Minimum 5-year Follow-up for Primary THA Using a Tapered, Proximally Coated Cementless Stem

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abstract

The purpose of this study was to assess the survivorship of a proximally coated, cementless femoral stem used for total hip arthroplasty at a minimum 5-year follow-up by assessing clinical outcomes and implant survival. A total of 936 primary total hip arthroplasties were performed in 854 patients by 3 high-volume surgeons between 2001 and 2007. Patients included 385 men and 469 women with a mean age of 56 years (range, 20-88 years) and a mean follow-up of 7 years (range, 5-11 years). The aseptic revision rate related to the femoral component was 0.3%. Three patients underwent revision of the femoral component. Mean postoperative Harris Hip Score improved to 91 points (range, 70-100 points). When stratified by primary cause of total hip arthroplasty, no differences were found in implant survivorship or postoperative Harris Hip Scores. With the exception of the 3 patients who underwent revision surgery, postoperative radiographic evaluation of the stems demonstrated no progressive radiolucencies, component malalignment, change in component position, or implant subsidence at most recent follow-up.

These results are encouraging and indicate a 0.3% revision rate for the femoral component. The cause of primary total hip arthroplasty did not affect the clinical outcomes. These types of prostheses will provide patients with a stable implant that is expected to have excellent durability and longevity.

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Total hip arthroplasty (THA) is one of the most successful orthopedic procedures, with reliable and reproducible results to alleviate pain, improve function, and increase range of motion in patients with end-stage degenerative hip disease who have failed nonoperative management. It is estimated that more than 230,000 THAs are performed in the United States annually, of which more than 60% use cementless prosthetic components. This estimate is projected to increase with the aging population and increase in the incidence of THA even in younger patients due to reported satisfactory rates of implant survivorship in multiple mid- to long-term follow-up studies.

Cementless THA using proximally coated stems was first introduced in the early 1980s in response to reported proximal stress shielding associated with fully coated femoral prosthetic components. Earlier reports with first-generation cementless prosthetic devices reported problems, such as thigh pain, proximal stress shielding, and higher failure rates requiring revision surgery due to component loosening. With advancements in the design and materials used in cementless THA prosthetic components, improvements have reduced stress shielding and increased biological fixation and in vivo biocompatibility. Currently, several types of cementless prosthetic devices have been developed; however, no consensus exists regarding the ideal femoral stem in terms of survivorship, design geometry, and surface treatment (eg, porous ingrowth vs ongrowth surfaces). Because the patients who receive these prostheses have become younger and more active, it is critical that good mid- to long-term results be demonstrated for these implants.

The purpose of this study was to report the minimum 5-year follow-up outcomes with a tapered, proximally coated cementless stem for patients who underwent a primary THA. The following questions were asked: (1) What was the stem implant survivorship; (2) Was there a difference in stem implant survivorship when patients were stratified according to the primary diagnosis; (3) What was the overall clinical outcome; (4) Was there a difference in clinical outcomes when patients were stratified according to the primary diagnosis; and (5) What were the radiographic outcomes?

**Materials and Methods**

The databases at 3 high-volume institutions were reviewed to find all patients who underwent a primary THA by 3 experienced fellowship-trained adult reconstructive surgeons (F.R.K., S.F.H., M.A.M.) to determine the number of hips that received the Accolade TMZF femoral component (Stryker Orthopaedics, Mahwah, New Jersey) for THA. In total, 1004 hips (908 patients) who underwent a primary THA between 2001 and 2007 were identified. Fifty-four patients (68 hips) were lost to follow-up after their 2-year examination and were excluded from this study because the minimum 5-year outcomes are reported; it should be noted that their implants were well fixed at the last follow-up visit.

The remaining 854 patients (936 hips) were included in the current study. Patients included 385 men and 469 women with a mean age of 56 years (range, 20-88 years) who had undergone a total of 936 primary THA procedures. All patients were evaluated clinically and radiographically at a mean follow-up of 7 years (range, 5-11 years). The outcomes of some patients at an earlier follow-up have been previously reported. All available hospital medical records, including admission history and physical examinations, radiographs, postoperative reports, discharge summaries, and postoperative clinic notes, were reviewed. Appropriate institutional review board approval for patient review was obtained.

Patients were stratified based on the underlying cause of the need for THA, which included 730 (78%) hips with osteoarthritis, 152 (16%) hips with osteonecrosis, and 54 (6%) hips with rheumatoid arthritis. Stem survivorship and clinical outcomes were further compared between the osteoarthritis and osteonecrosis cohorts.

All primary THAs were performed through an anterolateral or posterolateral approach. All patients received an Accolade TMZF femoral component prosthesis, which is a tapered, proximally coated titanium alloy cementless stem with a 50-μm PureFix hydroxyapatite thickness and modular head and was implanted using a press-fit technique. The acetabular prostheses were porous-coated (Trident acetabular component; Stryker Orthopaedics) and were implanted using a press-fit technique with or without screws and are not the subject of this report.

Pre- and postoperative Harris Hip Scores were used for clinical evaluation. All patients returned for follow-up examinations at 6 weeks, 6 months, and yearly thereafter. At the initial follow-up examinations, patients were assessed for any surgical or medical complications, such as hemato ma formation, prolonged wound drainage, superficial or deep infection, deep venous thrombosis, or pulmonary embolism.

During each postoperative visit, anteroposterior and lateral frog views of the hips were obtained, and implants were evaluated radiographically by the senior authors (F.R.K., S.F.H., M.A.M.) for any periprosthetic fracture, progressive radiolucency of the femoral component (according to the Gruen Zones21), heterotopic ossification, implant subsidence, or component failure. Stem failure was defined as revision of the femoral component for aseptic reasons, including osteolysis, pain and loosening, component malalignment, or fracture.

All data were recorded using an Excel spreadsheet (Microsoft Corporation, Redmond, Washington). Statistical data analysis was performed by using Fisher’s exact test and Student’s t test to evaluate implant survivorship and clinical out-
comes. A $P$ value of .05 was used as a threshold for statistical significance.

**RESULTS**

The femoral stem implant survivorship was 99.7% (933 of 936 hips) undergoing revision surgery involving the stem for aseptic component loosening. One revision occurred in a 29-year-old woman who had a medical history significant for sickle cell hemoglobinopathy and associated hip osteonecrosis. She underwent revision of both the femoral stem and acetabular components 9 months after the index THA and achieved a Harris Hip Score of 86 points at 108-month follow-up. The second patient was a 48-year-old morbidly obese man (body mass index, 43 kg/m$^2$) with a history of tobacco smoking who underwent revision of the femoral stem due to pain and aseptic loosening 8 months after the index THA. He achieved a Harris Hip Score of 82 points at 52-month follow-up. The third patient was a 63-year-old woman with a medical history significant for systemic lupus erythematosus and osteoarthritis (body mass index, 38 kg/m$^2$) who underwent stem revision due to aseptic loosening at 28 months from the index THA. She achieved a Harris Hip Score of 88 points at 48-month follow-up.

When the 3 revision surgeries were stratified based on the cause of primary THA, 2 were stratified into the cohort of patients with osteoarthritis, resulting in an overall femoral component survivorship of 99.7% (728 of 730). The other stem revision was stratified into the cohort of patients with osteonecrosis, resulting in an overall femoral component implant survivorship of 99.3% (151 of 152). No significant differences were observed in femoral component survivorship between the 2 cohorts ($P = .43$).

Mean Harris Hip Score improved from a preoperative score of 44 points (range, 30-56 points) to a postoperative score of 91 points (range, 70-100 points). When clinical outcomes were stratified based on the primary cause of THA, mean Harris Hip Score improved from 44 points (range, 30-54) preoperatively to 91 points (range, 70-100 points) postoperatively in the cohort of patients with osteoarthritis and from 42 points (range, 32-56) preoperatively to 89 points (range, 72-100) postoperatively in the cohort of patients with osteonecrosis. No significant difference was observed between the groups ($P = .45$).

With the exception of patients who had undergone revision surgery for aseptic stem failure, the postoperative radiographic analysis of the remaining patients demonstrated no stem subsidence, progressive radiolucencies, component malalignment, or change in component position at their most recent follow-up.

**DISCUSSION**

It is estimated that more than 230,000 THAs are performed in the United States annually, of which more than 60% are performed using cementless prosthetic components. With significant improvements in materials and the design and manufacture of cementless THA prostheses, several types of cementless prosthetic devices have been developed. The purpose of this study was to report the minimum 5-year follow-up outcomes with a tapered, proximally coated cementless stem for patients who underwent a primary THA. An overall 99.7% survivorship rate (with revision of femoral component for an aseptic reason as an endpoint) was found.

This study has several limitations. A prospective study could have ideally reduced potential bias in the study. Patient satisfaction and broader quality of life measures (such as the Western Ontario and McMaster Universities Osteoarthritis and the Short Form 12 or 36) were not evaluated. Nevertheless, the authors believe that the results are valuable because limited reported data exists on this stem and no previous report has stratified the clinical outcomes based on the primary diagnosis. Because of the paucity of reports, further prospective, multicenter, and long-term follow-up studies are needed to better evaluate the outcomes of primary THA using this specific stem.

Survivorship and clinical outcomes of the femoral stem in the current study are similar to other reports that evaluated this stem in primary THA. Casper et al reviewed 145 patients with a mean age of 68 years (range, 44-86 years) who underwent 158 primary THAs with a first-generation stem. They reported a 0.6% failure rate due to femoral component loosening at a mean follow-up of 7.5 years (range, 5-9 years). Lettich et al reviewed 700 THAs in 631 patients with a mean age of 67.6 years (range, 32-92 years) and reported that 8 (1.1%) patients underwent revision of the femoral stem component. Of those 8 revisions, 4 (0.57%) were due to stem loosening.

Survivorship and clinical outcomes of this stem in the current study are also comparable with previously reported outcomes of other proximally coated cementless stems used in primary THA. Lombardi et al retrospectively reviewed 1866 THAs using tapered titanium porous plasma-sprayed femoral components in 1525 patients who had a mean age of 53 years (range, 19-92 years). At a minimum follow-up of 24 months (mean, 119 months; range, 24-275 months), they reported 39 femoral revisions with a stem failure rate of 2%. Mean Harris Hip Scores improved from a preoperative score of 46 points (range, 5-46 points) to a postoperative score of 83 points (range, 18-100 points). Klein et al reviewed the results of 122 THAs using a collarless, tapered, fiber metal proximally coated femoral stem in 116 patients with a mean age of 57 years (range, 23-78 years) at the time of surgery. At a minimum follow-up of 60 months (mean, 81 months; range, 60-104 months), they reported that no femoral component was revised. Reported complications included 2 intraoperative nondisplaced fractures, 2 dislocations, 1 traumatic periprosthetic fracture, and 1 severe
grade 4 heterotopic ossification. They also reported a mean postoperative Harris Hip Score of 92 points (range, 38-100) at their most recent follow-up.24 Goosen et al25 reviewed outcomes of 106 THAs using a proximally hydroxyapatite-coated femoral stem in 100 patients with a mean age of 51 years (standard deviation, 8.2). At a minimum follow-up of 72 months (range, 72-120 months), 1 acetabular cup revision was reported but no femoral component was revised. However, they reported 35 stems had subsided, of which 7 stems had subsided by 5 mm or more. Median Harris Hip Score improved to 95 points (range, 36-100 points).25

**CONCLUSION**

Excellent stem survivorship, clinical and radiographic outcomes, and minimal complications were observed at a mean follow-up of 7 years using this stem, with a 0.3% aseptic femoral component revision rate. The cause of primary THA did not affect the clinical outcomes using this stem. These results confirm previously reported evidence suggesting early-to-mid-term success of these cementless stems. These types of prostheses will provide patients with a stable implant that is expected to have excellent durability and longevity.

**REFERENCES**