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# GRAFT POSITIONING IN SUPERIOR CAPSULAR RECONSTRUCTION: COMPUTATIONAL ANALYSIS OF GRAFT INTEGRITY AND SHOULDER STABILITY

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**Summary:** Arthroscopic superior capsular reconstruction (ASCR), for the treatment of irreparable rotator cuff tears (IRCTs), has been shown to produce excellent clinical outcomes. However, graft tear rates can range from 4.2% up to 75%. The position of the shoulder during graft fixation may affect the outcome of the procedure, possibly in different forms depending on the type of IRCT. But this topic lacks biomechanical evidence. The aim of this study was to evaluate the influence of the positioning of the graft in ASCR on shoulder stability and graft tear risk. A 3-D musculoskeletal model of the upper limb was modified to account for the fixation of the graft in ASCR. A total of 126 shoulder positions for graft fixation were evaluated. The material properties of the graft were defined based on previous experimental data of fascia lata graft constructs. The effect of the long head of the biceps tenotomy was also studied. Two biomechanical parameters were used to evaluate the integrity of the graft and shoulder stability: the graft strain and the glenohumeral joint reaction force (GH JRF), respectively. The statistical analysis was based on analysis of variance (ANOVA) and multiple comparison. The level of significance was set to $p < 0.05$.For abduction angles above 15° during fixation, the graft had a high risk of tearing when the arm returned to the side of the trunk, considered as the resting position. For abduction angles below 15°, the mean shoulder stability after graft fixation improved significantly, ranging between 6% and 20% ($p < 0.001$), for a IRCT affecting the supraspinatus tendon. Also, for this RCT tenotomy significantly decreased shoulder stability after ASCR ($p < 0.007$).This study showed that the position of the shoulder, during graft fixation, affected both graft tear risk and shoulder stability, after ASCR for the treatment of RCTs. ASCR also improved shoulder stability, compared to the preoperative condition, regardless of the shoulder position. This study provides important insight regarding the role of position of the shoulder during graft fixation.