

Forearm Muscle Contribution to Elbow Joint Stability

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ABSTRACT

Elbow dislocation and elbow instability are common injuries, particularly in a young, active population. The purpose of this investigation is to define the relative contributions of forearm muscle to elbow stability in the overhead throwing athlete.

Eight fresh frozen elbow joints were tested. Using a custom designed mounting device (Fig.1), the strain in the Medial Ulnar Collateral Ligament (MUCL) was measured with a Displacement Variable Reluctance Transducer (DVRT: Microminiature DVRT, MicroStrain Inc., Williston, VT) during individual muscle loading of the Flexor Pronator Mass (FPM) and Extensor Supinator Mass (ESM) at 45° and 90° elbow flexion angles. Kinematics were measured both with the MUCL intact and fully torn.

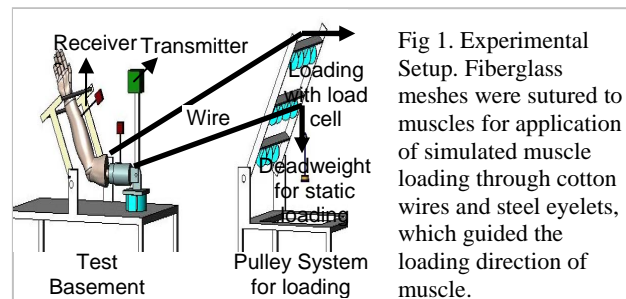


Fig 1. Experimental Setup. Fiberglass meshes were sutured to muscles for application of simulated muscle loading through cotton wires and steel eyelets, which guided the loading direction of muscle.

At 45° and 90° elbow flexion, loading of the flexor carpi ulnaris (FCU), flexor digitorum superficialis (FDS), and flexor carpi radialis (FCR) caused significant relief to the MUCL ($P < 0.05$), while the loading of the pronator teres (PT) did not ($P > 0.05$). At both 45° and 90°, the FCU created the most relief ($P < 0.01$) compared to the rest of the FPM. At 45°, the extensor carpi ulnaris (ECU) created a significant increase in MUCL strain ($P < 0.05$).

At 45° and 90°, individual loading of the FPM created significant ($P < 0.05$) varus motion in both MUCL conditions. Varus movements were higher at 45° than at 90° for the FCU, FDS, and FCR. At 45° and 90°, loading of the ECU and extensor digitorum communis (EDC) resulted in significant valgus movement ($P < 0.05$) during intact conditions. Loading of the extensor carpi

radialis (ECR) created significant valgus movement ($P < 0.05$) at 45° in both MUCL conditions. At 90° , the brachioradialis created a significant varus movement ($P < 0.05$).

Our findings suggest that the anatomical orientation of the FCU and FDS allow them to function as the primary and secondary dynamic stabilizers, respectively, in conjunction with the MUCL to elbow valgus stability. The significance of the ESM in elbow valgus stability is still unclear.