Introduction: New techniques for greater initial strength of a rotator cuff repair have been introduced such as a double-row repair. In addition to improved suturing techniques, augmentation of the repair with a biologic scaffold has been suggested to increase the initial strength of the repair.

An augmentation graft can be sutured to the intact tendon medial to the rotator cuff repair site and the greater tuberosity lateral to the rotator cuff repair site. The muscle force is transferred to the greater tuberosity not only by the repaired tendon, but also by the augmentation graft. The increased load to the repair site from the augmentation graft might help protect the rotator cuff repair site.

The purpose of this study was to evaluate the biomechanical advantage of the augmentation graft technique.

Materials and Methods: Six matched pairs of fresh-frozen human cadaveric shoulders were used. The supraspinatus tendon was dissected from the greater tuberosity, and the distal end at a width of 5 mm was resected. A single-row rotator cuff repair combined with an augmentation graft was performed in one shoulder, and only a single-row repair was performed in the contralateral side as a control. Suture Anchor Repair: Two suture anchors (5.5-mm Corkscrew® FT II with two No. 2 TigerTrail®, Arthrex, Naples, FL) were fixed at 5 mm lateral to the articular cartilage edge. Anchors were placed at a 45° angle relative to the footprint surface. Simple suture configurations were performed to fix the tendon to the bone (Fig. 1). Augmentation Graft: GRAFTJACKET® (Maxforce-extreme, Wright Medical Technology, TN) at the size of 3.5 x 4.0 cm was used as the augmentation graft. The graft was sutured to the supraspinatus tendon at 5 mm medial to the surturers of the rotator cuff repair site with 4 horizontal mattress sutures using No. 2 TigerTrail® sutures. Two 5.5-mm Corkscrew® FT II anchors with two No. 2 TigerTrail® were fixed in the lateral aspect of the humerus, 10 mm distal to the footprint.

The specimen was fixed on a materials testing machine (MTS systems, Minneapolis, MN) in 30° of glenohumeral abduction and neutral rotation. The humerus was fixed with bone cement and the supraspinatus muscle was clamped and frozen, at the muscle-tendon junction. After 10-N preload was applied, the tendon was cyclically loaded to 180 N for 1000 cycles. A 180-N load was reported as two thirds of maximum contraction load of supraspinatus [1, 2]. The gap distance at 180 N was measured for cycles 1-1000 by DVRT. And the tendon elongation at 180 N was measured for cycles 200-1000 by MTS. Prior to 200 cycles the elongation was non-linear. Following cyclic loading, the specimen was loaded to failure at a rate of 1.0 mm/sec and maximum force recorded.

A paired t-test was used to analyze the gap distance and elongation in the cyclic load testing and the maximum failure load. The level of statistical significance was set at p < 0.05.

Results: After 200 cycles of cyclic loading, the cycle-displacement curve was linear in both groups (Fig. 2). The elongation between 200 and 1000 cycles had no difference (Fig. 3). The gap distance measured by the anterior and posterior DVRT was 1.06 ± 0.64 mm and 1.35 ± 0.33 mm in the augmentation graft group, 1.49 ± 0.39 mm and 1.49 ± 0.15 mm in the control group respectively. There was no significant difference in the gap distance between two groups.

In the failure testing, the maximum force in the augmentation graft group (519.8 ± 90.5 N) was significantly higher than that in the control group (331.0 ± 61.3 N) (Fig. 3).

Discussion: The maximum failure load of the augmentation graft group was similar to that of a previously reported double-row technique [3]. The cyclic testing did not show a difference between the two groups in gap distance and elongation, with a 180-N load. The augmentation group had a significantly higher load to failure. The augmentation graft may provide protection to the initial rotator cuff repair during the early post operative period.


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