THE INFLUENCE OF DISTINCT ANATOMIC SUBREGIONS OF THE SUPRASPINATUS ON HUMERAL ROTATION

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Introduction: Prior research has demonstrated that the supraspinatus not only abducts the humerus and stabilizes the glenohumeral joint, it also induces humeral rotation. Additionally, anatomic studies have proven that the supraspinatus is composed of distinct anterior and posterior subregions. To date, the quantitative contribution of these anatomic subregions on humeral rotation has not been investigated. Also, current cadaveric studies which load the supraspinatus treat it as a single unit and do not account for the physiological difference in the forces that each subregion produces. Therefore, the objective of this study was to quantify the magnitude and direction of humeral rotation that results from loading the distinct anterior and posterior subregions of the supraspinatus both separately and as compared to the whole in a cadaveric model.

Materials and Methods: Fourteen cadaver shoulder specimens were carefully dissected to divide the supraspinatus into its anterior and posterior subregions. Each specimen was tested under four different loading conditions with a total weight of 140N. Each condition was based on the supraspinatus physiological cross section area (PCSA), where 70% of the total force is produced by the anterior subregion and 30% is produced by the posterior subregion: (1) anterior-only, (2) posterior-only, (3) physiologic, where each subregion was loaded simultaneously, and (4) non-physiologic, where the subregion anatomy was disregarded and the tendon was loaded as a whole. Each specimen was tested at 0, 15, 30, 45 and 60 degrees of glenohumeral abduction in the scapular plane and in fifteen degree increments from 60 degrees of internal rotation to 60 degrees of external rotation. The study was performed using a custom testing apparatus (Figure 1) that maintained flexion/extension or abduction/adduction of the humerus during supraspinatus loading. The magnitude and direction of humeral rotation that occurred was then measured using a rotary variable differential transformer (RVDT).

Results: The anterior subregion induced internal rotation, while the posterior subregion either did not induce rotation or induced external rotation at every abduction angle, and at every initial position of internal rotation (p<0.05) (Figure 2).

Discussion: In the scapular plane, the anterior subregion of the supraspinatus acts as both an internal and external rotator depending on the initial position of the humerus. The posterior subregion never acts as an internal rotator, and instead induces no rotation or external rotation of the humerus at all initial positions. With the exception of one position, the magnitude and direction of humeral rotation induced are not significantly different whether the tendon is loaded as a whole, or whether it is loaded in a more physiological manner. This study demonstrates a distinct functional difference between the anatomic subregions of the supraspinatus. It also confirms that the anatomy and function of the supraspinatus are more complex and that the supraspinatus can no longer be considered a single tendon with a simple function. Furthermore, knowledge of this difference in rotational function between the anatomic subregions may lead to the development of a safer postoperative range of motion protocol following rotator cuff repair which may more accurately protect the repair.