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Nineteen Year Results of THA Using Modular 9 mm S-ROM Femoral Component in Patients With Small Femoral Canals

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ABSTRACT

A retrospective analysis was undertaken of 30 consecutive THA performed in 25 patients with hypoplastic proximal femurs, who had received a 9-mm uncemented modular S-ROM stem. The mean patient age was 42 years (17–69 years), mean height was 152.5cm (130–170.5 cm), mean weight was 63 kg (39–90 kg), and mean follow-up period was 19 years (range, 12–23 years). Subsidence was seen in 2 hips, with asymptomatic femoral osteolysis present in 11 hips; overall survival of the femoral stem was 93.3%, with two revisions of the femoral component required for aseptic loosening. After a mean follow-up of 19 years, the use of the S-ROM 9 mm femoral stem in the patient with the small femur was associated with a low revision rate due to aseptic loosening of the stem.

Primary total hip arthroplasty (THA) for primary osteoarthritis (OA) has excellent long term outcomes with low rates of complications [1–5]. However, THA can be technically demanding, especially in patients with OA secondary to pre-existent anatomic deformities of the hip, including hypoplastic acetabuli, hypoplastic proximal femurs, or both (developmental dysplasia of the hip (DDH), juvenile rheumatoid arthritis, multiple epiphyseal dysplasia (MED), Achondroplasia) [6]. The outcome in these patients is less assured, and associated with higher complication rates; surgery addressing these types of pathologies often requires the use of small femoral components, and supplemental bone-grafting [7–13]. Furthermore, this population tends to require surgery at a much younger age than those with primary osteoarthritis.

The patients in this study have had their medium term (7.8 year) results previously reported, looking at the outcome of THA using the 9 mm S-ROM (Depuy, Warsaw, Indiana) femoral prosthesis in patients with deficient bone stock and small femoral canals [14]. In this retrospective study, we present the 19 year follow up and clinical results using a modular, uncemented, 9 mm diameter S-ROM femoral stem in this cohort of patients with small femoral canals.

Ethics

This study was approved by the relevant national and local research ethics committees and was registered in a public trials registry.

Methods and Materials

The underlying diagnosis for each patient requiring a 9 mm SROM femoral stem is seen in Table 1. The 9 mm femoral component is the smallest diameter available in North America (in Japan S-ROM stems as small as 6 mm are available). A number of patients had undergone previous surgery including one patient (two hips) with bilateral hip resurfacings, two patients (two hips) having had a hip arthrodesis, and one patient (two hips) that had undergone both a pelvic osteotomy and a femoral derotation osteotomy.

On the acetabular side, ingrowth cups were used, with the exception of one patient in whom a smooth threaded cup was inserted. Four THA had an acetabular component inserted with a diameter of 48 mm or greater, allowing a 28 mm head; the remaining patients had a 45 mm or smaller component inserted with a 4.6 mm polyethylene liner and a 22 mm femoral head. Of the 34 cases, 10 had acetabular roof grafts performed with allograft.

Clinical and radiographic follow up has been performed every two years since the last report. Clinical evaluation was carried out with the use of Harris Hip Score (HHS) [15], using the postoperative scores from the most recent follow-up. Routine radiographs, consisting of an

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Table 1
Underlying Diagnosis of Each Patient Requiring a 9 mm SROM Modular Uncemented Femoral Stem.

Diagnosis	Number of Patients	Number of THA
OA	2	2
DDH	15	19
Septic arthritis	3	3
Morquio's syndrome	1	2
MED	1	1
TB	1	1
Perthes	1	1
Athrogryposis	1	1
Total	25	30

MED – multiple epiphyseal dysplasia, TB – tuberculosis.

anteroposterior (AP) view of the pelvis, as well as an AP and lateral view of the affected hip have been performed, and compared to the initial six-week postoperative radiographs. Radiographs were evaluated by two fellowship trained hip arthroplasty surgeons (MD and NR) for evidence of femoral loosening, osteolysis (Gruen modes of failure [16]), and heterotopic ossification (graded according to Brooker's classification [17]). Vertical subsidence was evaluated, and instability of the femoral stem defined as subsidence of >2 mm or a change in the stem angle of >2°, as described by Campbell et al [18]. Stable osseous ingrowth was characterized by the presence of spot welds, absence of radiodense reactive lines, and cortical remodeling. Cortical remodeling was evaluated by assessing the proximal femoral osteotomy site for hypertrophy (densification) or rounding (atrophy) as described by Hedley et al [19], as well as by assessing the region of the fluted stem for periosteal hypertrophy. Formation of intramedullary bone at the distal tip was classified as none, slight (as indicated by a radiopaque halo), or complete (as indicated by a pedestal) according to the criteria described by Engh et al [20].

Statistical Analysis

Statistical analysis was performed using Microsoft Excel 2010 (© 2010 Microsoft Corporation). Means, standard deviations and paired student t-tests were calculated to describe the patient population, and compare the preoperative and postoperative functional outcome and pain scores. Survival analysis was performed using the Kaplan-Meier method, with a calculated 95% confidence intervals (CI) for the endpoints. The survival analysis regarded revisions performed for aseptic loosening of components as an endpoint.

Results

Between 1987 and 1999, THA using a modular 9 mm non-cemented S-ROM femoral component (Depuy, Warsaw, IN), was performed in 28 patients (34 THA) by a single surgeon (HUC). Three patients (8.9%) with four THA (11.8%) have been lost from the original cohort; one patient died six years after surgery, while two patients have been lost to follow-up after four and six years respectively. These patients were excluded from analysis, leaving a total of 30 THA in 25 patients available for mean follow up of 19 years (range, 12–23 years); patient demographics are seen in Table 2.

Clinical Outcome

The Harris hip score at most recent follow up was excellent for 60% of patients (18 hips), good in 23% (seven hips), fair in 10% (three hips), and poor in 7% (two hips). Eleven patients (15 hips) had no limp (50%), four patients (four hips) had a mild limp (13.5%), five patients (five hips) had a moderate limp (16.5%) and five patients (six hips) had a severe limp (20%). Mild thigh pain was described in association with two hips (6.6%) at eighteen months; this pain typically occurred only with prolonged activity, was not disabling, and did not require medication. Two patients reported mild pain in the groin.

Table 2
Patient Demographics.

Demographic	Number
Sex	2 male (2 hips), 23 females (28 hips)
Mean age	42 (range, 17–69)
Mean height	152.5 cm (range, 130–170.5)
Mean weight	63 kg (range, 39–90)
Mean follow-up	19 years (range, 12–23)

Radiographic Assessment of the Femoral Component

Stable osseous ingrowth was seen in twenty eight (93%) of thirty hips; only two stems showed signs of loosening. Twenty three hips had patterns of bony ingrowth: cortical hypertrophy on the medial cortex in eight hips, cortical hypertrophy of the lateral cortex in three hips, and signs of diffuse bony ingrowth in fourteen hips (Figs. 1 and 2). Endosteal spot welds (an increase in bone density at the lower end of the sleeve considered to be bone ingrowth) were seen in nine hips (Fig. 3). Femoral osteolysis was seen eleven hips (37%) in the proximal zones (five hips zone 1 and 7, three hips zone 1 alone, and three hips zone 7 alone). No distal osteolysis was noted. Fourteen hips (45%) had evidence of stress-shielding of the proximal metaphysis (Gruen zone 1 or/and 7) (Figs. 1 and 2), but only two hips (6.5%) had signs of cortical resorption. No femoral prosthesis developed varus or valgus tilt over time. Heterotopic ossification was seen in eight hips (26%), with seven Brooker's grade 1 and with one Brooker's grade 2 at most recent follow-up.

Revision Surgery

As previously reported, stem subsidence was seen within the first six months in two hips, one requiring revision at 6 and 13 years respectively after initial surgery. One patient with arthrogryposis sustained a femoral shaft fracture sustained in a fall in the immediate postoperative phase; the stem was upsized to an 11 mm stem and the fracture was stabilized with a femoral plate (this hip was excluded from revision analysis). No further revision surgery has been required

Fig. 1. Patient with Morquio's Syndrome, 23 years after surgery. Xray demonstrates an area of medial diaphyseal cortical hypertrophy with stress shielding in Gruen zones 1 and 7.