Introduction
Glenohumeral instability is often treated by surgical capsulorrhaphy. Recently thermal capsulorrhaphy has been advocated as a method for performing capsulorrhaphy with minimal limitation in the range of glenohumeral motion. This research was undertaken to explore the relationship between the limitation of translational laxity and rotational laxity after thermal capsulorrhaphy in a human cadaver model. We hypothesized that thermal capsulorrhaphy would limit both the immediate post-surgical rotational laxity and the translational laxity of the glenohumeral joint.

Methods and Materials
Nine fresh frozen cadaver shoulders were prepared leaving only the vented capsular-ligamentous structures of the glenohumeral joint intact. The scapulae were mounted in Plaster of Paris and rigidly fixed to the testing scaffold. Translation and rotation of each humerus, relative to its scapula, was quantified using an electromagnetic tracking device, which was securely fastened to the most proximal aspect of the humeral shaft. Using scapular coordinates, anterior translation and external rotation from a common initial test position of 45º abduction, 0º flexion, and neutral rotation were determined with uniform loads of twenty Newtons. Neutral rotation was defined as the midpoint between maximum internal and external rotations. Using previously published guidelines, a standardized anteroinferior thermal capsulorrhaphy was performed with a commercially available radio frequency thermal probe (1). Following thermal capsulorrhaphy, the humerus was returned to the original test position, relative to the scapula, and the anterior translational and external rotational laxity values were again obtained for comparison to the pre-surgical values. Paired t-tests were used to determine statistically significant changes in both translational and rotational laxity pre- and post-thermal capsulorrhaphy.

Results
Thermal capsulorrhaphy reduced the average anterior translation of the humeral head on the glenoid from 18.0mm to 9.2mm and the average external rotation of the humeral head from 46.1° to 32.9° (see Table 1). The changes in these two laxity measurements were highly correlated (r= 0.77, Figure 1).

<table>
<thead>
<tr>
<th>Decrement</th>
<th>Translation</th>
<th>Rotation</th>
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<tr>
<td>% Loss</td>
<td>51.4 ± 17.5</td>
<td>28.4 ± 14.3</td>
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<td>Paired t-test</td>
<td>p &lt; 0.00005</td>
<td>p &lt; 0.0005</td>
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Table 1.

Figure 1. Decrements in translation and Rotation

Discussion
Thermal capsulorrhaphy is used clinically to reduce translational laxity of the glenohumeral joint without jeopardizing the range of motion. The data from this study suggest that decrements in anterior translational laxity after anteroinferior thermal capsulorrhaphy are associated with loss of range of external rotation. During external rotation the glenohumeral ligaments wrap around the humeral head. If the available length of the capsule and ligaments are reduced by thermal capsulorrhaphy, both the translational and rotational laxity of the shoulder are diminished. These results suggest the need for careful clinical evaluation of the range of rotation after capsulorrhaphy and avoidance of excessive coagulation that may result in loss of glenohumeral function.

References