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Results of a Tapered Proximally-Coated Primary Cementless Stem for Revision Hip Surgery

Harpal S. Khanuja, MD, Kimona Issa, MD, Qais Naziri, MD, Samik Banerjee, MS (Orth), MRCS , Ronald E. Delanois, MD , Michael A. Mont, MD

Rubin Institute for Advanced Orthopedics, Center for Joint Preservation and Reconstruction, Sinai Hospital of Baltimore, Baltimore, Maryland

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ABSTRACT

Nineteen patients (nineteen hips) who had undergone revision total hip arthroplasties using a proximally-coated primary cementless stem were evaluated to determine if a subset of revision arthroplasty patients could be identified where the use of this stem would be appropriate. Of these 19 revisions, 15 were performed for the second stage treatment of infection. The femoral bone deficiency was classified as Paprosky Type I in 6 hips and Type II in 13 hips. At a mean follow-up of 49 months, aseptic stem survivorship was 95% with one revision due to aseptic stem failure. The mean Harris hip scores had improved from a mean of 44 points pre-operatively to 89 points post-operatively. Intra-operatively, there was one complication which included a peri-prosthetic fracture distal to the stem which was treated with an allograft strut with cerclage wires. The authors believe that in type I or II femoral defects, the use of this specific cementless stem may be beneficial in the setting of a revision total hip arthroplasty.

The number of revision total hip arthroplasties is increasing and projected to rise to 96,700 procedures by year 2030 which more than doubles the total from year 2005 [1]. The immediate goal of revision surgery is to obtain a stable and well-fixed construct that restores hip biomechanics. With a younger population and more patients needing revisions, some surgeons believe that the most proximal stable fixation should be employed, as it preserves distal bone stock if further surgery is necessary. Revision on the femoral side can consist of a broad spectrum of techniques, where the complexity is often dictated by the integrity of the remaining bone. Revision total hip arthroplasties with cemented prostheses have reported high mechanical loosening and failure rates and thus, cementless prostheses have become the gold standard for fixation [2–9].

Distal fixation is often routinely sought in revision femoral reconstruction because of poor proximal bone stock. However, distally fixed stems increase distal loading of the femur and can result in proximal stress shielding [10–12]. In revision settings when proximal femoral bone is sufficient, a proximally-fixed implant may be warranted [13]. The use of a proximally coated-tapered primary femoral stem that is non diaphyseal-engaging will allow for distal bone preservation in such a revision setting. The bone will be loaded more proximally and can potentially preserve valuable bone stock [14]. Some studies have reported results of proximally-coated femoral implants in revision settings, but none have described the appropriate indications for use with the most widely used primary proximally-coated stem.

The purpose of this study was to determine if a subset of revision arthroplasty patients can be identified where the use of this proximally porous-coated primary cementless stem would be appropriate. We reviewed our femoral revisions and asked the following questions: (1) what was the aseptic survivorship of this primary stem in the revision settings; (2) what were the clinical outcomes; (3) what were the complications associated with this primary stem in the revision settings, and (4) what were the radiographic outcomes?

Material and Methods

We reviewed our prospective joint arthroplasty database for patients who underwent a revision total hip arthroplasty at our institution over a 10-year period. All procedures were performed by three experienced, fellowship trained adult reconstructive surgeons (HSK, RED, and MAM) at a single high-volume institution. A total of 955 patients who had undergone a revision surgery between 2001 and 2010 were identified. All patients who received a cementless, tapered proximally-coated primary femoral prosthesis during revision total hip arthroplasty settings and had a minimum follow-up of 24 months were included in this study. Nineteen patients (nineteen

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Reprint requests: Harpal S. Khanuja, MD, Rubin Institute for Advanced Orthopaedics, Center for Joint Preservation and Reconstruction, Sinai Hospital of Baltimore, 2401 West Belvedere Avenue, Baltimore, MD 21215.

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hips) who had undergone revision hip arthroplasties and met the inclusion criteria were identified. There were 13 men and 6 women who had a mean age of 50.5 years (range, 18 to 85 years) at the time of revision surgery. All patients were evaluated both clinically and radiographically at a mean follow-up of 49 months (range, 25 to 118 months). None of the patients was lost to follow-up. Appropriate institutional review board approval was obtained for the study of these patients.

All available medical records and radiographs were reviewed by two of authors (QN and HSK). All femoral defects were graded pre-operatively according to the classification of Della Valle and Paprosky[15].

In all cases, an Accolade TMZF stem (Stryker, Mahwah, New Jersey) which is a tapered, proximally porous-coated stem with a modular head was implanted using a press-fit technique. This implant is designed to obtain primarily medio-lateral fixation in the metaphyseal region. The distal portion of the stem, while it enters the diaphysis, does not obtain distal fixation. The acetabular prostheses were porous-coated and were implanted using a press-fit technique with or without screws.

Digital templating of antero-posterior and lateral radiographs was performed in all cases pre-operatively, to assess the suitability of femoral shape and medio-lateral bone stock for implant fixation. Templating provided an estimate of the stem size required for maximal bony contact as well as appropriate offset and seating needed for correction of any pre-existing limb length discrepancy. The stem size which filled the proximal femoral metaphysis in the antero-posterior radiograph and provided the desired offset and leg length was recorded as the probable stem size required during surgery.

Intra-operatively, we assessed stability of the stem by the ability to obtain a medio-lateral press-fit with axial as well as rotational stability, as is the technique with primary hip arthroplasty. Stability was assessed by the surgeon's tactile feedback and experience. Failure of the broach to advance and a change in the pitch on impaction of the broach handle, combined with rotational stability with manual torquing of the handle indicated a stable broach. The prosthesis being slightly oversized, allowed for an additional press-fit. If this initial stability was not obtained, a different prosthesis was used. The amount of antero-posterior bony contact was not considered if medio-lateral, axial and rotational stability was attained. Bone grafting was not performed in any of these cases and a medio-lateral interference fit in the metaphyseal region was relied upon to provide initial stability and subsequent osseointegration.

During rehabilitation, all patients were encouraged to attempt to 50% weight-bear in the post-operative period with the use of ambulatory aids. Patients were also allowed to discontinue the use of ambulatory aids at six weeks. All patients underwent routine post-operative rehabilitation protocols which included range-of-motion exercises, progressive abductor strengthening, and gait.

All patients returned for follow-up visits at six weeks, three months, six months, twelve months, and then yearly thereafter. Clinical evaluation was based on the Harris hip scoring system [16]. At the initial follow-up visits, patients were examined thoroughly and assessed for any surgical complications such as prolonged wound drainage, hematoma formation, superficial or deep infection, deep venous thrombosis, or pulmonary embolism.

During each post-operative visit, antero-posterior and lateral views of the hips were obtained, and all implants were evaluated radiographically for any progressive radiolucencies or subsidence of the femoral or acetabular component, peri-prosthetic fracture, implant subsidence, or component failure.

Failure was defined as radiographic evidence of loosening or revision of the femoral component for aseptic loosening, including osteolysis or component malalignment.

All data were recorded using an Excel spreadsheet (Microsoft Corporation, Redmond, Washington). Statistical data analysis including Kaplan–Meier survivorship analysis was performed using GraphPad Prism 6.0 (GraphPad Software, Inc., La Jolla, California). A P value of less than 0.05 was used as a threshold for statistical significance.

Results

The femoral deficiency was classified as type I in 6 hips and type II in 13 hips (Table 1). The most common indication for using this stem in the setting of a revision surgery was after an infected primary total hip arthroplasty. Of the total of 19 revisions, there were 15 revisions that used this stem during the second stage of a two-staged re-implantation for infected primary total hip arthroplasty. These patients were all treated with a loosely cemented coated femoral component between stages. In addition, there were 4 revisions due to aseptic component loosening of a primary total hip arthroplasty. The previous femoral component in these hips included two proximally porous coated stems without distal fixation, one proximally porous coated stem that engaged, but did not in-grow into the diaphysis and 1 cemented stem.

Table 1
Demographics, Harris Hip Scores and Complications of the Proximally Porous Coated Stem in Revision Hip Arthroplasty.

Patient Serial Number	Age at Operation	Gender	Side	Pre-Operative Diagnosis	Femoral Defects	Pre-Operative HHS	Post-Operative HHS	Follow-Up in Months	Complication
1.	64	Male	Right	Infection	I	58	87	67	Intra-operative fracture
2.	77	Male	Left	Infection	I	54	95	36	None
3.	46	Male	Right	Aseptic loosening	I	47	75	105	None
4.	47	Male	Left	Infection	I	37	98	37	None
5.	52	Female	Right	Infection	I	32	83	25	None
6.	25	Male	Left	Infection	I	35	98	74	None
7.	56	Male	Right	Aseptic loosening	II	48	97	41	Aseptic loosening of femoral stem
8.	52	Female	Right	Infection	II	65	100	25	None
9.	18	Female	Right	Infection	II	44	98	49	None
10.	50	Male	Left	Infection	II	39	94	46	None
11.	42	Female	Left	Infection	II	33	77	40	None
12.	31	Female	Right	Aseptic loosening	II	36	67	34	None
13.	57	Male	Right	Infection	II	31	94	118	None
14.	53	Male	Right	Infection	II	62	96	36	None
15.	69	Female	Left	Infection	II	45	76	49	Aseptic loosening of acetabular cup
16.	30	Male	Right	Aseptic loosening	II	46	94	37	None
17.	44	Male	Left	Infection	II	39	97	36	None
18.	85	Male	Left	Infection	II	53	90	39	None
19.	62	Male	Left	Infection	II	37	82	41	Recurrent Infection