



Performance outcomes after medial ulnar collateral ligament reconstruction in Major League Baseball positional players



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Background: We sought to determine whether professional baseball positional players who underwent medial ulnar collateral ligament (MUCL) reconstruction demonstrate decreases in performance on return to competition compared with preoperative performance metrics and their control-matched peers.

Methods: Data for 35 Major League Baseball positional players who underwent MUCL reconstruction during 31 seasons were obtained. Twenty-six players met inclusion criteria. Individual statistics for the 2 seasons immediately before injury and the 2 seasons after injury included wins above replacement (WAR), on-base plus slugging (OPS), and isolated power (ISO). Twenty-six controls matched by player position, age, plate appearances, and performance statistics were identified.

Results: Of the 35 athletes who underwent surgery, 7 did not return to their preinjury level of competition (return to play rate of 80%). In comparing preinjury with postinjury statistics, players exhibited a significant decrease in plate appearances, at-bats, and WAR 2 seasons after injury but did not demonstrate declines in WAR 1 season after injury. Compared with matched controls, athletes who underwent MUCL reconstruction did not demonstrate significant decline in statistical performance, including OPS, WAR, and ISO, after return to play from surgery. Of all positional players, catchers undergoing surgery demonstrated lowest rates of return to play (56%) along with statistically significant decreases in home run rate, runs batted in, and ISO.

Conclusion: Major League Baseball positional players undergoing MUCL reconstruction can reasonably expect to return to their preinjury level of competition and performance after surgery compared with their peers. Positional players return to play at a rate comparable to that of pitchers; catchers may experience more difficulty in returning to preinjury levels of play.

Level of evidence: Level IV; Case Series; Treatment Study

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Keywords: UCL; Tommy John; medial ulnar collateral ligament; return to sport; positional player; pitcher; catcher

This study is exempt from Institutional Review Board approval according to New York University Langone Medical Center Office of Science and Research as it does not contain human subjects research and all data are publicly available.

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The medial ulnar collateral ligament (MUCL), specifically the anterior bundle, functions as the primary stabilizer of the elbow to valgus force.^{2,16,24-26} The elbow of the overhead athlete is subject to large degrees of valgus stress during throwing,^{3,7,9,19} and insufficiency of the MUCL can be devastating to sport-specific performance.^{10,12} Before the popularization of surgical reconstruction, rupture of the MUCL was generally thought to be a “career-ending” injury. However, with the advent of MUCL reconstruction surgery, athletes now have the opportunity to return to play after injury.¹⁹

Return to play and performance after MUCL reconstruction has been well studied in competitive pitchers.^{7,8,11,18,20,21,23} Whereas conflicting results have been reported regarding statistical performance after injury,^{11,18,23} pitchers have a high reported return to play rate (67%-97%).^{7,11,18,20,21,23} Numerous performance metrics, including earned run average, walks plus hits per inning pitched, batting average against, wins above replacement (WAR), runs above replacement, average and peak velocity, games, games started, innings pitched, wins, losses, saves, strikeouts, walks, hits, runs, and home runs, have been studied for pitchers.^{7,11,18,20,21,23} Although a significant amount of literature has examined outcomes of MUCL reconstruction in pitchers, there exists a paucity of data regarding performance outcomes in positional baseball players after MUCL reconstruction. Positional players are defined as any player other than pitcher. To our knowledge, there are no peer-reviewed studies investigating return to play and performance in positional elite baseball athletes after MUCL reconstruction.

The purpose of our study was to evaluate performance before and after injury in Major League Baseball (MLB) positional players who underwent MUCL reconstruction. In addition, the study aimed to compare the performance of these subjects with uninjured, matched controls. We hypothesized that although positional players with MUCL reconstruction would experience a decrease in statistical performance compared with their preinjury levels, they would demonstrate high rates of return to play similar to those observed in pitchers.

Methods

The study group included MLB positional players who sustained MUCL injuries and who subsequently underwent surgical reconstruction. Minor league players were not included. Players were identified during a period of 31 seasons (1984-2015). The injury cohort was identified using a comprehensive online injury database (www.prosportstransactions.com), cross-referenced and confirmed for accuracy with team press releases, online injury reports, and player profiles (www.mlb.com; www.baseballreference.com). This methodology has been previously validated for reporting outcomes and return to play rates for professional and amateur athletes across a variety of different sports.^{1,4,6,11,14,15,27}

Thirty-five positional players who underwent MUCL reconstruction were identified. Return to play was defined as returning to at least 1 game of MLB-level competition after return from injury. Seven players did not return to their previous level of competition after surgery and were excluded from formal statistical performance

analysis ($n = 28$). In addition, 1 player returned to the previous level of competition but had <100 plate appearances in the preinjury season and another player had <100 plate appearances in the postinjury season and were excluded from analysis in an effort to limit type II error. The remaining 26 positional players had complete statistical performance data and were included in the study as the injury cohort. A 1-to-1 matched control group was selected on the basis of age, experience, position, performance, time frame, and overall “similarity score” provided by a comprehensive online database (www.baseballreference.com) and a methodology described by James.¹⁷ Efforts were made to select controls without a significant history of injury. Players were designated according to position: infielders (first baseman, second baseman, third baseman, and shortstop), outfielders (left, center, and right fielders), and catchers. Total sample size for all analyses was 52 (26 subjects and 26 controls). An inclusion and exclusion algorithm can be found in [Figure 1](#).

The index year was defined as the season in which the player sustained an injury to the MUCL and underwent surgery. The index year for controls was matched to the age of the injured players at the time of MUCL injury. Study parameters included the season before and after injury and 2 seasons before and after injury in the case of comprehensive statistics. Demographic data including age, body mass index (BMI), hand dominance, position, batting handedness, throwing handedness, and number of seasons of experience were recorded. Performance data recorded included WAR, isolated power (ISO), on-base plus slugging (OPS), batting average, doubles rate, triples rate, home run rate, strikeout rate, base on balls rate, and runs batted in (RBI) rate. Performance data were normalized by at-bats per season and reported as rates per at-bat to control for variations due to player experience and plate appearances.

MLB WAR data were collected for both cohorts. WAR is a new statistical method that summarizes a player’s total contributions to the team in 1 statistic. WAR can be used to represent the number of additional wins the team benefits from because of a player compared with a replacement-level player who may be obtained for minimal cost. WAR is a comprehensive statistic that additionally allows comparisons between players, with higher values suggesting that the team is likely to enjoy greater wins because of playing a particular player over another. In addition, ISO was collected for both cohorts. ISO is a statistic that measures a batter’s raw power, measuring how many extra bases a player averages per at-bat.

Student *t*-tests and Fisher exact test were used to compare differences in continuous and categorical variables, respectively, between cases and controls. Paired *t*-tests were used to determine significance of preoperative and postoperative performance statistics in players undergoing Tommy John surgery (TJS). Mean difference in preoperative and postoperative performance statistics was calculated between groups, after which Student *t*-tests were used to compare TJS players and matched controls. To determine whether MUCL reconstruction on the dominant or nondominant batting hand affected performance statistics, a subgroup analysis was performed on the MUCL reconstruction group; switch hitters and those who had surgery on the elbow opposite their batting side were compared with patients who had surgery on their designated batting side.

Further subgroup analysis focusing on preoperative and postoperative differences was performed on the basis of position to determine whether variations occurred in outfielders, infielders, and catchers and whether the player was a switch hitter or not. Finally, analysis of variance with subsequent post hoc Tukey analysis when appropriate was performed to determine whether difference in performance statistics varied between outfielders, infielders, and

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