews found only an 8% return to preinjury level after rotator cuff repair.<sup>15</sup> As knowledge is gained into the pathology of the throwing shoulder, true outlet impingement becomes less common. Despite this, Stephens et al found a 67% return to preinjury level after arthroscopic acromioplasty in overhead athletes.<sup>19</sup> Data on players undergoing shoulder surgery in this study indicate that return to preinjury level of play may not be as high as previously documented.

A review of other studies of elbow procedures on throwing athletes found that the majority (range, 62%-94%) were able to return to their preinjury level following UCL reconstruction (Table 5).<sup>11</sup> In fact, several studies have found a greater-than-90% rate of return to the elite throwing level,<sup>7,13,16,17,20</sup> although return may take an average of 18 months.<sup>8</sup> In this study, of the 12 players who underwent UCL reconstruction, 67% returned to

professional baseball, whereas 50% returned to the same or higher level. Although the overall number of cases is low, a lower percentage of players returned, compared to what has been reported.<sup>7,13,16,17,20</sup> Of note, 11 of these were performed by surgeons outside the organization, with only 5 (45%) returning to the same or higher level. For injuries to the throwing elbow, other procedures have been less reliable. Andrews and Timmerman<sup>1</sup> found a lower rate of return associated with ulnar nerve transposition for treatment of ulnar neuritis and for arthroscopic osteophyte excision for posteromedial elbow impingement. Data on players undergoing elbow surgery in this study indicate that return to preinjury level of play may not be as high as previously documented.

A number of factors influence whether professional players can return to their preinjury levels after surgery. Some players are higher-round draft picks or undrafted free agents who may not be advancing to the next level and an injury leads to their retirement from professional baseball. Another potential reason for failing to return to the same level is that of secondary gain: In terms of workers' compensation, if a player no longer believes that he is competitive and may thus be "on the way out," he may have surgery before officially retiring from baseball. Others may not be able to return to the same level strictly as a result of their injury. This study did not identify age, position played, preoperative level of play, or round drafted as statistically significant factors for return after shoulder or elbow surgery. A larger sample size of professional baseball players undergoing such procedures may indicate statistical significance with one or more of these factors.

This study has several strengths. First, it analyzed injury to both the shoulder and the elbow and each player's return to a specific level of professional baseball. Previous studies document the percentage of return in professional baseball but

<sup>5</sup>References 3, 6, 9, 10, 14, 15, 18, 19, 21.

<sup>11</sup>References 1, 2, 5-7, 11, 13, 16, 17, 20.

Table 5. Elbow procedures and return to throwing sports.<sup>a</sup>

Study	Procedure	Patients, n	Return to Preinjury Level, %
Azar et al <sup>2</sup>	UCL reconstruction	78	79
Conway et al <sup>5</sup>	UCL reconstruction	56	68
Dines et al <sup>6</sup>	UCL reconstruction	22	86
Dodson et al <sup>7</sup>	UCL reconstruction	100	90
Gibson et al <sup>8</sup>	UCL reconstruction		82
Koh et al <sup>13</sup>	UCL reconstruction	20	94
Paletta and Wright <sup>16</sup>	UCL reconstruction	25	92
Rohrbaugh et al <sup>17</sup>	UCL reconstruction	36	92
Thompson et al <sup>20</sup>	UCL reconstruction	83	93
Andrews and Timmerman <sup>1</sup>	UCL reconstruction	72	73
	Posteromedial osteophyte excision		
	Loose body excision		
	Ulnar nerve transposition		
Indelicato et al <sup>11</sup>	Medial elbow reconstruction	25	80
Kim et al <sup>12</sup>	Posterolateral elbow impingement	12	92

<sup>a</sup>UCL, ulnar collateral ligament.

not to specific levels as related to a player's preinjury level of play.<sup>†</sup> Return to an elite level of throwing places a significant demand on the shoulder and elbow, and injury to these structures may not ultimately allow full return.

The study also has several weaknesses, including that of including multiple surgeons (both inside and outside the organization). Surgeons have varied philosophy and treatment regimens for the throwing arm; thus, treatment techniques and postoperative protocols were not completely consistent. However, all postoperative rehabilitation was performed by the major league team medical staff.

## CONCLUSION

Following surgery of the shoulder or elbow, the baseball players in this study did not return to the same professional level at a high percentage (48%). Mid- or lower-level professional players (AA or A) who are at the borderline of advancing to the next level preinjury may have a higher likelihood of retiring from baseball after surgery.

<sup>†</sup>References 1-3, 4-7, 12, 13, 15-18, 21.

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