Bridging Reconstruction Provides Greater Improvements in Strength and Function Compared to Superior Capsular Reconstruction: A Randomized Controlled Trial

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Introduction

Large-to-massive rotator cuff tears (>3cm in size) lead to pain and decreased function for many individuals, requiring surgical intervention. Rotator cuff repair (RCR) has been the gold standard for many years but leads to re-tear rates of up to 90%[1]. The introduction of grafting procedures has since been introduced with the aim of improving clinical and radiographic outcomes. Bridging rotator cuff reconstruction (BRR) and superior capsular reconstruction (SCR) have been described with acellular human dermal allograft to manage large or massive rotator cuff tears and have shown satisfying clinical results[2]. However, limited research directly compares their outcomes. This randomized trial aimed to evaluate the radiographic, functional and self-reported outcomes of patients who received BRR or SCR with human dermal allograft, providing new insights into the relative benefits of these two surgical approaches for managing large-to-massive rotator cuff tears.

Material & Methods

This study was a prospective, single-site, double-blinded (patient & evaluator), randomized controlled trial for patients with large to massive rotator cuff tears. Participants were randomized to BRR or SCR groups (Figure 1) and evaluated pre-operatively and at 6-, 12-, and 24-months post-operatively. The primary outcome was acromiohumeral index (AHI) as determined by x-ray. The secondary outcomes were re-tear rate, Western Ontario Rotator Cuff Index (WORC), Disabilities of the Arm, Shoulder, and Hand (DASH) scores, and shoulder strength and range of motion. Statistical analysis included two-way mixed repeated measures ANOVA (time x group) and post-hoc testing with significance set to alpha=0.05.

Results

There were no demographic differences between the groups ($p>0.05$). The BRR group demonstrated preservation of AHI ($p=0.68$; pre=5.9±2.8mm;15 months=6.1±1.8mm), whereas the SCR group demonstrated non-significant worsening in AHI ($p=0.09$; pre=6.7 ± 2.2mm; 15 months=5.6±2.8mm).There were significant between-group differences in pre-post change in AHI ($p=0.02$). There was no difference between the groups in complete retear rate (BRR: 22%, SCR 23%; $p>0.05$). Both BRR and SCR groups showed significant improvements in WORC and DASH scores from baseline to all post-operative time points ($p<0.001$). Although there was no difference in patient-reported outcomes between the groups, there was a trend towards better WORC scores at 24-months in the BRR group (BRR: 19.65 vs SCR: 32.22, $p=0.13$). Flexion strength significantly improved at 24-months in the BRR group only (5.5lbs, $p<0.001$; Figure 2). Passive flexion (BRR: 24.6°, $p<0.001$; SCR 28.88°, $p<0.001$) and abduction (BRR: 32.18°, $p<0.001$; SCR: 32.47°, $p<0.001$) significantly improved within both groups from pre- to post-operatively, but no significant differences were found between groups.

Discussion

The findings of this prospective randomized controlled trial highlight the effectiveness and superiority of BRR compared to SCR in maintaining AHI and improving forward flexion strength in patients with large-to-massive, irreparable rotator cuff tears at 24-months post-operatively. While both techniques are effective at improving post-operative pain and function, there is a key trend towards superior functional outcomes and healing in the BRR group leading to improved strength and significantly in forward flexion. These findings highlight the superiority of BRR over SCR; however, tailoring the choice of surgical technique to individual patient characteristics and goals may optimize outcomes in this challenging clinical population.

References

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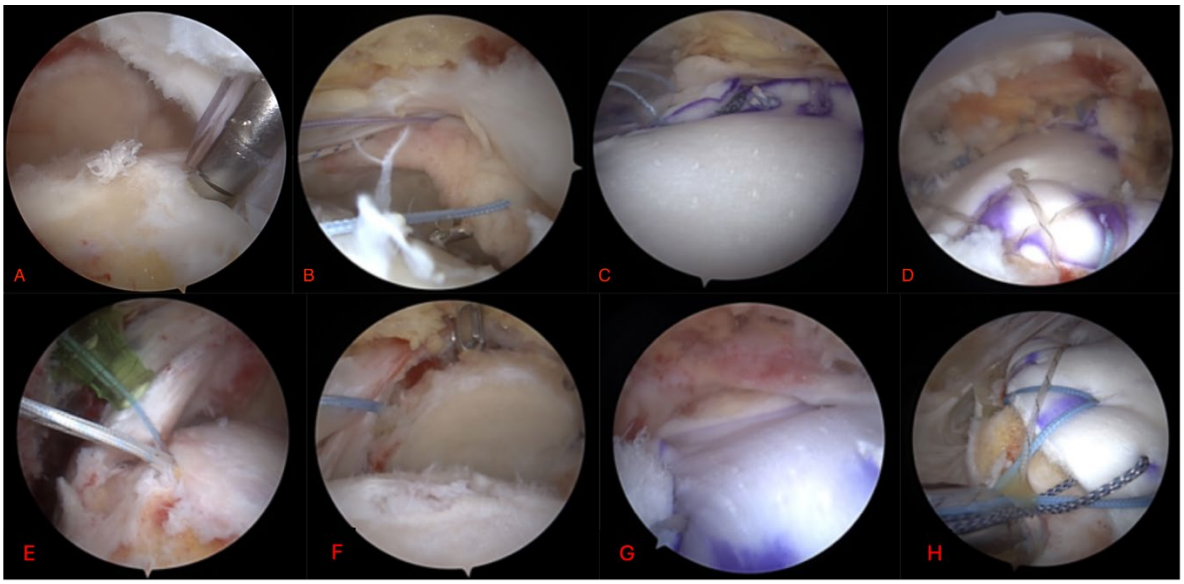

Figure 1. Bridging reconstruction (BRR) demonstration of a left shoulder in lateral decubitus position, viewing from the lateral portal. (a) Partial repair of the remnant anterior and posterior cuff is performed. (b) A spectrum suture passer is used to pass the sutures from the dermal allograft through the remnant medial cuff tissue. (c) The graft is shuttled into the shoulder and securely tied down to the remnant cuff and greater tuberosity anchors. (d) The graft is tensioned to the greater tuberosity using a double-row configuration.
Superior capsular reconstruction (SCR) is demonstrated with intraoperative images of a left shoulder in lateral decubitus position, viewing from the lateral portal. (e) Partial repair of the remnant anterior and posterior cuff is performed. (f) Three suture anchors are inserted into the glenoid neck at the 10, 12 and 2 o'clock position. A 12 o'clock anchor is being placed through an accessory Neviaser portal. (g) The graft is shuttled into the joint and tied down to each suture anchor and the remnant posterior rotator cuff. (h) View from the posterior portal. The graft is tensioned to the greater tuberosity using a double-row configuration.

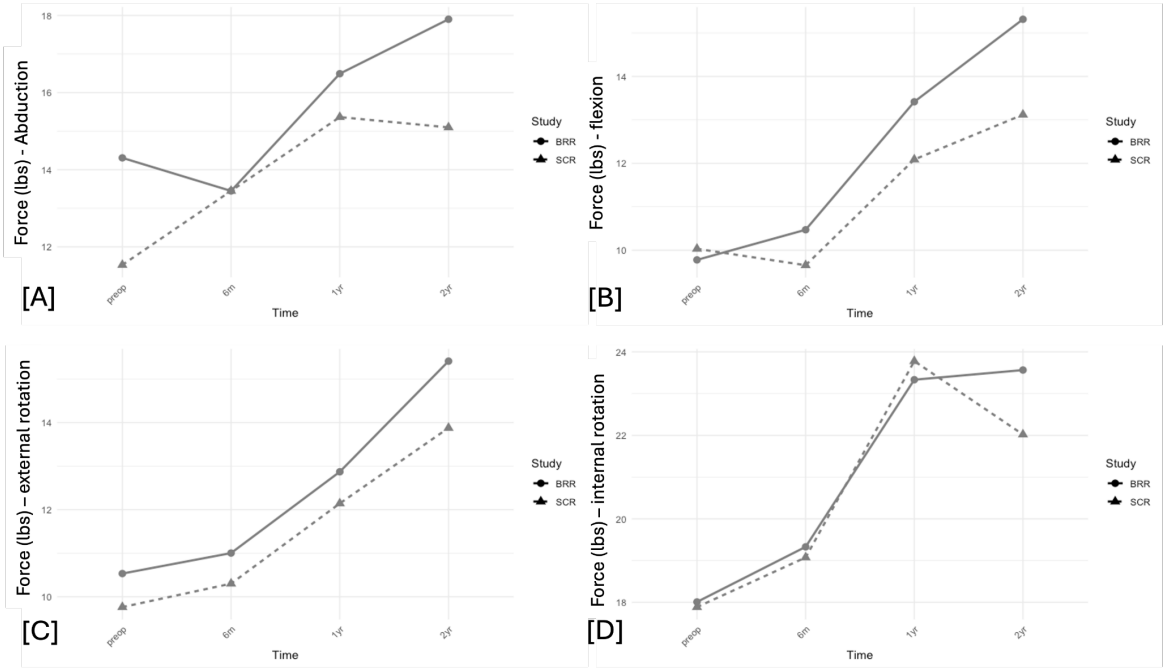

Figure 2. Shoulder strength for [A] abduction; [B] flexion; [C] external rotation; [D] internal rotation from baseline (pre-op) to 24-months post-operation measured in pounds (lbs) using a handheld dynamometer.