Early Postoperative MRI Comparison of UTE T2* Values and Muscle Volume following Rotator Cuff Repair with and without Autologous Subacromial Bursal Tissue Augmentation

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INTRODUCTION: Several studies have examined the make-up of subacromial bursa and shown that this bursal tissue is a reliable source of mesenchymal stem cells. In routine arthroscopic rotator cuff repair, this tissue is often debrided and discarded. This poses the question as to whether the subacromial bursal tissue can be used as a biologic augmentation source in rotator cuff repair surgery. MRI is the gold standard imaging modality for rotator cuff disease diagnosis. Quantitative ultrashort echo time-T2* (UTE-T2*) mapping has been advocated for use in in other areas of orthopaedics, including the evaluation of lumbar disc degeneration and for following graft maturation after ACL reconstruction. The purpose of this study is to compare postoperative supraspinatus tendon integrity and muscle belly volume following arthroscopic rotator cuff repair with and without the reimplantation of autologous subacromial bursal tissue. We hypothesize that MRI imaging will show improvements in both tendon tissue quality and muscle volume in patients receiving reimplantation of their own bursal tissue.

METHODS: Patients undergoing primary arthroscopic rotator cuff repair surgery by a single surgeon were randomized into two groups: those who received reimplantation of autologous subacromial bursal tissue and those who did not. The autologous subacromial bursal tissue was harvested using a collection device attached to the suction of an arthroscopic shaver. The minced bursal tissue was then placed in a syringe and injected back into the shoulder where it was placed on top of the rotator cuff tendon at the conclusion of the case. Postoperative MRIs were obtained at 6 and 12 months. A total of 38 MRIs were available for review in 30 patients. Of those 38 MRIs, 31 were performed at the 6-month interval and there were 7 at the 12-month interval available for review at the time of this writing. All 38 MRI's underwent evaluation of rotator cuff volume via sagittal cuts. Volume occupation ratios of muscle to fossa were calculated using the Thomazeau method. Twenty MRIs were available for evaluation using UTE T2* mapping. These MRIs were first evaluated using the sectioning software Mimics. Using the results of this software, analysis produced relaxation coefficients which were used to calculate T2* values.

RESULTS: Eleven males and 6 females were included in the non-bursa group, whereas 13 males and no females were included in the bursa group. Fisher exact tests and Mann Whitney U tests were used accordingly. The average age in the non-bursa group was 64.6 years old (12.5) and the average age in the bursa group was 64 years old (8.3). The average ratios of supraspinatus muscle volume to fossa volume were 0.56 (0.16) in the non-bursa group and 0.63 (0.1) in the bursa group ($p = 0.24$). When assigning the Thomazeau classification in the non-bursa group, ten were stage 1, eight were stage 2, and four were stage 3. In the bursa group, eleven were stage 1, five were stage 2, and there were none in stage 3. The average occupation ratio was 0.56 (0.16) in the non-bursa group and 0.63 (0.1) in the bursa group ($p = 0.18$). Occupation ratios improved from 6 to 12 months by an average of 0.04 in the non-bursa group and 0.06 in the bursa group ($p = 0.63$). Results of T2* mapping showed a long value of 17.8 (7) in the non-bursa group and 15.7 (4.1) in the bursa group ($p = 0.77$). Short values resulted in 4.1 (1.9) for the non-bursa group and 4.3 (1.9) in the bursa group ($p = 0.6$).

DISCUSSION AND CONCLUSION: Our data shows higher supraspinatus muscle volume occupation ratios in the bursa group when in comparison to the non-bursa group. The average ratio in the bursa group was 0.63, placing this group in stage 1: normal/slight atrophy. The non-bursa average ratio of 0.56 places this group in stage 2: moderate atrophy. Furthermore, there were no patients in stage 3: severe atrophy in the bursa group, but 4 patients were in this stage for the non-bursa group. T2* mapping analysis showed lower scores for long measurements in the bursa group than the non-bursa group (15.7 versus 17.8). These results did not reach statistical significance, but suggest potential for improved postoperative supraspinatus muscle volume and tendon tissue quality with the use of autologous bursal tissue. T2* mapping short values were almost identical (4.1 in the non-bursal group vs. 4.3 in the bursal group). This preliminary study shows that the reimplantation of autologous subacromial bursal tissue at the conclusion of arthroscopic rotator cuff repair appears to be a viable method for biological augmentation in the endeavor to improve tissue quality after arthroscopic rotator cuff repair. Continued research is ongoing to include additional assessment at longer postoperative time intervals as well as the inclusion of patient-reported outcomes.