Ten-year survival of the MS-30 matt-surfaced cemented stem

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The Morscher-Spotorno (MS-30) femoral stem is a stainless-steel, straight, three-dimensionally tapered, collarless implant for cemented fixation in total hip replacement.

We report the results at ten years of a consecutive series of 124 total hip replacements in 121 patients with the matt-surfaced MS-30 stem and an alumina ceramic head of 28-mm diameter. All the stems were fixed with Palacos bone cement with gentamicin using a modern cementing technique. They were combined with an uncemented, press-fit cup. The mean period of observation was 10.2 years (8.3 to 12.1) and no patient was lost to follow-up. Twenty-seven patients (22%) died with the implant in situ. Nine could only be interviewed by telephone. We included 85 patients with 88 hips in the clinical and radiological follow-up examinations.

None of the stems or cups had been revised. The Harris hip score was excellent or good in 97% (85 hips) and moderate in 3% (three hips). Radiologically, six hips (6.8%) had osteolysis adjacent to the stem, mostly in Gruen zone 7. Twenty (22.7%) showed one or more radiolucent lines. Twenty-two stems (25%) had subsided by 2 mm to 5 mm. In these cases two showed osteolysis (9.1%) with subsidence and four without (6.1%). Radiolucent lines were seen in seven with migration (31.8%) and in 13 without (19.7%). No infections and no acetabular osteolysis were observed.

The clinical results were excellent with survivorship after ten years of 100% and only a slightly statistically non-significant higher rate of osteolysis and radiolucency in cases of subsidence.
original matt surface, especially with regard to radiolucency, osteolysis and subsidence.

Patients and Methods
The cemented MS-30 stem with a matt surface and an alumina-ceramic femoral head was introduced clinically in 1990. It was always fixed with Gentamicin-Palacos bone cement (Kulzer GmbH, Bad Homburg, Germany) containing gentamicin using a modern cementing technique.

Between January 1990 and December 1992, we implanted 124 stems (121 patients). The mean age of the patients at surgery was 67.6 years (36 to 89) for the 76 women and 67.3 years (49 to 86) for the 45 men. Of the 124 hips, the pre-operative diagnosis was osteoarthritis in 99 (80%), avascular necrosis in 12 (9%), dysplasia in seven (6%), post-traumatic osteoarthritis in four (3%) and rheumatoid arthritis in two (2%).

Twenty-four patients (nine women, 15 men) had already undergone a contralateral THR with a Müller straight stem (Zimmer Ltd) before their initial surgery, while 14 (nine women, five men) subsequently had a contralateral procedure. The operations were performed by ten different surgeons of the Orthopaedic Department of the University of Basel, Switzerland, each with a different level of experience.

The right hip was treated in 58 cases and the left in 66. Twenty-seven patients (22.3%, 14 women, 13 men) died during the observation period. Nine (five women, four men) were either unable or unwilling to attend the follow-up at ten years and were interviewed by telephone. In all the THR was in situ. We reviewed 85 patients (56 women, 29 men; 88 hips) clinically and radiologically at ten years. No patient was lost to follow-up (Table I).

For the acetabular component, the Morscher press-fit cup (Zimmer, Fig. 3) was used in all patients. It was made of conventional ultra-high-molecular-weight polyethylene covered with an orientated titanium mesh (Sulmesh; Zimmer Ltd).

The patients underwent surgery in a supine position and all the implants except one were inserted through a lateral approach. No trochanteric osteotomy was performed. A rasp which was approximately 2 mm larger than the stem was used in order to provide the necessary space for the cement. The medullary canal was irrigated and packed with sponges until immediately before the introduction of the
cement. The cementing technique included the use of a cement gun, plugging of the distal femoral canal and pressurisation. The centraliser, designed to position the stem distally, is an integral part of the MS-30 stem. It serves to prevent contact between the implant and bone to avoid malalignment. The selected centraliser was usually one size larger than its respective stem. The femoral component was fixed with gentamicin-Palacos cement, according to the manufacturer’s instructions. The mean length of surgery was 1.5 hours (1 to 3.5).

The peri-operative regimen was the same for all patients and included the use of antibiotics pre-operatively (2 g Mandokef; Eli Lilly, Vernier, Switzerland) and prophylaxis against venous thrombosis (heparin 5000 U and Sintrom (acenocoumarol; Novartis Consumer Health Schweiz AG, Bern, Switzerland) from the second post-operative day for six weeks). Post-operative rehabilitation consisted of mobilisation on the evening of the day of surgery or on the first post-operative day, partial weight-bearing for six weeks, and physiotherapy for three to six months.

The mean follow-up was for 10.2 years (8.3 to 12.1). Clinical assessment was in accordance with the International Documentation and Evaluation System (IDES) from the Institute of Documentation of the M. E. Müller Foundation in Bern, Switzerland. In addition, the Harris hip score was used for the evaluation of function. Radiological assessment. This included radiography of the pelvis, pubic symphysis and both hips. Osteolysis was defined as a new cystic lesion with endosteal scalloping and/or migration, which had not been recorded on the post-operative radiograph taken at six weeks. The radiograph at the latest follow-up was examined for radiolucent lines (> 2 mm) at the cement-bone interface which were rated according to the Gruen zones in which they were found. Fixation of the acetabular component was also inspected for osteolysis and radiolucency in zones I to III of DeLee and Charnley.

The stem was assessed for varus-valgus position. A varus-valgus malalignment was defined as a deviation from the longitudinal axis by more than 3°. The cement mantle was examined for fractures and subsidence within the mantle was measured as the distance between the upper circumference of the shoulder of the prosthesis and the sclerotic line above it. Ectopic ossification was assessed using the method of Brooker et al.

Statistical analysis. The data were analysed and descriptive statistics calculated using Excel 95 (Microsoft Corp, Redmond, Washington). Survivorship was corrected according to Kaplan and Meier.

Results
Clinical findings. The mean pre-operative Harris hip score improved from 73 (49 to 83) to 96 (72 to 100) post-operatively.

Table I. Details of the patients and implants

<table>
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<tbody>
<tr>
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<tr>
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<tr>
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<td></td>
</tr>
<tr>
<td>Female</td>
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<td>Mean age at surgery in yrs (range)</td>
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<tr>
<td>Men</td>
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<td>Women</td>
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<td>Died by end of 2001</td>
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<td></td>
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<tr>
<td>Unable to attend follow-up</td>
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<td>Number (%) clinically and radiologically followed up</td>
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<td>85 (70)</td>
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<td>Mean observation time in yrs (range)</td>
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<tr>
<td>Bilateral, two stages</td>
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<tr>
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<td>Bilateral, two stages</td>
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Fig. 3
Photograph of the uncemented Morscher press-fit cup.
operatively. The overall results were excellent in 73 hips (83%), good in 12 (14%) and fair in three (3%). None of the surviving 25 patients with differing bilateral hip replacements (MS-30 and contralateral Müller straight stem) indicated a preference for either hip. Two patients with only a fair post-operative result and migration of 2 mm and 4 mm respectively, but with no osteolysis or radiolucency, had severe dysplasia of the hip and their pre-operative Harris hip scores were poor (53 and 56, respectively). One patient with a club foot had only a fair score of 72.

Complications. Intra-operatively, there was one fracture of the greater trochanter and one of the proximal femur. These were stabilised with cerclage wire. Post-operatively, eight haematomas occurred. One dislocation was treated by closed reduction. There were no infections, no deep-vein thromboses and no deaths related to surgery.

Revisions. No revision, either of the MS-30 stems or of an acetabular component, was performed.

Radiological findings. Six osteolyses (6.8%) and 20 radiolucenties (22.7%) in one or more Gruen zones were found. Migration occurred in 22 hips, two (9.1%) of which showed osteolysis and seven (31.8%) radiolucent lines. In the 66 hips without migration, there was osteolysis in four (6.1%) and radiolucent lines in 13 (19.7%). The sites of the radiolucent lines and osteolyses are shown in Figure 4. In only one hip was a radiolucent line found to surround the cement mantle completely and the stem was therefore designated as radiologically loose. With the exception of this case, all subsidence took place within the cement mantle. Subsidence of less than 4 mm was found in 17 hips (19.3%) and between 4 mm and 5 mm in five (5.7%). No stem subsided more than 5 mm and no fracture of the cement was seen. Six hips with Brooker stage III peri-acetabular ossification were identified, but none had Brooker stage IV. One stem had a valgus displacement of 4˚ and seven a varus displacement of between 4˚ and 7˚.

Acetabular component. There were no osteolyses and no revisions of the acetabular component. Three radiolucencies with a sclerotic line were observed, two in zone I and one in zone II.

Discussion

Past experience with the Exeter stem, reported by Ling, Howie, Middleton and Costi and Malchau and Herberts, showed a significantly higher revision rate for matt than for polished stems. A higher rate of revision with cemented, roughened titanium than with cemented smooth stems was also recently reported by Hinrichs et al. By contrast in an earlier study, we found no difference between the two surface finishes of the MS-30 stem in regard to survivorship or subsidence, or to the incidence of osteolysis over a five-year period of observation. Spotorno et al reported a rate of revision for aseptic loosening of only 1% in a prospective, consecutive series of 197 hips with the polished FMS-30 stem (Zimmer Ltd) with a mean follow-up of 9.2 years.
When designing the MS-30 stem, the main goal was to improve the quality of the cement mantle without abandoning the proven concept of a tapered design. The rationale to allow a tapered stem to subside recognises that subsidence within a cement mantle fails to correlate with pain and allows the stem to restabilise, a phenomenon which we call the “second line of defence”. Subsidence is believed to reduce the tensile and shear loads of the cement, while increasing loading in compression.

Debonding, with subsidence of a tapered, collarless stem within the cement mantle, usually takes place within the first two years of surgery. Migration is faster in the first year, then becomes slower and stops after two years. In the present study, 25% of the MS-30 stems subsided up to 5 mm within two years of surgery. Osteolysis was seen in 2% and radiolucent lines in 8% after subsidence of between 2 mm and 5 mm had occurred. Continued subsidence after the second year, however, must be considered as definitive loosening.

By contrast, studies of the surface roughness of the stem and creep-induced subsidence by Norman et al., suggested that subsidence of the stem is not important for the maintenance of a taper-lock, and creep-induced subsidence does not result in an increase in the normal stress patterns at the stem-cement interface.

Our study shows that the clinical survivorship for both the cemented MS-30 stem with a matt surface and the uncemented Morscher press-fit cup is excellent (Fig. 5). The slightly higher rate of osteolysis and radioluency in cases of subsidence may be evidence for the superiority of a polished over a matt surface for tapered stems, as has been shown for the Exeter component. Further observations of patients with a matt-surfaced MS-30 stem are clearly indicated although it has been recently withdrawn from the market. This recommendation for further observation is supported by a number of studies which report that polished-surface cemented stems perform better than roughened stems and that subsidence of a polished stem is advantageous.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References