Glenoid Retroversion and Critical Shoulder Angle Play a Significant Role in the Development of Glenohumeral Osteoarthritis, an Osteological Study

Andrew Jacob Moyal, Bryan Ren[1], Devika Nandwana, Douglas Stanley Weinberg, Robert J Gillespie, Raymond W Liu
[1]University of Michigan

INTRODUCTION:

Few studies have analyzed how specific anatomical variations may increase a patient's risk for glenohumeral osteoarthritis (GHOA). Recent literature notes potential importance of glenoid retroversion, critical shoulder angle (CSA), neck shaft angle (NSA), and glenoid size. The goal of this osteological study is to analyze the relationship between OA grade and several key anatomic parameters.

METHODS:

Utilizing a human osteological collection, 1028 specimens were evaluated for GHOA severity based on grading each the glenoid and humeral head. Specimens were further measured for glenoid version, humeral version, NSA, CSA, glenoid AP diameter, and glenoid superior-inferior diameter.

RESULTS:

Multivariate regression utilizing the above components was seen to significantly predict 16% of the total variance seen in GHOA grade among the cohort. Age positively correlated with GHOA grade ($R = .33$, $p = <.01$), while glenoid version ($R = -.13$, $p < .01$) negatively correlated with GHOA grade. While CSA was not significant in the multiple regression, when stratifying it into ≥30° and <30° cohorts based previous literature, the <30° group was found to have significantly increased OA grade ($p = .049$).

DISCUSSION AND CONCLUSION:

Glenoid retroversion and CSA <30° threshold correlate with higher grade of GHOA. These findings show potential importance of avoiding glenoid retroversion and a CSA of <30° to minimize wear on a native and artificial glenohumeral joint. Anatomic variations in glenoid version and CSA significantly account for increased risk for GHOA in a normal patient population. This data should be considered when planning shoulder reconstruction surgery.

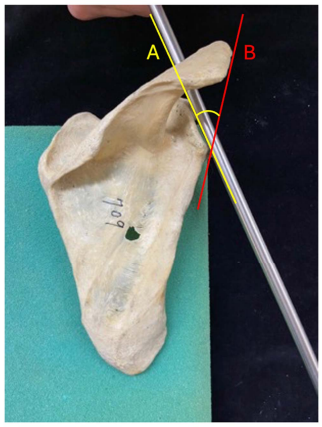

Figure 1. Example of planes required for measurement of critical shoulder angle, along with completed measurement in bony specimen. A metal rod was placed on the glenoid surface to facilitate digital measurement.

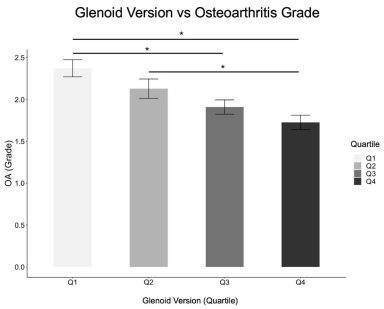

Figure 2. Increased glenoid retroversion is seen to significantly impact mean grade of GHOA.

Figure 3. Histogram showing the z-score distribution of CSA amongst the study population. CSA <30°represents a z-score of ≤-1.3 for the study population, visualized by the blue line. This correlates to <10th percentile for the study population