INTRODUCTION:

The shoulder is a very complex joint. The capsular structures and the glenohumeral ligaments are considered the main stabilizers near the end ranges of motion. This is particularly true at the end ranges of internal and external rotation motions when humeral head migration is suspected to be the greatest. Humeral head translation is also most likely associated with humeral head rotations (Borsa et al., 2008; Werner et al., 2004) as one would expect a higher degree of capsular laxity (thus allowing for greater anterior translation) during the end ranges of external rotation. Clinically, this is most apparent in the overhead, throwing athletes (i.e., pitcher) who often exhibit excessive anterior capsular laxity and humeral head translation as they reach maximal external rotation during late cocking of a pitch or as observed in the classic anterior apprehension test in other clinical populations who exhibit anterior instability. Conversely, in the healthy shoulder, with no external, anteriorly applied load (as with apprehension test) or as provided by the trunk during the pitch, it is mechanically plausible that the humeral head will migrate posteriorly as the large posterior muscles rotate the humerus externally also will serve to pull the humeral head back relative to the glenoid. To date, the relationship between GH joint motion during external rotation and the concomitant humeral head translation has not been well described. This is because quantifying these rotations and translations in vivo has proven difficult and most data sets are limited to the overhead athlete whose inherent physiological differences may not apply to non-athletic populations. Understanding the relationship of humeral head migration during external rotation in healthy subjects would help not only provide valuable knowledge as to general shoulder function, but also provide the baseline support for future comparison of patients (overhead athletes as well as general population) with anterior shoulder instability.

The purpose of this study was to accurately measure and correlate the in vivo three-dimensional glenohumeral rotations and translations during external rotation with the arm at 90 degrees of abduction. We hypothesize that external rotation will be positively correlated with inferior and posterior humeral head translation.

METHODS:

A bplane fluoroscopy system was used to measure the 3D pose of the scapula and humerus of 10 healthy male subjects (age: 29.7±6.6 yrs, height: 183.6±4.6 cm, weight: 89.8±8.9 kg) as they performed external rotation at 90 degrees of abduction. Flouroscopy was performed at 30 frames per second. A high-resolution CT scan of each subject was performed. The glenoid rim was used as the reference point for determining the glenoid center. The humeral head center was assumed to be midway between the superior and inferior aspects of the humeral head circumscribed by the contour of the humeral head. The glenoid center was assumed to be midway between the superior and inferior aspects of the glenoid. The results of this study support the hypotheses that during unassisted, seated arm external rotation with the arm at 90 deg of abduction, there are inferior (2.9mm) and posterior (4.0mm) translations of the humeral head which are significantly correlated with the arm external rotation angle. This is likely due to the activation of the large posterior muscles in order to externally rotate the arm. The information in this study is a valuable baseline for future comparisons with pathological groups.

REFERENCES: