Biomechanical Validation of the Anteromedial Ligament In Cadaveric Knees

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INTRODUCTION: Knee stability is conferred by static and dynamic structures that work together to prevent excessive laxity. The anteromedial ligament (AML) is a newly described ligament originating deep, posterior, and inferior to the superficial medial collateral ligament (MCL) at the medial femoral epicondyle, and inserts on the rim of the anteromedial tibial plateau. Biomechanical validation of this ligament is lacking. The study aims to identify the position in which the AML is in tension and to verify that the AML contributes to knee stability.

METHODS: Four fresh frozen cadaver knees were prepared and mounted with the femur potted in a custom jig in a fixed position, and with the tibia free. The tibial and femoral bony and ligamentous anatomy were marked. The relative positions of these anatomically marked points were analyzed in six static positions using kinematic analysis software. These positions included full flexion and extension, in addition to maximal internal and external tibia rotation in both flexion and extension. These data were exported into a 3D rendered biokinematic model and used to calculate the point-to-point distance between the reference points. Measurements were taken for all configurations before and after ligament transection.

RESULTS: Maximum AML length and tension was in extension and external rotation. In all configurations, an increase in measured post-transection distance was found. After AML transection, the average change in distance for all attachment points was 2.4 , 0.9, and 5.55 mm for the deep MCL, superficial MCL and AML, respectively. The post-transection translation of the ligament attachments were 0.04, .85, .61, -.71, and 5.55 mm for the extended and internal rotation, extension, flexion, flexed and internal rotation, and flexed and external rotation, respectively. There was a significant difference in the translation of the AML points for flexion and external rotation versus flexion and internal rotation p=.022)

DISCUSSION AND CONCLUSION: Previous studies have revealed that ligament sectioning increases the distance between their origin and insertion points, signifying their role in limiting joint motion. Transecting the AML resulted in an average 5.5 mm increase origin-insertion distance during flexion and external tibia rotation, thus confirming the AML as a ligamentous structure which contributes to knee stability in this position. This ligament may therefore play a role in anteromedial rotatory instability injuries.