J Shoulder Elbow Surg (2016) 25, 1681–1689

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Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Total shoulder arthroplasty for glenohumeral arthritis associated with posterior glenoid bone loss: results of an all-polyethylene, posteriorly augmented glenoid component

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Background: Posterior glenoid bone loss is commonly encountered in total shoulder arthroplasty (TSA). The purpose of our study is to report the clinical and radiographic findings of patients with a minimum of 2 years' follow-up treated with an all-polyethylene, augmented glenoid component.
Methods: Twenty-two shoulders with posterior glenoid bone loss were treated by a single surgeon. All underwent primary TSA using a posteriorly augmented, all-polyethylene, stepped glenoid component. Outcome data included visual analog scale, Western Ontario Osteoarthritis of the Shoulder index, and Short Form 36 scores. Radiographic analysis was performed to evaluate bone-cement interface lucency, implant seating, and osseous integration of the central peg.
Results: The mean follow-up period was 36 months. Average preoperative retroversion measured with computed tomography scan was 23.5°. In addition to statistically significant increases in forward flexion and external rotation, the visual analog scale score, Western Ontario Osteoarthritis of the Shoulder score, and Short Form 36 physical component summary score all improved significantly ($P < .001$). Twelve shoulders had osseous integration between the central-peg flanges, 6 had bone adjacent to the central-peg flanges but without identifiable osseous integration, and 1 showed osteolysis. The mean Lazarus score was 0.5. All glenoids had perfect seating scores. Two patients sustained a total of 3 episodes of prosthetic instability.
Conclusions: Early results of a posteriorly augmented, all-polyethylene, stepped prosthetic glenoid component to address posterior glenoid loss in TSA are encouraging. Continued evaluation will determine prosthetic longevity and maintained clinical improvement.
Level of evidence: Level IV; Case Series; Treatment Study
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Keywords: Augmented glenoid component; glenoid bone loss; shoulder arthroplasty; survival

Total shoulder arthroplasty (TSA) is an effective and reliable treatment for glenohumeral arthritis.[3,7] Both component positioning and prosthetic stability are important factors in component longevity and favorable patient outcomes. Failure

Institutional review board approval was obtained from The Jewish Hospital of Cincinnati (Study JH No. 12-36).

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1058-2746/$ - see front matter © 2016 Journal of Shoulder and Elbow Surgery Board of Trustees. All rights reserved.
http://dx.doi.org/10.1016/j.jse.2016.02.020

of TSA is multifactorial, but glenoid component failure remains the single most common reason.[2,24,32,37] Survivorship for TSA in the absence of significant posterior glenoid bone loss is estimated to be greater than 85% at a 15-year minimum follow-up.[5]

Posterior glenoid bone loss is a common finding in advanced glenohumeral arthritis.[33,34] Walch et al[33] classified glenoid wear patterns, and in their series, 24% had erosive changes (types B2 and C) posteriorly. Friedman et al[9] identified a significant difference in the amount of glenoid retroversion between a control group and a severely arthritic group. The optimal management for bone loss is unclear, but failure to address bone loss during TSA will likely lead to suboptimal results.[8,14,35] Farron et al[8] performed a finite element analysis of glenoid components placed in various degrees of retroversion. Increased retroversion resulted in significant increases in stress within the cement mantle and cement-bone interface. They suggested that retroversion greater than 10° should be corrected or if not possible, glenoid implantation should not be performed. Ho et al[14] reviewed 66 TSAs with an all-polyethylene glenoid component. They identified glenoid component osteolysis with component retroversion of 15° or greater. Walch et al[35] reviewed the results of TSA in biconcave glenoids. At a mean of 6 years' follow-up, glenoid loosening occurred in 20.6% and revisions occurred in 16.3% of 92 patients. Glenoid bone loss and increased retroversion were significantly associated with glenoid component loosening.

Re-establishing ideal glenoid version during TSA is particularly challenging in the presence of significant posterior glenoid wear. Restoring anatomic glenoid version improves prosthetic glenoid wear characteristics and reduces failure rates according to biomechanical and finite element studies.[8,26,30] Asymmetrical glenoid reaming is an accepted treatment, but more significant retroversion may not be correctable without excessive medialization and loss of glenoid bone stock resulting in peg perforation or obligate component downsizing.[6,25] Glenoid bone grafting is another purported treatment option but is technically challenging and has been associated with a 10-fold higher rate of prosthetic glenoid failure.[13] Nonunion, subsidence, and graft resorption are common causes of failure,[13,28,31,35] with unsatisfactory outcomes in 8% to 47% of patients.[13,18,23,31] Sabesan et al[28] reviewed 12 patients with severe glenoid bone loss with an average retroversion of 44° and reported more favorable outcomes. Ten of the 12 shoulders had graft incorporation without any resorption and 2 had minor bone resorption at an average of 53 months.

Augmented glenoid components offer a theoretical solution to a difficult problem. In recent biomechanical studies, an all-polyethylene, augmented glenoid component with a posterior step performed favorably.[15,17,29] Presently, there are 3 augmented components that are Food and Drug Administration approved and available for use in the United States, with only 1 study in the peer-reviewed literature reporting short-term outcomes.[38] The purpose of our study is to report the clinical and radiologic findings of patients with at least 2 years' follow-up after TSA with a posteriorly augmented, all-polyethylene, stepped glenoid component. We hypothesized that patients would improve clinically and would have radiographic component survival consistent with previously reported outcomes for non-augmented glenoid components in TSA.

Materials and methods

This is a retrospective review of a prospectively collected series of consecutive patients with glenohumeral arthritis and posterior glenoid bone loss with retroversion measuring 15° or greater who underwent TSA with an augmented glenoid component. Informed consent was obtained from all patients before participation in the study.

Patient population

Between May 2011 and January 2013, 22 shoulders in 19 patients (15 men and 4 women) underwent primary TSA by a single surgeon. In all cases, an all-polyethylene, posteriorly augmented, stepped glenoid component (Global StepTech Anchor Peg Glenoid; DePuy Synthes, Warsaw, IN, USA) was implanted (Fig. 1). One patient was lost to follow-up. One patient was unable to undergo follow-up imaging because of a stem cell procedure for a pulmonary disease. Therefore, 20 shoulders in 17 patients had both clinical and radiographic data available for follow-up. The mean follow-up period was 36 months (range, 26-46 months). The mean patient age at the time of surgery was 62 years (range, 44-77 years). All patients were routinely followed up postoperatively at 2 weeks, 6 weeks, 3 months, 6 months, 1 year, and then annually. The same postoperative rehabilitation protocol was prescribed for all patients except for 1 patient who underwent a rotator cuff repair. All patients had a preoperative diagnosis of osteoarthritis except for 1 patient who was diagnosed with rheumatoid arthritis (Table I).

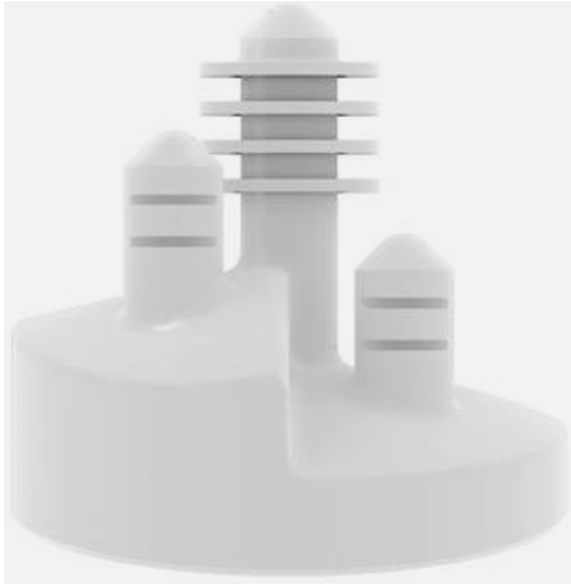

Figure 1 StepTech Anchor Peg Glenoid augmented glenoid component (GLOBAL® STEPTECH® Anchor Peg Glenoid courtesy of DePuy Synthes Joint Reconstruction).

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