Introduction: Glenohumeral internal rotation deficit (GIRD) is a common finding in overhead athletes. To date, no study has investigated the biomechanical consequences of GIRD as it approaches values seen in athletes with symptomatic pathology. The purpose of this study was to create a reproducible cadaveric GIRD model and to determine the biomechanical changes that occur with a full spectrum of GIRD.

Methods: Six cadaveric shoulder specimens were tested using a custom testing system in 90 degrees of humerothoracic abduction with 22 N of compressive force. The specimens were tested in native state ("Intact"), after non-destructive external rotation (ER) stretch to simulate increased ER seen in overhead athletes ("Stretched"); and GIRD of 5%, 10%, 15% and 20%. For each condition, maximum ER, maximum internal rotation (IR) and total range of motion were measured using 2.2 Nm of torque. Kinematic data were obtained to determine the humeral head apex (HHA) position at 30 degree increments of rotation. The amount of translation in the anterior, posterior, superior and inferior directions was measured using loads of 10 and 15 N.

Results: Range of Motion: A significant decrease in total range of motion was observed beginning with 15% GIRD and a significant decrease in internal rotation was observed beginning with 5% GIRD as compared to the intact condition. External rotation was significantly increased as compared to the intact condition for the stretched and 5% GIRD states.

Humeral Head Apex Position: At maximum ER, there was a significant shift of the HHA in the superior direction as compared to the intact condition for all GIRD states. At maximum IR, the HHA shifted significantly in the inferior direction as compared to the intact and stretched conditions starting at 10% GIRD. There was no difference in HHA shift when comparing the intact and stretched states for any rotation.

Glenohumeral Translation: Starting at 10% GIRD the amount of posterior translation decreased significantly, and starting at 20% GIRD, the amount of inferior translation decreased significantly. There was no difference in translation in the anterior or superior directions.

Conclusions: This study shows that biomechanical alterations occur in the glenohumeral joint with as little as 5% GIRD. As the amount of GIRD increases, more significant biomechanical changes take place and eventually lead to diminished translations in the posterior and inferior directions. This study reinforces that increasing amounts of GIRD in the overhead athlete can lead to alterations of joint mechanics that can lead to pathology.

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