DOES HIGH MEDIAL ELBOW STRESS DURING PITCHING COMPROMISE THE DYNAMIC STABILIZERS OF THE ELBOW?

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**Background:** The flexor carpi ulnaris (FCU) and flexor digitorum superficialis (FDS) are thought to provide dynamic stability to the medial elbow, with a lesser contribution from the pronator teres (PT).

**Purpose:** The purpose of this study was to determine if baseball pitchers with higher valgus elbow torque (an index of medial elbow stress) experience greater postgame FCU and FDS fatigue and slower subsequent recovery.

**Study Design:** Descriptive Laboratory/Field Study.

**Methods:** A pilot study was performed to identify valid tests of FCU and FDS Function. Surface EMG signals were recorded from the FCU, FDS and PT during hand-held dynamometry testing of middle finger (MF) and ring finger (RF) flexion strength in 10 healthy men (36±12 yr). EMG amplitudes, expressed as percent of maximal voluntary contraction (MVC) based on standard MVC tests for each muscle, were compared between tests and muscles with repeated measures analysis of variance (ANOVA).

Field Testing was performed in NCAA D3 baseball pitchers during the Fall season and Spring preseason. MF, RF and grip strength were tested prior to, immediately after, and one day after 14 pitching performances. Elbow valgus torque was measured from an inertial measurement unit, housed in a compression sleeve, worn on the elbow during pregame bullpen pitches (removed prior to game). Pitchers were categorized as having high or low valgus torque (> or < 50 Nm; 62±7 Nm vs 32±3 Nm). Effect of valgus elbow torque on fatigue and strength recovery was assessed using mixed-model ANOVA.

**Results:** Pilot Study: MF force was greater than RF force (77±11 N vs. 58±11 N, P<0.001) and neither were different between pitchers with high (n=8) versus low (n=6) valgus torque (P=0.288, P=0.541). Pitchers threw 58±12 pitches with no difference between pitchers with high versus low valgus torque (P=0.263). Pitchers with high valgus torque (n=8) experience marked post-game MF fatigue (88% of baseline) and incomplete recovery the following day (95%), while pitchers with low valgus torque (n=6) exhibited no strength changes (107% of baseline post game, 106% a day later; group x time P=0.022). Similarly, pitchers with high valgus torque experience post-game RF fatigue (94% of baseline) with minimal recovery the following day (96%), while pitchers with low valgus torque exhibited no fatigue (114% of baseline post game) and no delayed strength loss (107% a day later; group x time P=0.048). By contrast, grip strength was decreased post game (95% of baseline) and had not recovered by the following day (95%; time effect P=0.013) but these effects were not different between pitchers with high versus low valgus torque (P=0.143). Valgus torque explained 40% of the variance in post-game RF fatigue (P=0.015). A combination of valgus torque and pitch count explained 57% of the variance in post-game MF fatigue (P=0.010). Neither valgus torque (P=0.129) nor pitch count (P=0.845) were related to post-game grip strength.

**Conclusions:** Based on EMG analyses, the MF and RF strength tests provided a functional assessment of the dynamic stabilizers of the medial elbow. Based on field testing, high valgus torque at the elbow during pitching results in greater fatigue and slower recovery of the dynamic stabilizers of the medial elbow. These are the first data to show a link between elbow stress during pitching and compromised dynamic stability in the medial elbow.

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