Introduction:
Arthroscopic application of thermal energy to the glenohumeral joint is currently being used to treat shoulder instability. In theory, this technique theoretically produces less morbidity than the standard open treatments, which have been shown to often limit shoulder motion, especially in external rotation. While previous studies have demonstrated the biomechanical effects of sectioning the glenohumeral ligaments, little is known regarding the biomechanical consequences of thermally shrinking specific capsuloligamentous structures in the shoulder. The purpose of this study was to examine the effects of arthroscopic, anterior, thermal capsulorrhaphy with a radiofrequency probe on the range of motion of the glenohumeral joint in translation and rotation.

Materials and Methods:
Eight unpaired, fresh frozen cadaveric shoulders (average age = 65.2 years) were stripped of soft tissue except the insertions of the rotator cuff tendons at their confluence with the glenohumeral capsule, the long head of biceps brachii tendon, the coracohumeral ligament, the brachii tendon, the coracoacromial arch, the and coracohumeral ligament. The scapula was potted in custom aluminum holder with dental plaster. A 13mm threaded rod was fixed in the humeral canal.

Translation: The scapular holder was attached to the actuator of a servohydraulic testing machine (MTS Corp., Eden Prairie, MN) and with the humerus fixed to an xy floating stage. The shoulder was placed in 90° of abduction and 90° of external rotation. An 80N joint centering force was applied to the humeral head to seat the head centrally in the glenoid. Prior to testing, the joint force was reduced to 20N. The shoulder was preconditioned for 10 cycles through application of anterior/posterior loads of ±10N at 0.25Hz, followed by a 20 second wait period. The joint was then loaded at a rate of 1N/Sec from 15N anteriorly and followed by a 20 second wait period to 15 N posteriorly followed by 20 second wait period. Anterior and posterior glenohumeral laxity was measured by an infrared optical measurement system (Qualisys Inc., Glastonbury, CT).

Rotational: The IM humeral rod was locked into the actuator with the long head of the biceps tendon aligned with the anterior edge of the acromion to obtain 90° of external rotation. The potted scapular holder was placed on an incline to maintain 60° of glenohumeral abduction. Under a joint compression force of 20N, the humerus was rotated to the limits of internal and external rotation. The humerus was rotated at .5Hz for 25 cycles. The shoulder was returned the arthroscopy lab and arthroscopic shrinkage of the anterior capsule was performed with a radiofrequency probe (Oratec Interventions, Inc.). Translation and rotation testing were repeated on the treated specimens. Stiffness data was calculated from slopes of force/displacement curves.

Results:
Mean anterior translation was 4.8±2.6mm pre-treatment, and decreased to 3.4±2.0mm post –treatment (p=0.03). Mean posterior translation was 4.9±5.2mm pre-treatment, and decreased to 3.1±2.9mm post treatment (p=0.07) (Figure 1). Total translation pre-treatment was 9.8±5.7mm, and dropped to 6.5±4.2mm post treatment (p=0.003). The reduction in translation averaged 29.2% anteriorly, 36.7% posteriorly, and 33.2% for total shoulder motion (Figure 2). There was a slight increase in the stiffness of the shoulder in anterior and posterior translation, but it was not statistically significant. Glenohumeral rotation did not significantly decrease in external (p=0.51) or internal (p=0.10) rotation. A decrease in total rotation was significant (p=0.02). Mean losses in rotation were: 1.8% of external, 9.0% of internal, and 10.8% total (Figure 3). Stiffness in internal and external rotation did not change significantly.

Discussion: The results of this study suggest that arthroscopic, anterior, thermal capsulorrhaphy with a radiofrequency probe may be successful to treat anterior glenohumeral instability by reducing excessive translation due to capsular laxity. The results also suggest that this may be achieved without significant changes in rotation or stiffness, which is important in attaining a good clinical outcome.

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