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ORIGINAL ARTICLE

Radiographic changes differ between two different short press-fit humeral stem designs in total shoulder arthroplasty

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Background: The purpose of this study was to compare the radiographic changes of the humerus in the short term after total shoulder arthroplasty with two different short-stem humeral components. The hypothesis was that there would be no difference in radiographic changes or functional outcome based on component type.

Methods: A retrospective review was conducted of primary total shoulder arthroplasties performed with a short press-fit humeral component. Group A included a collarless humeral stem with an oval geometry and curved stem (Ascend or Ascend Flex; Wright Medical, Memphis, TN, USA). Group B included a humeral stem with a metaphyseal collar, rectangular geometry, and straight stem (Apex; Arthrex, Inc., Naples, FL, USA). Radiographic changes and functional outcome were evaluated at a minimum of 2 years postoperatively.

Results: There were 42 patients in group A and 35 patients in group B available for analysis. There was no difference in functional outcome between the groups. In group A, the mean total radiographic change score of the humerus was 3.9, with changes classified as low in 38% and high in 62%. In group B, the mean total radiographic change score of the humerus was 2.5, with changes classified as low in 77% and high in 23% ($P < .001$). Medial calcar osteolysis was present in 71% of group A compared with 28.5% of group B ($P < .001$).

Conclusion: At short-term follow-up, there is no difference in functional outcome or revision between 2 different humeral stem designs. However, bone adaptive changes and the rate of medial calcar osteolysis are significantly different.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

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Keywords: Total shoulder arthroplasty; short stem; humeral loosening; stress shielding; press fit; bone adaptations; metaphyseal fixation

Southern Oregon Institutional Review Board approved this study.

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Anatomic total shoulder arthroplasty (TSA) has proved to be a viable treatment for glenohumeral arthritis and leads to improvement in function and relief of pain in the majority of cases. However, revision is necessary in approximately 10%

of cases within 10 years and 20%-30% of cases within 20 years after the index procedure.^{4,8} The potential need for revision as well as the complication rate after revision (ie, greater tuberosity fracture from removal of a finned stemmed component) has led to development of shorter humeral stems that are potentially bone preserving and more easily revised in the event of the need for revision.

Recent studies have reported on the clinical results and radiographic findings after TSA with a short-stem component. In 2 of these reports, the rate of radiographic changes was very high with a collarless stem with a curved shape.^{1,7} However, a variety of stem designs exist with variation in features, such as the presence of a metaphyseal collar or stem shape (curved circular vs. straight rectangular). To date, no studies have compared the radiographic findings with different types of short-stem components.

The purpose of this study was to compare the radiographic changes of the humerus in the short term after placement of 2 different short-stem humeral components. The hypothesis was that there would be no difference in radiographic changes of the humerus based on component type.

Methods

A retrospective review of prospectively collected data was conducted of anatomic TSAs performed at 2 institutions between July 2012 and June 2014. Inclusion criteria included a primary TSA with a short humeral stem placed with a press-fit technique and a minimum follow-up of 2 years. Exclusion criteria included revision arthroplasty and concomitant glenoid bone grafting.

Surgical technique

TSAs were performed by 2 different surgeons using a consistent technique with the type of humeral stem as the only intrasurgeon variation during the study period. A deltopectoral approach was used to gain access to the glenohumeral joint. A freehand anatomic cut of the humeral head (respecting native inclination and retroversion) was performed after removal of osteophytes. The humeral canal was broached to accept a press-fit humeral component using a compaction technique to minimize bone removal. A cemented all-polyethylene glenoid was used in all cases, and attention was turned to placement of the final humeral component.

Group A was composed of a collarless stem with a circular geometry and curved shape (Ascend or Ascend Flex; Wright Medical, Memphis, TN, USA). This stem design was the short stem of choice for the surgeons in the first 18 months of the study period. The stem ranges in length from 66 to 98 mm and is available in 3 different humeral inclinations (127.5°, 132.5°, and 137.5°) (Fig. 1, A).

Group B was another press-fit short humeral stem (Apex; Arthrex, Inc., Naples, FL, USA) that was the primary stem of choice for all TSAs performed by the surgeons during the last 6 months of the study period. This stem ranges in length from 60 to 65 mm based on the appropriate size. This stem has a metaphyseal collar, rectangular geometry, and adaptability in humeral inclination between 125° and 140° (Fig. 1, B).

Clinical evaluation

Function and range of motion were assessed preoperatively and postoperatively at the final follow-up. Function was determined with the Simple Shoulder Test, Single Assessment Numeric Evaluation score,

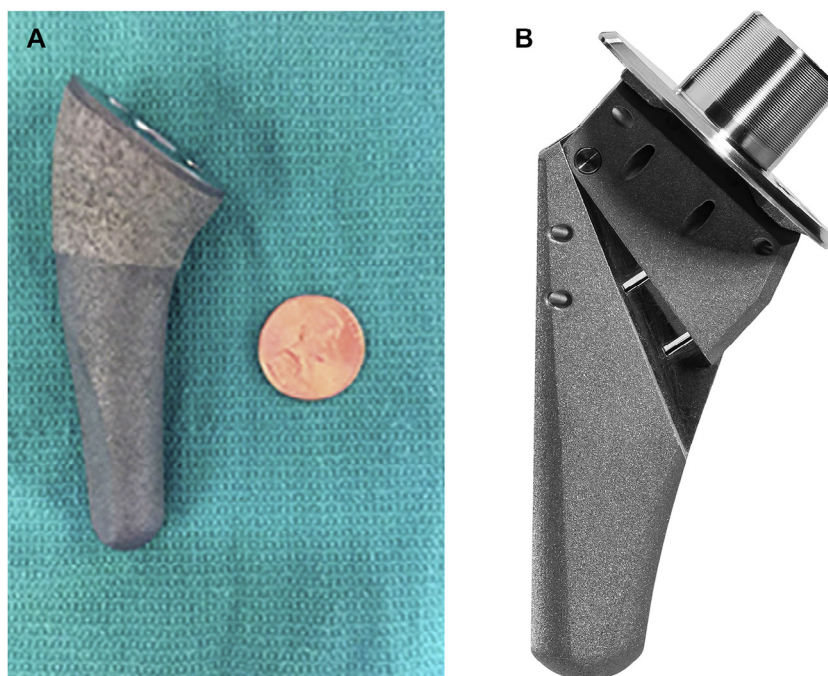


Figure 1 (A) Photograph of Ascend Flex stem (Wright Medical). (B) Photograph of Apex stem (Arthrex, Inc.). (A modified with permission from Morwood MP, Johnston PS, Garrigues GE. Proximal ingrowth coating decreases risk of loosening following uncemented shoulder arthroplasty using mini-stem humeral components and lesser tuberosity osteotomy. *J Shoulder Elbow Surg* 2017;26:1246-52.)

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