

# INFLUENCE OF THE TEAR PATTERN ON SHOULDER STABILITY AFTER ARTHROSCOPIC SUPERIOR CAPSULAR RECONSTRUCTION

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## Introduction

Arthroscopic superior capsular reconstruction (ASCR) was introduced for the treatment of irreparable rotator cuff tears (RCTs) [1]. In ASCR a graft is fixed, in the supraspinatus (SSP) pathway, with the aim of restoring the stability of the shoulder. The four most common patterns of RCTs in ASCR include an irreparable full-thickness tear of the following tendons: SSP; SSP + Subscapularis (SC); SSP + Infraspinatus (ISP); and SSP+SC+ISP [2]. Concomitant procedures during ASCR may be considered to restore the action of the SC or ISP: pectoralis major transfer (PMT) or latissimus dorsi transfer (LDT) for the SC; and LDT or lower trapezius transfer (LTT) for the ISP [3]. However, biomechanical evidence regarding the role of the graft for tears extending beyond the SSP [4], and the necessity of concomitant procedures during ASCR, is lacking. The aim of this study was to evaluate the influence of the RCT pattern on the stability of the shoulder after ASCR, with or without concomitant procedures applied.

## Methods

A 3D musculoskeletal model of the upper limb was modified to simulate the ASCR procedure and estimate the stability of the glenohumeral (GH) joint [5]. The four most common RCT patterns were modeled by removing the muscles, affected by the RCT, from the model. The muscular and joint reaction forces were estimated based on inverse dynamics, considering motion capture data collected from a biomechanics laboratory. The muscle force sharing problem was solved by minimizing muscle energy consumption, while ensuring the fulfilment of the equations of motion and the stability of the joints. The stability of the GH joint was estimated as the ratio between the GH reaction force components, augmented by a weighting factor that indicates the amount of additional muscular activity necessary to prevent

dislocation of the shoulder. The insertion sites for the tendon transfer were defined with the guidance of experienced orthopedic surgeons. The comparison between the pre and postoperative conditions was based on ANOVA and Tuckey's test ( $p < 0.05$ ).

## Results

For the isolated tear of the SSP, ASCR increased the stability of the shoulder ( $p < 0.001$ ), compared to the preoperative condition; for the SSP+SC pattern, it degraded stability ( $p < 0.05$ ); and for the SSP+ISP and SSP+SC+ISP patterns, although it increased stability, the improvement was not significant (Figure 1).

## Discussion

The main finding of this study was that the isolated fixation of the graft in ASCR for RCTs extending beyond the SSP is not able to compensate for the loss of the SC and/or ISP. Our results provide biomechanical evidence to support the suggestion from orthopedic surgeons to not perform ASCR without repairing the SC tendon. Accordingly, the application of concomitant procedures that restore the transverse force couple is of great importance.

## References

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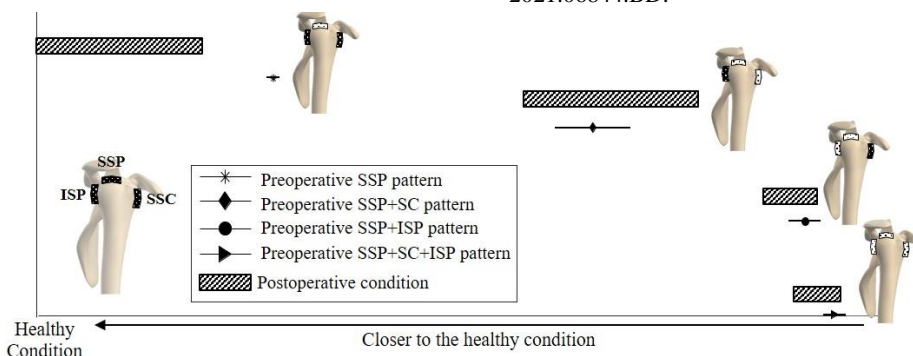


Figure 1: Multiple comparison test of the four RCT patterns simulated: preoperative condition, mean and standard deviation, considering the analysed motion capture data, are shown; and postoperative condition, shoulder stability range, considering all shoulder positions for the fixation of the graft, is shown.

