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Biologic resurfacing of the glenoid with humeral head resurfacing for glenohumeral arthritis in the young patient

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Background: Resurfacing of the glenoid with an interposition soft tissue graft in conjunction with humeral head arthroplasty has been proposed as an option to improve glenohumeral arthritis in young patients while avoiding the potential complications associated with total shoulder arthroplasty. There currently exist minimal outcomes data for this procedure, and the results have not been consistent. The purpose of this study was to report on the outcomes in our cohort of patients aged younger than 55 years.
Methods: A multicenter review of 16 patients who had undergone humeral head arthroplasty with soft tissue interposition grafting of the glenoid was performed. All patients had a minimum follow-up time of 24 months, unless revision surgery was required because of failure of the procedure.
Results: At a mean follow-up of 60 months, the patients showed improvement in the visual analog scale score for pain from 8.1 to 5.8 ($P < .05$), and the American Shoulder and Elbow Surgeons score improved from 23.2 to 57.7 ($P < .05$). Forward elevation improved from 128° to 134° ($P = .33$), and external rotation improved from 28° to 32° ($P = .5$). Internal rotation showed no improvement. Conversion to a total shoulder arthroplasty was performed in 7 patients (44%) at a mean of 36 months.
Conclusions: The optimal management for the young patient with arthritis has not yet been established. Because of the limited improvement in patient outcomes and the relatively high revision rate, biologic resurfacing of the glenoid with humeral head resurfacing is no longer our primary treatment option for young patients and should be used with caution.
Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Arthritis; biologic resurfacing; shoulder arthroplasty; young adult

Total shoulder arthroplasty (TSA) is an effective treatment for end-stage glenohumeral arthritis and has been shown to reliably provide pain relief and improve motion in properly selected patients.[2,8,16,17] However, the management of glenohumeral arthritis in the young patient

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is challenging because of the expected need for a revision of the TSA during his or her lifetime.[5,7,14,19,20] Resurfacing of the glenoid with an interposition soft tissue graft in conjunction with humeral head arthroplasty has been proposed as an option to improve outcomes and avoid the potential complications associated with TSA, such as component loosening and polyethylene wear.[5,17] Unfortunately, there currently exists minimal outcomes data for this procedure, and the results have not been consistent, with Burkhead and colleagues[5,11] reporting excellent outcomes in most patients and Elhassan et al[9] reporting a large number of patients with persistent pain.

The purpose of this study was to investigate the short-term to midterm outcomes of humeral head arthroplasty combined with glenoid resurfacing using soft tissue interposition allograft in a cohort of patients aged younger than 55 years. We hypothesized that our patients would show lasting improvement in pain and function after the procedure. In this report, we describe our preferred technique and experience with the procedure after a minimum of 2 years of clinical follow-up.

Materials and methods

We performed a retrospective review of 16 patients from 2 centers who had undergone humeral head arthroplasty with soft tissue interposition grafting of the glenoid between 2003 and 2008. We included all patients aged younger than 55 years who underwent the procedure for end-stage osteoarthritis. Patients needed to have shown severe limitation of their activities of daily living and failure of conservative management including anti-inflammatory medication, activity modification, and physical therapy for a minimum of 6 months before undergoing surgery. The procedure was not offered to patients with major glenoid osseous deficiency, advanced rheumatoid arthritis, prior shoulder arthroplasty, or chronic infection.

Surgical technique

All surgeries were performed with the patient in the beach-chair position by a standard deltopectoral approach. A subscapularis peel was performed to enter the joint. A complete capsular release outside of the labrum was performed, and any excess labrum and biceps were debrided. At surgery, all patients showed severe degeneration of the articular cartilage, glenoid wear and erosion, and flattening of the osseous surfaces. The humeral head was replaced with a standard hemiarthroplasty prosthesis (Tornier, Saint-Ismier, France) or humeral head resurfacing implant (Arthrosurface, Franklin, MA, USA). Seven glenoids were resurfaced by 1 surgeon(R.G.) using a commercially available, acellular, allograft human dermal matrix–based scaffold (GraftJacket; Wright Medical Technology, Arlington, TN, USA). An Achilles tendon allograft was used in 9 patients treated by a second surgeon(R.J.N.).

Glenoid resurfacing with acellular, allograft human dermal matrix scaffold

The glenoid was first prepared with a burr to decorticate the articular surface down to bleeding bone. The thawed graft with a 3-mm thickness was sized to the patient's native glenoid anatomy. A series of single-loaded suture anchors (Bio-SutureTak; Arthrex, Naples, FL, USA) were placed circumferentially around the glenoid at the 12-, 2-, 5-, 7-, and 10-o'clock positions. The sutures were then passed circumferentially in a mattress configuration through the graft material. A parachute technique was used to reduce the graft material onto the articular surface of the glenoid, and the sutures were secured with the aid of an arthroscopic knot pusher.

Glenoid resurfacing with Achilles tendon allograft

The glenoid was prepared with a burr to decorticate the articular surface to bleeding bone. The graft was thawed, and the osseous calcaneal attachment was excised. The tendon was folded over and contoured to create a shape of appropriate diameter with regard to the native glenoid. A running everted mattress suture was placed circumferentially around the periphery of the graft. Four single-loaded suture anchors were placed circumferentially around the glenoid at the 12-, 3-, 6-, and 9-o'clock positions. The sutures were then passed through the graft circumferentially in a horizontal mattress fashion. A parachute technique was used to reduce the graft material onto the articular surface of the glenoid and tied into place.

Patients followed a postoperative rehabilitation protocol according to the surgeon's preference. Surgeon 1(R.G.) kept patients in a sling for the first 2 weeks, with passive range of motion for the first 4 weeks; active range of motion started after 4 weeks. Surgeon 2(R.J.N.) immobilized patients for 6 weeks with passive range of motion. Active-assisted range of motion was initiated after 6 weeks and gradually progressed to active range of motion.

Outcomes analysis

Preoperative and postoperative outcome measures included active forward elevation, active external rotation, active internal rotation, the American Shoulder and Elbow Surgeons score, and a visual analog scale (VAS) pain score.[22] All patients had a minimum follow-up time of 24 months unless revision surgery was required because of failure of the procedure. A paired Student *t* test was performed to assess the degree of improvement in clinical parameters at the time of latest follow-up, and significance was set at $P < .05$.

Results

Our cohort consisted of 12 male and 4 female patients who underwent surgery at a mean age of 36.1 years (range, 14-45 years) and were evaluated at a mean follow-up of 60 months (range, 24-96 months). Preoperative indications for surgery (Table I) included glenohumeral arthritis (n = 11), glenohumeral chondrolysis after a prior arthroscopic stabilization procedure for persistent instability (n = 2), idiopathic glenohumeral chondrolysis (n = 1), instability arthropathy (n = 1), and capsulorrhaphy arthropathy after a Bristow procedure (n = 1). The 3 patients who had undergone prior shoulder surgery had each undergone a single procedure.

The patients showed significant improvement in the mean VAS pain score (±standard deviation) from 8.1 (±1.5) to 5.8 (±2.9) ($P < .05$), and the mean American Shoulder and