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Survival and radiographic analysis of a glenoid component with a cementless fluted central peg

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Background: Aseptic loosening of glenoid components is a common problem associated with total shoulder arthroplasty and one cause for failure. A new cementless fluted glenoid component was developed and has shown excellent bony ingrowth in a canine model.
Hypothesis: Clinical utilization of this cementless fluted pegged glenoid component in total shoulder arthroplasty would lower rates of radiolucent lines and aseptic loosening.
Materials and methods: Between January 2005 and December 2007, 83 primary shoulder arthroplasties with a minimum of 2 years' follow-up were performed with the uncemented fluted pegged glenoid component. Radiographs and records were reviewed to determine stability and survival of the glenoid component.
Results: All cementless fluted pegged glenoid components had survived at the most recent clinical follow-up. Radiographs showed no evidence of component loosening or radiolucent lines. Evidence of fingerlike projections of bone between the flanges of the implant was found in 24 cases (29%).
Conclusions: A cementless fluted pegged glenoid component showed excellent initial clinical survival and integration. Further studies regarding continued durability of this component appear warranted.
Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Shoulder arthroplasty; glenoid component; cementless fluted pegged glenoid component; radiolucency; survival

Total shoulder arthroplasty has been reported to deliver good to excellent function in over 90% of patients at initial evaluation.[1-4] However, glenoid component loosening is one of the primary causes of failure.[10-12,16,20] Radiolucent lines at the bone-cement interface of the glenoid component are noted in 30% to 96% of cases.[1,2,4,6-8] The appearance and progression of these radiolucencies appear to correlate with symptomatic component loosening.[18]

These worrisome findings have spurred development of new glenoid component designs. Wirth and Rockwood[21] reported their results using a new cementless fluted pegged glenoid component in a canine model. The fluted glenoid component showed excellent biomechanical stability and bony ingrowth around the peg flanges.

The favorable canine data resulted in the development of a commercial clinical product (Anchor Peg Glenoid; DePuy, Warsaw, IN). The purpose of this study was to perform a retrospective review of the clinical results of this cementless fluted pegged glenoid component.

Materials and methods

Mission Health institutional review board approval (150581-1) was obtained for a review of the radiographs and records.

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Figure 1 Photograph of cementless fluted pegged glenoid (Anchor Peg Glenoid; DePuy).

Between January 2005 and December 2007, I performed 92 primary shoulder arthroplasties, of which 83 had radiographic and clinical data available for a minimum of 2 years' follow-up. No other exclusion or inclusion criteria were used.

There were 45 men and 35 women included in the study. Three patients in the study had undergone bilateral shoulder arthroplasty. The mean age at the time of arthroplasty was 67 years (range, 51-87 years). The mean length of follow-up was 34 months (range, 24-47 months). Indications for arthroplasty were osteoarthritis in 76 shoulders, post-traumatic arthritis in 4, avascular necrosis in 2, and postarthroscopic glenohumeral chondrolysis in 1. Glenoid morphology was classified as type A1 in 49 shoulders, A2 in 7, B1 in 19, and B2 in 8.[19]

Surgical technique

All surgical procedures were performed with the Anchor Peg Glenoid component (DePuy) (Figure 1) and the Global AP humeral component (DePuy). A standard deltopectoral approach was used for exposure. Components were implanted following the manufacturer's guidelines, which included the following steps regarding glenoid insertion.

The glenoid was prepared by removing any remaining labrum tissue for exposure. The center of the glenoid was chosen and prepared by creating a centering hole with an initial drill. The glenoid reamer was then used to remove any remaining articular cartilage and provide a congruent surface for the final prosthesis. Eccentric anterior reaming of up to 5 mm was used in patients with posterior glenoid wear and subluxation. No posterior glenoid bone grafts were used in this series.

The drill for the central fluted pegs was then inserted into the central hole over a guide. The peripheral drill guide was then inserted and the peripheral drill used to generate the 3 peripheral peg holes. All holes were irrigated and then packed with Surgicel (Ethicon, Somerville, NJ) before implantation of the final component.

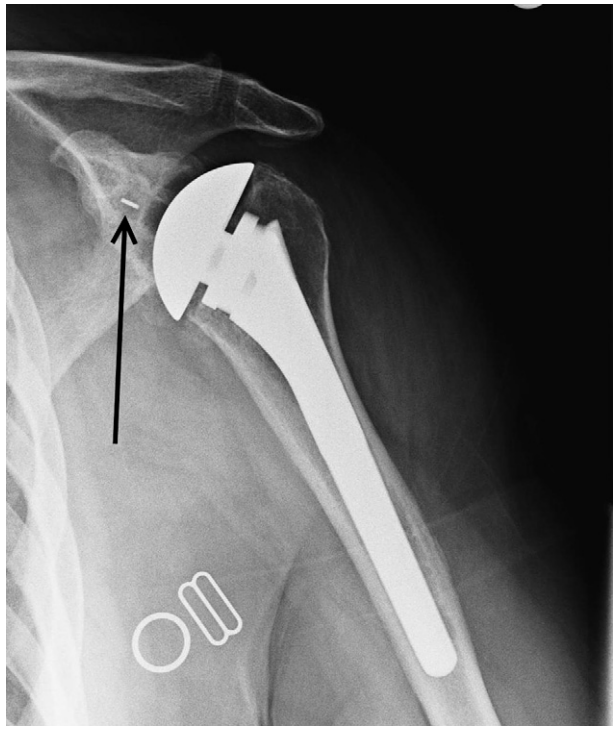

Figure 2 True anteroposterior radiograph of shoulder arthroplasty showing interdigitating radiodensity around fluted central peg (*arrow*) of glenoid component.

Bone cement without antibiotics was mixed and applied with a syringe to the 3 peripheral peg holes after removal of the Surgicel. Bone graft from the drill holes was applied to the flutes of the central peg. The final prosthesis was then inserted and a glenoid impactor used to ensure seating of the prosthesis. No rotator cuff repairs were performed in this series. The standard 6 mm of diametral mismatch was utilized in all arthroplasties.

Radiographic assessment

I graded radiographic lucency according to modification of Lazarus et al.[14] True anteroposterior and axillary lateral radiographs were reviewed from the last clinical visit. Radiographs were inspected for evidence of radiodensity interdigitating around the fins of the central peg. Radiographs were further assessed for any radiolucency. The radiographs were graded from 0 to 5.

Results

A total of 83 patients in this study were available for a minimum 2-year evaluation of the survival and radiographic analysis of a cementless fluted pegged glenoid component. No patients in the study group underwent revision during the evaluation. All glenoid components were assessed as having grade 0 radiolucency at the latest evaluation. Of the shoulders, 24 (29%) showed evidence of fingerlike projections of radiodensity around the fluted central peg (Figure 2).

Discussion

The initial description of a cemented polyethylene keeled component by Neer[15] opened a new chapter in the treatment of shoulder arthritis. The design remained the dominant component of arthroplasty, although notes of radiolucent lines around the components were frequent.[1-4] This incidence of radiolucency spurred the development of multiple variations of glenoid design, because reviews have correlated the incidence of radiolucent lines and component loosening.[18]

Pegged glenoid components with fixation by cement appear to have reduced radiolucencies compared with keeled designs.[13,14] In an effort to provide cementless fixation of an all-polyethylene pegged component, Wirth and Rockwood[21] reported the addition of flutes to a central peg in a canine model. This study details the first clinical report of the efficacy of this design.

The study correlates with the canine findings. All components at most recent follow-up were in place without signs of loosening. I did observe fingerlike radiodensities interdigitating around the fins of the central peg in 24 cases (28%). These findings correlate with the bony ingrowth around the central fluted peg observed in all canine specimens.[21]

Although Wirth and Rockwood[21] commented that increased bone density in the subchondral portion of the implant was observed in all cases, it is unclear how many specimens showed interdigitation on radiographs. In this study, there was no observed difference in survival or loosening noted between implants showing these radiodensities and those without increased radiodensities around the central flutes.

No radiolucencies were identified at the bone-cement interface in this study. The component design appears important. I agrees with Barwood et al[5] that pegged designs allow a precise fit between pegs and bone holes, allowing more effective pressurization of cement and limiting thermal necrosis. The specific glenoid component type used in this study further limited the amount of bone cement used. It has been calculated that the total amount of cement required to fix the 3 peripheral pegs in this design is 0.9 cm^3 (personal communication, DePuy, 2009). The small amount of cement used may make radiographic detection of bone cement lucency difficult.

Although the low incidence of radiolucency in this study is remarkable, it is far from unique. The incidence of radiolucency around pegged glenoid components has seen a continual decline. Lazarus et al[14] reported a multicenter study of pegged components in 2002 to have an initial rate of radiolucency of 37%. Barwood et al[5] reported improved results with utilization of cement pressurization lowering the rate of radiolucent lines to 10% in 69 shoulders studied. Gartsman et al[10] reported a single-institution rate of postoperative radiolucency of only 5% in a prospective randomized study.

Although this study represents the work of a single surgeon, there are obvious limitations. Although the sample size is robust, the length of follow-up is limited. The survival of a variety of glenoid implants was reported by Cofield and colleagues.[9,17] The 5-year survival rate of an all-polyethylene glenoid component ranged from 96% to 99%. Longer follow-up will obviously be required to determine whether the good initial results with a cementless pegged fluted glenoid continue and whether these results compare favorably with other designs.

This study is further limited by the use of plain radiographs in the determination of radiolucencies. Fluoroscopy or computed tomography would yield improved assessment of lucency and loosening.[5] However, the use of 2 plain radiographs allows comparison of results with previous studies and is still the most common imaging method to evaluate shoulder arthroplasty components.[5]

Conclusion

A cementless fluted pegged glenoid component yielded excellent clinical survival (100%) and no evidence of radiolucency at a mean follow-up of 34 months. The initial clinical results for this glenoid prosthesis are encouraging and should spur additional follow-up and investigation.

Disclaimer

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