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Radiographic and clinical outcomes of total shoulder arthroplasty with an all-polyethylene pegged bone ingrowth glenoid component: prospective short- to medium-term follow-up

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Background: Glenoid components often cause total shoulder arthroplasty failure. This study examines short-term to midterm radiographic and clinical results of a hybrid glenoid component with 3 cemented peripheral pegs and a central peg, which allows biologic fixation with use of native humeral head autograft.
Methods: In 4 years, 80 glenoid components were implanted during primary total shoulder arthroplasty with at least 2-year follow-up data. Within 12 months, 4 shoulders were revised and excluded from final analyses. Seven patients did not complete their questionnaires. Outcomes data included the American Shoulder and Elbow Surgeons (ASES) questionnaire, Constant score, and satisfaction score. A shoulder and elbow fellowship-trained surgeon, not involved in the care of these patients, analyzed radiographs for radiolucent lines, glenoid seating, and radiodensity in between the flanges of the central peg.
Results: Only 1 of 80 shoulders was revised for aseptic glenoid loosening. At final follow-up, 81.6% had a radiolucency grade of 0 or 1. Nearly 90% had a glenoid seating grade of A or B. Grade 2 or 3 bone around the central peg was seen in 88.2%. No statistical association existed between Walch glenoid types and radiolucency grades, bone grades around the central peg, perfect radiolucency grade, seating grade, and grade 3 bone around the central peg. There was significant improvement in mean ASES score, adjusted ASES pain score, Constant score, and satisfaction score as well as in forward flexion, abduction, and external rotation.
Conclusions: The hybrid glenoid can produce stable radiographic and clinical outcomes at short- to medium-term follow-up.

Funding: The specific information on the implant used, date of surgery, preoperative data, and follow-up data was collected and stored in the Tornier Aequalis Database (Tornier, Inc., Edina, MN, USA) as well as in our electronic outpatient clinic charts. The implant manufacturer provided funding for the collection and entry of data. This funding is provided to the 2 senior authors (T.R.N. and J.D.K.) to offset the costs of collecting and entering the data. However, the implant manufacturer did not assist with the data analysis or the design of this study. All of the patients were assigned study identification numbers, and their personal information was kept confidential from the implant manufacturer.
The Sutter Health Institutional Review Board waived HIPAA and consent for this study: No. 615912-1. All patients provided verbal and written consent for the operative procedure.

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Total shoulder arthroplasty (TSA) is a successful pain-relieving and function-improving procedure for patients with degenerative glenohumeral disease,[25] with survival rates surpassing 90% at 10 years postoperatively.[16,29] The incidence of primary TSA has steadily increased in the United States in the last 10 years,[11,19] with a corresponding increase in revision surgeries for implant failures, primarily due to failure of fixation of the glenoid component.[11] Glenoid component longevity remains a concern in TSA.[6,24,28] Although the reported incidence of loosening varies widely, its presence is significantly associated with pain.[2,4,14,17,26,27,29,38] Neer reported radiolucency at the bone-cement interface in 59 cases (30%) and no instances of clinical loosening in his series of 194 TSAs.[25] Other studies have not produced the same results. Of 73 TSA prostheses, Cofield found 8 glenoids (11%) with radiographic evidence of definite loosening and 52 components (71%) with radiolucency at the bone-cement interface.[9] In a larger series of 113 TSAs, the authors found 75 glenoids (84%) with radiolucency at the bone-cement interface and 39 components (44%) with radiographic evidence of loosening at a mean of 12.2 years of follow-up.[29] Subsequently, Barrett et al found that of 50 TSAs, 37 glenoids (74%) had radiolucency, and 3 of these (6%) required revision for loosening at a mean follow-up of 3.5 years.[2] In a review of the literature, Gonzalez et al[17] reported 379 (14.3%) of 2657 TSAs having glenoid loosening, defined as implant migration or a radiolucent line 2 mm or wider around the implant. In a meta-analysis, Bohsali et al[4] found 134 cases (32%) of glenoid loosening in 414 reported complications involving TSA.

Metal-backed cementless tissue ingrowth glenoid components were designed to minimize glenoid loosening but have fallen out of favor because of high failure rates due to screw breakage, increased polyethylene wear, component migration, tray fracture or dissociation from polyethylene, and severe osteolysis.[4,5,22,35] As a result of these studies, cemented all-polyethylene glenoid components have been in use, with most results in favor of pegged implants.[12,13,15,20,27,30] Recently, there has been an increasing trend toward partially cemented glenoid components, with a central peg that has flutes to receive bone graft from the resected native humeral head to facilitate osseous integration.[8,18,36,37] Radiographs and computed tomography (CT) scans have demonstrated bone ingrowth in between the flutes of this central peg, with reported rates ranging from 29% to 75%.[8,18,37]

The purpose of this study was to evaluate the radiographic and clinical results, in patients with primary TSA, of a hybrid partially cemented pegged all-polyethylene glenoid implant that includes a central peg with fins to receive bone autograft and to allow biologic fixation. Unique to this implant are the 2 additional fins at its backside to provide immediate fixation to the subchondral bone of the prepared glenoid. We hypothesized that this unique glenoid implant design would have a low rate of loosening, with radiographic evidence of bone ingrowth between the flanges of the central peg.

Materials and methods

This study is a retrospective review of our patient database, involving 158 consecutive shoulders (149 consecutive patients) treated with primary TSA for primary or secondary osteoarthritis or inflammatory arthritis of the glenohumeral joint between January 2008 and December 2011 by two surgeons (T.R.N. and J.D.K.). The Affiniti CortiLoc glenoid (Tornier, Inc., Edina, MN, USA) component was used in all arthroplasties. Patients treated with this implant for revision TSA or who had <24 months of radiographic and clinical outcomes follow-up were excluded.

This glenoid implant has a central peg with 4 circumferential flanges, allowing placement of autograft from the resected humeral head for osseous integration, and 3 peripheral pegs for cement fixation. Two additional circumferential flanges are located at the base of the central peg, allowing immediate fixation to the subchondral cortical bone (Fig. 1). Available sizes include diameters of curvature of 40, 44, 48, 52, and 56 mm. By matching of glenoid and humeral head sizes, the radial mismatch was 3 mm.

Outcomes data were collected preoperatively and postoperatively at 12 months and annually thereafter. Clinical outcomes evaluation included the American Shoulder and Elbow Surgeons (ASES) questionnaire, the Constant score, the adjusted ASES pain score (0, best; 10, worst), and the patient satisfaction score. The satisfaction score had 4 levels: very satisfied, satisfied, dissatisfied, and very dissatisfied. The change in satisfaction level was given a numerical value (positive or negative) based on the number of levels changed from preoperatively. For example, if a patient was very dissatisfied with the shoulder preoperatively and reported being satisfied at the latest follow-up, a numerical value of 2 was given. Clinical assessments were performed at the preoperative visit and postoperatively by the operative surgeon (T.R.N. or J.D.K.). Active shoulder forward flexion, abduction, and external rotation with the arm adducted was recorded in 5° increments. Internal rotation was recorded as the highest pelvic or vertebral level on the back that the patient could reach with the tip of the thumb. The change in internal rotation, compared with preoperative level, was recorded as a numerical value (positive or negative) corresponding to the change in number of pelvic or vertebral levels. A change of internal rotation from the lateral thigh to the buttock was designated a 1-level improvement, and