INTRODUCTION
Impingement of the rotator cuff and subacromial bursa between the coracohumeral arch and the humerus is a well-established clinical finding resulting in shoulder pain. Traditional operative management of this pain, which is worse with overhead activities, includes arthroscopic or open release of the coracoacromial (CA) ligament. Recent studies, however, indicate the CA ligament plays an important role in normal shoulder function (1) and therefore capsulotomy at 2.4 ± 1.2 mm, and is 4.5 ± 1.7 mm at abduction. At lower levels of abduction, release of the CA ligament resulted in increased anterior translation, especially in anterior and inferior directions. A Joint compression load (20N) was simulated. A load (15N) was then applied to the humerus in anterior, posterior, superior, or inferior directions and translations on the glenoid were measured using an electromagnetic tracking device (Ascension Technology Corporation, Colchester VT). The accuracy of this device is 0.8 mm for the translation measurement and 0.8° for rotation measurement. For the experiment, the humerus was sequentially positioned in combinations of 0°, 30°, and 60° of abduction and neutral, 30° internal, and 30° external rotation. The entire experiment was then repeated after a complete release of the CA ligament from the acromion end. A multivariate ANOVA was used to compare the glenohumeral joint translations 1) before and after CA ligament release, 2) in the anterior, posterior, superior and inferior directions and 3) at 0°, 30°, and 60° of humeral abduction. A multivariate ANOVA with a p-value of 0.05 was used for statistical analyses.

RESULTS
The CA ligament had a role in the static stabilization of the glenohumeral joint at lower levels of abduction. It restrained anterior translation and provided a suspensory function. This was less important with internal and external rotation at higher levels of abduction. At lower levels of abduction, release of the CA ligament resulted in meaningful increases in glenohumeral translation, especially in anterior and inferior directions. Glenohumeral translation decreased in all directions with the increase in abduction, especially in internal rotation. After release of the CA ligament with the joint in neutral rotation, the change in anterior translation at 0° of abduction was 1.8 ± 2.5 mm, at 30° of abduction it was 4.5 ± 3.5 mm, and was 4.5 ± 3.5 mm at 60° of abduction. With the joint in internal rotation, the change in anterior translation at 0° of abduction was 3.2 ± 2.7 mm (p < 0.05), at 30° of abduction it was 1.8 ± 3.5 mm, and was 4.4 ± 1.6 mm at 60° of abduction. For the inferior translation changes in neutral position at 0° of abduction and increased 1.3 mm at 30° of abduction. With the joint in internal rotation, the change in inferior translation at 0° of abduction was 3.2 ± 1.2 mm, at 30° of abduction it was 1.7 ± 0.9 mm, and was 0.2 ± 0.1 mm at 60° of abduction. With the joint in external rotation, the change in inferior translation at 0° of abduction was 2.5 ± 0.7 mm, at 30° of abduction was 0.2 ± 1.5 mm, and was -0.2 ± 0.2 mm at 60° of abduction. The joint in internal rotation, the change in inferior translation at 0° of abduction was 4.4 ± 1.6 mm, at 30° of abduction it was 2.4 ± 1.2 mm, and was 1.5 ± 1.1 mm at 60° of abduction. The remaining glenohumeral positions did not show a significant difference in translation before and after CA ligament release.

DISCUSSION
The CA ligament has been implicated as being the most important soft tissue structure in impingement syndrome and its release has traditionally been performed liberally. This was because the CA ligament was thought to have no functional importance (2). However, the results from this study suggest that the CA ligament does have a role in static stabilization of the glenohumeral joint. Detachment of the CA ligament resulted in increased anterior and inferior translation of the internally and externally rotated glenohumeral joint. We believe that the CA ligament release from the acromion results in violating the continuum of the glenohumeral socket. This glenohumeral socket continuum consists of the glenoid labrum, the acromion process, the CA ligament, and the supporting capsular ligaments, which also include the coracoacromial ligament. This socket for the humerus generously encloses the humeral head and provides glenohumeral stability. Therefore, when the CA ligament is detached, the geometric socket continuum for the humerus is structurally compromised. Specifically, the interaction between the CA ligament and the coracoacromial ligament is compromised, which we believe is responsible for the findings of this study. Individuals with glenohumeral instability commonly develop impingement syndrome indicating that instability can result in impingement syndrome. This study indicates that treatment for impingement syndrome can also result in glenohumeral instability. For this reason, release of CA ligament for the treatment of impingement syndrome should be reserved for patients without glenohumeral instability.