INTRODUCTION:
Anterior instability of the shoulder is classically treated with arthroscopic or open procedures. In cases of capsular redundancy, shortening or shifting of the capsule is added, such as an inferior capsular shift. However, despite being performed as a standard treatment procedure, the quantitative effects of arthroscopic anteroinferior suture capsular plication have not been elucidated. The purpose of this study was to compare the glenohumeral rotational range of motion, glenohumeral translations and the path of glenohumeral articulation in intact shoulders, following rotational stretching of the capsule using a novel cadaveric instability model, and then after arthroscopic anteroinferior suture capsular plication.

METHODS:
Six fresh frozen cadaveric shoulders were thawed and tested in a custom shoulder testing system and Microscribe (Immersion Corp, San Jose, CA) before and after simulating anterior laxity and then following arthroscopic anteroinferior suture capsular plication (Figure 1). The anterior shoulder laxity was simulated by nondestructive incremental stretching of the glenohumeral joint capsule in external humeral rotation at 60° of glenohumeral abduction. Data were recorded for intact shoulders, after nondestructive stretching of the glenohumeral joint capsule to 20% beyond maximum external humeral rotation, after making arthroscopic portals (AS), and following 10mm arthroscopic suture plication to two suture anchors in the anteroinferior quadrant (Figure 2). Specifically, the path of glenohumeral articulation, rotational range of motion, and translation were measured in 60° glenohumeral abduction (to simulate 90° of total shoulder abduction) using a Microscribe 3DLX system. Translation was measured with the humerus secured in 90° of external rotation. Capsulolabral depth was measured to quantify the increase after plication. The data were analyzed using repeated measures analysis of variance with a Tukey post hoc analysis.

RESULTS:
Nondestructive stretching of the glenohumeral joint capsule to 20% beyond maximum external humeral rotation resulted in a significant increase in external rotation (23.2°, 14.3%, p < 0.001) and anterior translation (15N: 5.8% and 20N: 7.4%). After plication, external rotation decreased significantly when compared to the stretched state (12.6°, -7.9%, p < 0.05), but was still greater than intact (10.8°, 6.4%, not significant) (Figure 3). Anterior translation decreased 61.1% and 49.8% with 15N and 20N translational load applied after plication when normalized to intact (p < 0.0001) (Figure 4). Posterior translation was decreased with both 15N and 20N applied (11.4% and 13.1%, p = 0.2 and 0.12). Inferior translation decreased a statistically significant amount at 20N as well (0.51 mm, -3.2%, p = 0.04). The path of glenohumeral articulation was significantly more posterior at 60°, 90°, and 120° external rotation and significantly more inferior at 90° and 120° external rotation (Figure 5). The depth of the capsulolabral “bumper” increased from 2.9 mm to 6.4 mm following plication (p = 0.002).

DISCUSSION:
Arthroscopic anteroinferior plication effectively reduces anterior translation. There are small but consistent reductions in posterior and inferior translation as well. The increase in external rotation following stretching is not entirely lost after plication when compared to intact suggesting a “site specific effect” at the anterior band of the inferior glenohumeral ligament. Capsulolabral buildup may help limit anterior translation without affecting rotation. Following plication, the path of glenohumeral articulation shifts posteriorly and inferiorly on the glenoid articular surface throughout the arc of motion. Careful attention should be paid to the amount of capsule included in the plication.

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AFFILIATED INSTITUTIONS FOR CO-AUTHORS:
*** Osaka Medical College, Takatsuki, Osaka, Japan