



ORIGINAL ARTICLE

Changes in pitching mechanics after ulnar collateral ligament reconstruction in major league baseball pitchers



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Background: Medial ulnar collateral ligament (UCL) reconstruction is a common procedure performed on Major League Baseball pitchers. Variations in pitching mechanics before and after UCL reconstructive surgery are not well understood.

Methods: Publicly available pitch tracking data (PITCHf/x) were compared for all Major League Baseball pitchers who underwent UCL reconstruction between 2008 and 2013. Specific parameters analyzed were fastball percentage, release location, velocity, and movement of each pitch type. These data were compared before and after UCL reconstructive surgery and compared with a randomly selected control cohort.

Results: There were no statistically significant changes in pitch selection or pitch accuracy after UCL reconstruction, nor was there a decrease in pitch velocity. The average pitch release location for 4-seam and 2-seam fastballs, curveballs, and changeups is more medial after UCL reconstruction ($P < .01$). Four-seam fastballs and sliders showed decreased horizontal breaking movement after surgery ($P < .05$), whereas curveballs showed increased downward breaking movement after surgery ($P < .05$).

Conclusions: Pitch selection, pitch velocity, and pitch accuracy do not significantly change after UCL reconstruction, nor do players who require UCL reconstruction have significantly different pitch selection, velocity, or accuracy than a randomly selected control cohort. Pitch release location is more medial after UCL reconstruction for all pitch types except sliders. Breaking movement of fastballs, sliders, and curveballs changes after UCL reconstruction.

Level of evidence: Level III; Retrospective Case-Control Design; Treatment Study

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Keywords: Baseball; Tommy John; UCL; Pitch; release location; MLB; PITCHf/x; Valgus instability

All data in this study were accessed through publicly available resources and thus no Institutional Review Board Approval was necessary.

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Ulnar collateral ligament (UCL) injury is among the most common of injuries in professional baseball, with a prevalence of up to 25% in Major League Baseball (MLB).⁷ UCL injuries are thought to be the result of overuse of the UCL due to valgus stress during both the late cocking and acceleration phases of the overhead pitching motion.^{1,2,9,12,23} Often, UCL tears in MLB pitchers are treated surgically by one of

several available techniques for UCL reconstruction.^{3,8,19} Despite numerous studies that analyze statistical, demographic, and biomechanical risk factors, there has been little consensus on the primary causes of this injury. Moderate to good results have been reported after UCL reconstruction in MLB pitchers in terms of success,^{4,10,15,17,19} and return to play rates range from 73%-94% after UCL reconstruction.^{12,13,16,18} It has been reported that the incidence of UCL reconstruction has been increasing in the last decade, with some even suggesting it to be an “epidemic,”⁴ likely owing to increased diagnostic methods, increased recognition, and overuse at young ages.^{4,24} A number of previous studies have also examined pitch velocity as a potential risk factor for, and as an outcome after, UCL reconstructive surgery.^{14,17,24} Chalmers et al and Whiteside et al reported that pitchers with higher fastball velocities are more at risk for UCL injury using regression analysis.^{6,24} The purpose of this study was to analyze fastball percentage and the release location, velocity, and movement of each pitch type in an effort to better understand alterations in pitching mechanics after UCL reconstruction.

Materials and methods

Patient population and demographics

This is a retrospective case-control study of MLB pitchers who underwent UCL reconstruction between the end of the 2007 baseball season and May 2013. In that period, 105 MLB pitchers were identified to have undergone UCL reconstruction surgery through publicly available media records and a free online database.²⁰ Only primary UCL reconstruction surgeries were included for this study. All pitchers with at least 100 pitches in the year leading up to surgery (index year) were considered eligible for analysis. Likewise, to maintain consistency for year-to-year analysis, only players who returned to MLB within 2 years of surgery and pitched >100 pitches in the second year and third year after their surgery date were included (Fig. 1). The first year after UCL reconstruction was considered a recovery year and thus not analyzed. Outcome year 1 was defined as the range 366-730 days after operation, and outcome year 2 was defined as the range 731-1095 days after operation. If an included player was known to have had a revision surgery that occurred >3 years after his initial surgery date, he was still included in the analysis. Subject demographics including age, height, weight, pitching arm, and draft

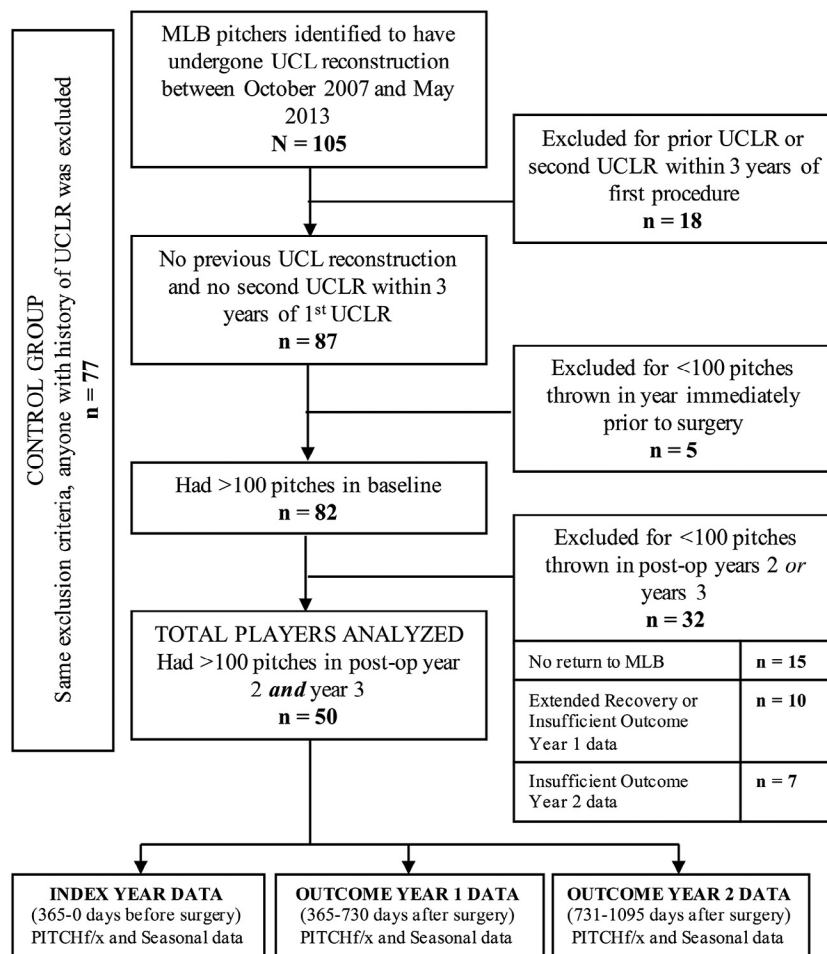


Figure 1 Study flow diagram of subject inclusion and exclusion. *MLB*, Major League Baseball; *UCL*, ulnar collateral ligament; *UCLR*, ulnar collateral ligament reconstruction.

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