LATISSIMUS DORSI TRANSFER IN IRREPARABLE CUFF TEARS: SHOULD WE ADD THE TERES MAJOR?

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Introduction: The transfer of the latissimus dorsi (LD) to treat irreparable rotator cuff tears was first published by Gerber in 1988 (1). The aim of this transfer is to provide external rotation and abduction moments on the humerus. To achieve this goal, we showed, in a recent 3D modeling of this transfer (2), that the best point of fixation of the transfer on the humeral head was not the supraspinatus but rather the infraspinatus (IS) insertion. Even at its optimal point of fixation, the LD transfer was weak compared to the innate shoulder external rotators. Recently, the transfer of the teres major (TM) onto the greater tuberosity of the humeral head was proposed by Combes & Mansat (3), Celli (4) and Wang (5) to treat irreparable rotator cuff tears. However, there is little biomechanical information available about this transfer. The purpose of this paper is to include the TM in our 3D model of shoulder muscle transfers to see if both muscles transferred to the infraspinatus insertion on the humeral head were better able to match the moments of the innate infraspinatus and teres minor muscles.

Methods: The right scapula and humerus were harvested from a fresh cadaver and mounted in a frame, reproducing the “zero” clinical position (arm held against the thorax, elbow flexed at 90°, forearm parallel to the sagittal plane of the body) of the shoulder. Steel balls inserted into the center areas of muscle origins and insertions were used to model muscle vectors: 3D modeling of muscle vectors was obtained by stereoradiographs. The external/internal rotation and abduction/adduction moments were calculated by increments of 3°, taking into account the “rolling up” of the muscle vectors around the humeral head. For muscle force calculation, results from a previous study (7) of shoulder muscle physiological cross-sectional area (PCSA) were used. The figures used for muscle force-producing capability was 3.6 kg for 1 cm² PCSA (7).

Figure 1: An artist’s rendition of muscle modeling with the humerus in a neutral position. (Note: the muscle force vectors are linearly represented here, whereas the “rolling up” around the humeral head was taken into account for calculating the moment).

Results: The theoretical values for the external/internal rotation and abduction/adduction moments of the innate shoulder external rotators (innate infraspinatus and teres minor) were obtained and compared to the moments of the isolated LD and TM, and both LD and TM transfers to the IS insertion. The results are shown in Figures 2 and 3.

Discussion: In this study, the combined innate infraspinatus and teres minor muscles provided not only external rotation but also abduction moment on the humerus in a neutral position, from 0° to 90° gleno-humeral abduction. The transfer of either the isolated LD or TM also provided external rotation and abduction moments, but these moments were weak compared with those of the combined innate infraspinatus and teres minor. Our results suggest that transferring both the LD and TM to the infraspinatus insertion is superior, in terms of rotation and abduction moments, to transferring the isolated LD alone.

References