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The high failure rate of biologic resurfacing of the glenoid in young patients with glenohumeral arthritis

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Background: The current study evaluated the outcomes of biologic resurfacing of the glenoid using a lateral meniscus allograft or human acellular dermal tissue matrix at intermediate-term follow-up.

Methods: Forty-five patients (mean age, 42.2 years) underwent biologic resurfacing of the glenoid, and 41 were available for follow-up at a mean of 2.8 years. Lateral meniscal allograft resurfacing was used in 31 patients and human acellular dermal tissue matrix interposition in 10.

Postoperative range of motion and clinical outcomes were assessed at the final follow-up.

Results: The overall clinical failure rate was 51.2%. The lateral meniscal allograft cohort had a failure rate of 45.2%, with a mean time to failure of 3.4 years. Human acellular dermal tissue matrix interposition had a failure rate of 70.0%, with a mean time to failure of 2.2 years.

Overall, significant improvements were seen compared with baseline with respect to the visual analog pain score (3.0 vs 6.3), American Shoulder and Elbow Surgeons score (62.0 vs 36.8), and Simple Shoulder Test score (7.0 vs 4.0). Significant improvements were seen for forward elevation (106° to 138°) and external rotation (31° to 51°).

Conclusion: Despite significant improvements compared with baseline values, biologic resurfacing of the glenoid resulted in a high rate of clinical failure at intermediate follow-up. Our results suggest that biologic resurfacing of the glenoid may have a minimal and as yet undefined role in the management of glenohumeral arthritis in the young active patient over more traditional methods of hemiarthroplasty or total shoulder arthroplasty.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Glenohumeral arthritis; biologic resurfacing; lateral meniscal allograft; Graftjacket

Although total shoulder arthroplasty is becoming more common and has been reported as a reliable treatment for pain secondary to glenohumeral degenerative disease, results in younger patients have not been as favorable and concerns remain regarding early failure of the glenoid component.[21] Humeral head replacement alone has been reported to

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provide short-term pain relief and improved function, but studies with longer follow-up have demonstrated progressive joint space narrowing, glenoid erosion, and diminishing outcomes over time.[12,15,17,19] For these reasons, alternative treatment methods have been investigated for young patients with symptomatic glenohumeral arthritis.

First proposed by Burkhead and Hutton in 1988,[4] biologic resurfacing of the glenoid, combined with hemiarthroplasty, has been used in the treatment of glenohumeral arthritis in young patients, with variable results. In their initial series, interposition of soft tissue between the humeral head implant and the native glenoid provided pain relief and improvement in shoulder range of motion at 2 years of follow-up.

As experience with biologic glenoid resurfacing has increased, other interposition options have been used, including Achilles tendon allografts and, more recently, lateral meniscal allografts and processed tissue grafts such as human acellular dermal tissue matrix (Graftjacket regenerative tissue matrix; Wright Medical Technology, Arlington, TN, USA).[1-6,13,16] Durability of biologic glenoid resurfacing was reported by Krishnan et al[9] in their 2- to 15-year follow-up of 36 patients. Other studies, however, have reported contrasting results, with a rapid deterioration in postoperative functional outcome, return of pain, and a high rate of conversion to total shoulder arthroplasty.[6]

A short-term follow-up evaluation of 30 patients treated with lateral meniscal allograft resurfacing of the glenoid combined with hemiarthroplasty was published in 2007 from our institution.[13] At a mean follow-up of 18 months, significant improvements were noted in American Shoulder and Elbow Surgeons (ASES) scores, Simple Shoulder Test (SST) scores, visual analog scale (VAS) pain scores, and shoulder range of motion parameters. Complications requiring revision surgery occurred in 5 patients (17%) within the first postoperative year; however, despite this incidence, 94% of study patients reported satisfaction with their clinical outcome and would have the procedure again if necessary. The current investigation re-evaluated these patients at intermediate-term follow-up, reporting their current clinical status and the incidence of failure of biologic resurfacing. The analysis also included a group of patients treated with human acellular dermal tissue matrix as their soft tissue interposition with a similar duration of follow-up. We hypothesized that the clinical outcomes seen in our short-term evaluation would diminish with longer-term follow-up, highlighted by a high incidence of revision surgery in patients treated with lateral meniscal allograft as well as those treated with human acellular dermal tissue matrix resurfacing of the glenoid.

Materials and methods

Between November 2001 and December 2008, 45 patients undergoing humeral head hemiarthroplasty or humeral head resurfacing (HemiCAP; Arthrosurface, Franklin, MA, USA) combined with biologic resurfacing of the glenoid for treatment of symptomatic degenerative joint disease of the glenohumeral joint were identified from our institutional database. All patients underwent the informed consent process. Four fellowship-trained orthopedic surgeons (B.C., G.N., A.R., N.V.) in shoulder surgery or sports medicine performed all surgical procedures.

Table I Preoperative etiologies

Diagnoses	Patients (No.)
Primary glenohumeral osteoarthritis	29
Post-traumatic arthrosis	7
Capsulorrhaphy arthropathy	7
Chondrolysis	1
Avascular necrosis of the humeral head	1

Biologic resurfacing of the glenoid, combined with hemiarthroplasty or humeral head resurfacing, was indicated in these patients secondary to their relatively young age, symptomatic bipolar disease, and anticipation of return to overhead activities. The most common etiology treated was primary glenohumeral osteoarthritis in 29 patients (Table I). Patients in this cohort had failed nonoperative management before consideration for operative intervention. Of the 45 patients identified, 32 (71.1%) had undergone previous operative procedures on the affected shoulder, with a mean of 1.7 prior procedures performed per patient.

All study patients completed a preoperative assessment that included demographic and social history, detailed medical and surgical history, an ASES score, SST score, VAS pain score, and an evaluation of shoulder range of motion. For the VAS pain score, clearly defined anchors for the scale were used, including ''no shoulder pain or discomfort with any and all activity'' on one end and ''constant, disabling pain'' at the other end.

Operative technique: lateral meniscal allograft or human acellular dermal tissue matrix resurfacing

With the patient in the beach-chair position under a combination of regional interscalene anesthesia and general anesthesia, a deltopectoral approach was used. Biceps tenodesis was performed in all patients. Preparation of the humeral head was routinely performed first, providing adequate access to the glenoid. The glenoid labrum was left in situ to serve as an anchor for fixation of the lateral meniscal allograft or the human acellular dermal tissue matrix. Any remaining articular cartilage on the glenoid surface was removed with a curette. Concentric reaming was performed to create a concentric surface with punctate bleeding to allow for adhesion and healing of the interposed tissue to the native glenoid. Once reaming was complete, nonabsorbable sutures were placed through the labrum, allowing for 6 to 8 points of circumferential fixation to the glenoid. When necessary for supplemental graft fixation, suture anchors or transosseous sutures, or both, were inserted into the glenoid rim.

For lateral meniscal allograft resurfacing, a male lateral meniscus from a donor younger than 30 years was used to maximize glenoid surface coverage. The sutures from the labrum were then passed through the lateral meniscal allograft, orienting the graft so that the anterior and posterior horns faced anteriorly and the thickest portion of the graft covered the posterior portion of the glenoid. The horns were sutured together to provide stability during peripheral fixation. Each circumferential suture