15-year follow-up results of the hydroxyapatite ceramic-coated femoral stem

R Slack, A Tindall, AA Shetty
South East Thames Orthopaedic Training Programme, UK

KD James, C Rand
Medway Maritime Hospital, Gillingham, Kent, UK

ABSTRACT

Purpose. To evaluate the clinical and radiological outcomes following implantation of the Furlong hydroxyapatite ceramic–coated femoral stem in total hip arthroplasty.

Methods. A longitudinal cohort of 116 consecutive patients (134 hips) was followed up prospectively. The follow-up period was at least 13 years (range, 13–15 years). Clinical and radiological assessments were made using the Merle d'Aubigne and Postel score and Engh score for fixation and stability, respectively. Osteointegration was assessed radiographically by examining the bone implant interface using the method described by Gruen.

Results. 22 patients died during the study period and 6 were lost to follow-up. The respective mean Merle d’Aubigne and Postel scores for pain, range of movement, and ability to walk were 2.2, 2.8, and 2.4 preoperatively and 5.8, 4.8, and 5.4 postoperatively. Engh described satisfactory bony ongrowth as 10 points or more; the mean Engh score for fixation and stability was 24.7 (fixation=10, stability=14.7). One femoral stem was revised for a periprosthetic fracture caused by a fall, but none was revised for loosening. This gave a 99% survival at 13 years (95% confidence interval 94–100).

Conclusion. The long-term results of this hydroxyapatite ceramic–coated femoral prosthesis are very satisfactory.

Key words: arthroplasty, replacement, hip; hip prosthesis; hydroxyapatites

INTRODUCTION

Aseptic loosening of cemented femoral prostheses is a well-recognised problem. Much work has focused on finding a successful means of cementless fixation. Promising experimental evidence, favours using hydroxyapatite for this purpose despite concerns about its porosity, degradation, delamination, and low-
fatigue strength. There are few long-term clinical studies of the *in vivo* performance of hydroxyapatite. Previous study on the survival of the Joint Replacement Instrumentation’s (JRI) hydroxyapatite ceramic (HAC)–coated (Furlong) femoral prosthesis showed a 100% success rate after 10-year follow-up.\(^1\) We present this prospective study with a 13-year minimum follow-up on uncemented femoral prosthesis and demonstrate survival at least equal to that reported for cemented prostheses.

**MATERIALS AND METHODS**

A longitudinal cohort of 116 consecutive patients (88 female and 28 male) who underwent a primary total hip arthroplasty at the Medway Maritime Hospital in Kent, UK between November 1989 and December 1991 was followed up prospectively. There were no exclusion criteria, and the patients’ mean age was 75 years (range, 26–95 years). In these patients, 134 hips were replaced: 66 right, 32 left, and 36 bilateral (10 simultaneously, 8 consecutively). The primary diagnosis was osteoarthritis (n=130), avascular necrosis (n=3), and rheumatoid arthritis (n=1).

A single consultant orthopaedic surgeon performed all operations through an anterolateral (Watson-Jones) approach. All patients received a fully HAC-coated JRI stem with a collar and a 28-mm cobalt-chrome or ceramic head (Fig. 1). An HAC-coated threaded cup or cancellous screw-fixed (CSF) cup was used. Immediate weight bearing was encouraged postoperatively, and all patients received routine antibiotic cover and prophylaxis for deep venous thrombosis.

Clinical evaluation was based on Merle d’Aubigne and Postel (MAP) scores.\(^2\) In addition to scores of overall pain, range of movement, and ability to walk, patients were asked specifically whether they experienced any thigh pain. Clinical and radiological assessments were made preoperatively and postoperatively at 6 weeks, 3 months, one year, 2 years, and 5 years. The minimum follow-up period was 13 years (range, 13–15 years).

Standardised anteroposterior and lateral radiographs were taken, and comparison was made between the early postoperative, subsequent, and the most-recent radiographs. Fixation and stability were assessed using Engh radiological score for uncemented prostheses.\(^3\) The degree of femoral subsidence (relative to the tip of the greater trochanter) was measured: an increase of >2 mm was considered significant. Radiographs were examined for evidence of spot welds and bone pedestals (Figs. 2 and 3). Calcar remodelling was recorded as hypertrophic, atrophic, or indifferent.\(^3\) The criteria for failure were
revision or impending revision caused by either pain or loosening.

RESULTS

22 patients died during the study period and 6 patients were lost to follow-up. The mean MAP scores improved from 7.4 (preoperative) to 15.9 (postoperative). The total score of all patients except one improved, as did each component of the total score. No patient complained of thigh pain.

The mean Engh score for fixation and stability was 24.7 (fixation=10, stability=14.7). 81% of the stems showed a pedestal at the tip of the prosthesis (Fig. 3). No stem showed evidence of radiolucent lines at the bone stem interface, and no subsidence was evident on any of the radiographs. The results for the total hip arthroplasty have been previously reported.4 Two patients had an early deep venous thrombosis, one of them progressed to a fatal pulmonary embolus. There were 2 transient femoral nerve palsies and one transient common peroneal nerve palsy. One late deep infection resolved after antibiotic therapy. One patient underwent a femoral stem revision for fracture following a fall down stairs (Fig. 4).

DISCUSSION

Our series showed 99% survival at 13 years (95% confidence interval 94–100). This agrees with the shorter-term follow-up results of this implant1 and other cementless implants.5–7 MAP scores were greatly improved in all but one patient who had severe heterotopic ossification. No patient, when asked specifically, complained of anterior thigh pain. This is comparable with studies involving other HAC-coated femoral prostheses.7,8

Engh described satisfactory bony ongrowth as 10 points or more.3 The mean Engh radiological score in our series was 24.7. The presence of spot welds and pedestals and the absence of radiolucent lines support the radiological evidence of bony ongrowth. The prosthesis was conical proximally, thereby avoiding the problem of stress shielding. Endosteal reaction was seen both proximally and distally, with trabecular streaming and pedestal formation. Calcar atrophy, a positive sign of stability, was noted early in the follow-up and was found to be non-progressive.

The only prosthesis failure in our series was a periprosthetic femoral fracture caused by a major fall down stairs. At revision, the prosthesis was found to be well fixed and very difficult to remove. The patient made an excellent recovery.

CONCLUSION

This study shows 99% survival of the HAC-coated (Furlong) femoral stem at 13 to 15 years’ follow-up. This adds further evidence to shorter-term studies that support the use of this prosthesis.

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