Strength of Dynamic Stabilizers of the Elbow in Professional Baseball Pitchers Decreases during Baseball Season

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Objectives: Injuries to the ulnar collateral ligament (UCL) are one of the most common and severe incurred by pitchers. Baseball pitchers of all ages and levels have seen an increase in the diagnosis of these injuries. Tears of the UCL are caused by high valgus forces at the elbow of which the UCL is the primary restraint. Biomechanical studies have demonstrated that baseball pitchers either approach or exceed the maximum tensile strength of the UCL while throwing. Valgus force is additionally resisted by the flexor pronator (FP) muscles: flexor carpi ulnaris (FCU), flexor digitorum superficialis (FDS), and pronator teres (PT), which act as secondary stabilizers. The importance of these secondary stabilizers has not been clearly demonstrated. The goal of this study was to monitor the strength changes in the secondary stabilizers of the elbow over the course of the baseball season and to attempt to correlate any of those changes to observed UCL injuries.
Methods: With approval of the Institutional Review Board, 19 professional minor league baseball pitchers were evaluated in spring training and then at the conclusion of the season for flexor-pronator muscle strength. Additionally, their medical histories were assessed for incidents of ulnar collateral ligament injuries and days missed from baseball activities. Each player was assessed using custom testing devices measuring forearm pronation strength, wrist flexion strength, and isolated ring finger FDS strength. Both dominant and non-dominant arms were evaluated and the same testing procedure was performed both at spring training and at the conclusion of the baseball season. Strength was defined as the maximum isometric force generated over three trials. For each test, percentile rank was determined within the sample. A comparison between spring and fall assessments was done using a paired two sample T-test for means.
Results: For all three tests, there was a demonstrated decrease of strength in both the pitching arm and non-pitching arm over the season. Pronation strength, wrist flexion strength, and FDS strength to the ring finger decreased 16.1%, 13.7%, and 4.9% respectively in the throwing arm. The decrease in pronation strength and wrist flexion strength in the throwing arm were statistically significant ($p=0.001$ and 0.003 respectively). Although the non-throwing arm also decreased in strength, it did not reach statistical significance. Two of the nineteen players were diagnosed with ulnar collateral ligament sprains during the season. The two injured players were the 1st and 3rd weakest in a composite percentile strength ranking from the spring assessment.
Conclusion: In this study, we showed a diminution of strength of the muscles that act as secondary stabilizers of the ulnar collateral ligament over the course of the professional baseball season. The flexor pronator muscles (specifically the FCU, PT, and FDS) may help protect baseball pitchers from ulnar collateral ligament injuries and weakness of these muscles might make individuals prone to ulnar collateral ligament injuries and subsequent valgus overload syndrome. It is possible that this data would be helpful to predict individuals who are predisposed toward ulnar collateral ligament injuries, as well as in the development of comprehensive flexor-pronator muscle strengthening programs aimed at maintaining secondary stabilizer strength over the course of the baseball season.

Maximum Absolute Strength				
	Test	Spring	Fall	p value
Throwing Arm	FDS (N)	53.23 ± 18.75	50.11 ± 19.18	0.202
	Pronation (Nm)	8.33 ± 2.28	6.93 ± 2.18	0.001
	Flexion (N)	265.03 ± 45.78	225.32 ± 48.82	0.003
Non-Throwing Arm	FDS (N)	50.32 ± 14.29	48.7 ± 16.83	0.188
	Pronation (Nm)	7.37 ± 2.35	6.69 ± 1.55	0.120
	Flexion (N)	255.0 ± 53.47	236.13 ± 47.56	0.071

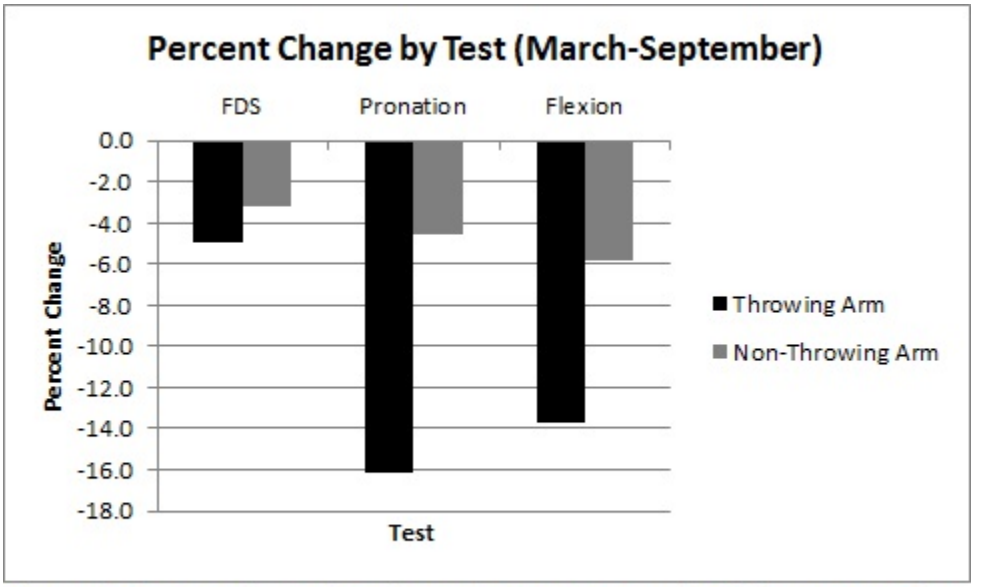

Figure 1: Percent change from the spring assessment to the fall assessment for each test.

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