A REVIEW OF THE 2- TO 8-YEAR RESULTS WITH A PROXIMALLY FIXED NONCEMENTED THREADED MODULAR TOTAL HIP

H. U. CAMERON

A review of 50 cases of a proximally modular noncemented stem has been carried out. The primary method of fixation was a proximal threaded sleeve which was screwed into bone. Mean follow-up was 5.2 years. Six cases were revised, two for stem loosening. The remaining cases rate 69% excellent, 14.3% good, 11.9% fair and 4.8% poor. Two cases showed distal lucency due to polyethylene debris which leaked through the taper lock because of two vertical grooves. The results were felt to be adequate, but the threaded sleeve is too difficult to insert which lead to an alternative method of sleeve fixation. The longitudinal grooves, which were obviously a fault in design, have been removed.

Keywords : noncemented prosthesis ; hip.
Mots-clés : prothèse non cimentée ; hanche.

INTRODUCTION

The diameter of the medullary canal of the metaphysis bears no relationship to the diameter of the canal in the diaphysis (4). In an attempt to overcome this anatomical problem of achieving fit and fill, a modular stem was developed (3). The method of attaching the stem to bone was two-fold : a press fit of the distal stem in the diaphysis and attachment to the metaphyseal zone by means of a threaded sleeve which could be locked to the stem (fig. 1a, b, c).

Noncemented smooth threaded components have fallen out of favor in North America, but are still in use in Europe. A review of the results achieved with this stem seemed in order.

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MATERIALS AND METHODS

Stem design

The stem, manufactured by Joint Medical Corporation*, was the first version of the SROM stem. Smooth, circular and highly polished, it was split distally in the coronal plane like a clothespin to reduce bending stiffness. A longitudinal groove running the full length of the stem was placed on both sides at right angles to the coronal split.

The sleeve was circular and threaded with thin, sharp, self-tapping threads. It was attached to the stem by means of a Morse taper lock. Two pins were placed on the proximal stem which fitted into notches on the sleeve to give supplementary rotatory fixation to the taper lock. The stem material was 6Al4VaTi. The head was cobalt chrome, 28 mm in diameter, and attached to the stem by means of a further Morse taper lock.

Insertion technique

The medullary canal of the diaphysis was reamed until firm circumferential cortical contact was made. This gave the stem sufficient diameter. The metaphysis was then reamed conically until contact was made with the endosteal cortex. Initially it was felt that cancellous bone might have enough load-bearing capacity, but it soon became evident that this was not the case (fig. 2a, b). A sleeve of suitable dimensions was then screwed into the metaphyseal canal. The stem was introduced through the sleeve, the last few hammer blows locking the Morse taper.

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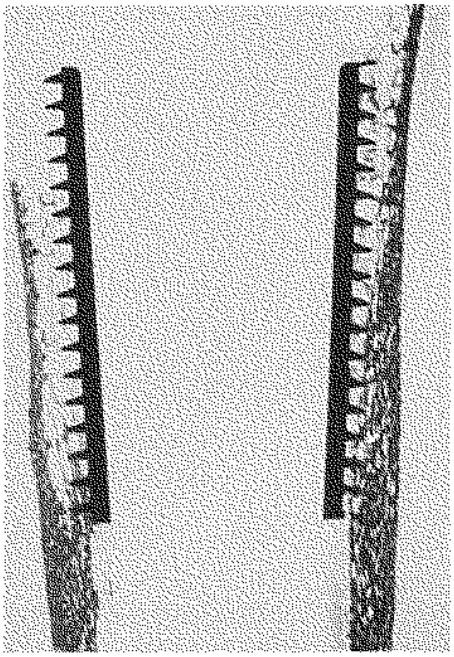

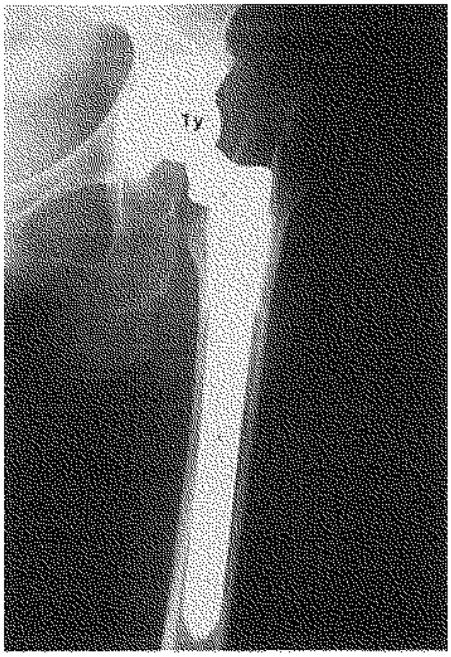

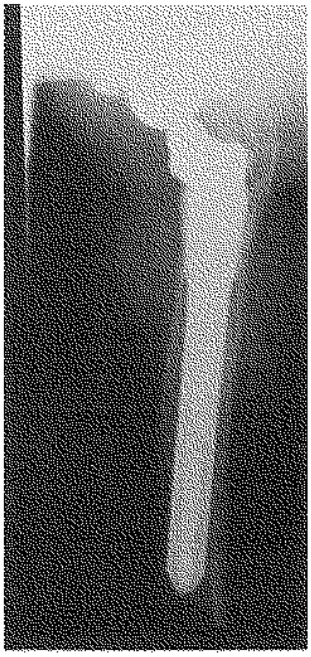

Fig. 1A *Fig. 1B* *Fig. 1C*

Fig. 1A. — The sleeve is threaded into the metaphyseal endosteal cortex as seen in this autopsy case retrieved shortly after insertion (courtesy of Dr. C. Engh and Dr. D. Bobyn).

Fig. 1B and 1C. — This patient had a Girdlestone procedure for a previously infected total hip replacement. The sleeve is of proper dimensions and fills the metaphyseal zone, making contact with the endosteal cortex. These xrays taken at 1 year have shown no subsequent change.

All patients were kept nonweightbearing for 8 weeks. The acetabular component used was the smooth-threaded SROM cup (2) with one bipolar and one small ingrowth socket.

All cases were operated by the author. The patients were followed prospectively at 3 months, 6 months and annually thereafter, and were rated using the Harris hip score (8). Radiographic examination consisted of an AP x ray of the pelvis and AP and lateral views of the hip. The radiologic rating was that of Gruen (7). The Engh (6) classification for noncemented components as modified by Dorr (5) was also used : i.e. type 1A — no lucency, type 1B — partial lucency not involving the ingrowth zone, type II — lucency involving the ingrowth zone, the lines being parallel to the stem, type III — lucent zones surrounding the implant, the lines diverging from the implant.

There were 50 cases, including 24 females and 26 males. The mean age was 48.4 years (range : 20-67 years). The disease process was congenital hip dislocation in 3 cases, epiphyseal slip in 3 cases, childhood septic hip in 3 cases, ankylosing spondylitis in 2 cases, avascular necrosis in 2 cases and juvenile rickets in 1 case. The others had primary osteoarthritis. Thirteen cases (26%) had previous surgery, which included a Girdlestone procedure for a previously infected total hip prosthesis in 3, intertrochanteric osteotomy in 5, fusion in 3 and revision of a total hip prosthesis in 2. Follow-up ranged from 2 to 8 years with a mean of 5.2 years.

RESULTS

Clinical results

Two cases were lost to follow-up at 2 years and 6 were revised, leaving 42 for review. The Harris rating was excellent in 69%, good in 14.3%, fair in 11.9% and poor in 4.8%. There were 40.5% with some groin or buttock symptoms and 19% with some thigh symptoms.

Fig. 2A. — This sleeve was undersized and fails to make contact with the endosteal cortex. Contact with a distal lateral endosteal cortex appears to be of considerable significance.

Fig. 2B. — At 6 years, there is lucency surrounding the sleeve. Some condensation of bone has occurred around the distal end of the sleeve. The patient remains asymptomatic.

Of the six that were revised, one required revision for a loose acetabular component only. Two had stem-loosening symptoms sufficient to require revision at 2.5 and 5 years. Two were revised for sepsis, one a previous sepsis reactivation at 3 years (fig. 3a, b). The same organism that had caused the original infection was cultured. One late infection occurred at 6 years. One patient, early in the series before revision stems were available, sustained a fracture of the femur below the stem tip at 2 months following the index operation and required revision using a different type of stem.

There were five calcar splits at the time of sleeve insertion, all of which required wiring.

Radiological results (42 patients)

Radiolucency on the AP x ray was complete in 2.4% of cases, high-grade, i.e. 4 or more zones, in 19%, low-grade in 59.5% and absent in 19.1%. The lateral x ray gave roughly similar results, being complete in 7.1% of cases, high-grade in 35.7%, low-grade in 38.1% and absent in 19%.

By the Engh-Dorr classification, if we assume that the threaded sleeve is comparable to the ingrowth zone in a partially porous coated prosthesis, which may be an unwarranted assumption, in the AP x ray 19% were type IA, 54.8% were type IB, 21.4% were type II and 4.8% were type III. The lateral x ray gave fairly similar results, being 21.4% type IA, 57.1% type IB, 19% type II and 2.4% type III.

Twenty-six stems were in a neutral position, and 18 were in some degree of varus. Those in neutral placement showed on the AP x ray 16% high-grade lucency, 56% low-grade and 28%, 0. Those in varus placement showed 26% high-grade lucency, 63.5% low-grade and 10.5%, 0. Canal fill measured at the isthmus was more than 80% in 38%, 73-79% in 31% and less than 72% in 31%. When this was compared with lucency, those with good canal fill on the AP x ray showed 12.5% high-grade lucency, 62.5% low-grade and 25%, 0. With intermediate canal fill, 16.7% showed high-grade lucency, 58.7% low-grade and 25%, 0. With poor canal fill, 38.8% showed high-grade lucency, 61.5% low-grade and 7.7%, nil.

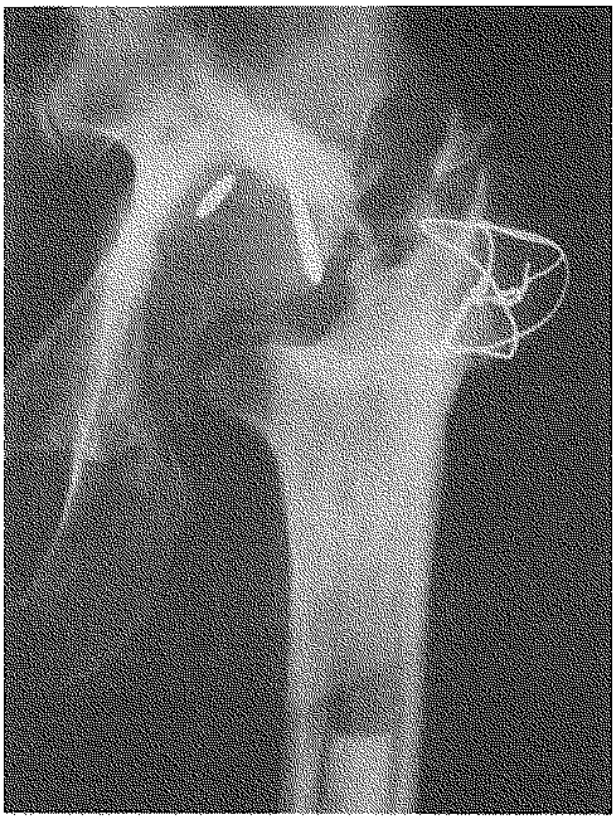

Fig. 3A

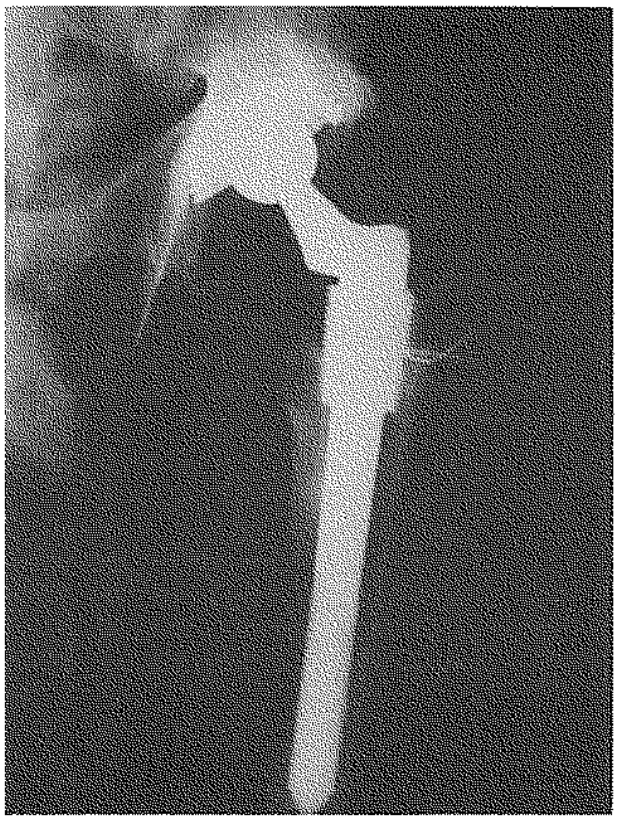

Fig. 3B

Fig. 3A. — This patient had a Girdlestone procedure for sepsis.
Fig. 3B. — The patient functioned well for 3 years and then the acetabular component loosened. He was found to be infected with the same organism as his original sepsis. The stem remained tight. Both components were removed, and the patient again left after a Girdlestone procedure.

Two cases showed oseolysis below the sleeve. No case showed sinkage of more than 2 mm.

DISCUSSION

The radiological results demonstrate the importance of achieving "fit and fill". Undersized stems show more radiolucency.

The high incidence of varus placement resulted from the inexperience of the author with straight stem prostheses which require a large back cut into the trochanter. As Engh has pointed out (6), the back cut must be large enough that the first circular reamer can be inserted by hand and not make contact with the side of the pilot hole. The newest version of the reamers for the SROM stem are no longer capable of end cutting. They are side cutting only and can be introduced over a 3.5-mm guide wire to ensure neutral placement.

Initially, it was also not recognized that threading into the endosteal cortex was very important, especially with respect to distal/lateral contact (1). Several of the initial sleeves and most of the sleeves inserted in varus were therefore undersized.

There were five (10%) calcar splits, indicating the difficulty with this system. The threaded sleeve had to make contact with the endosteal cortex. If there is little hoop stress, the fixation is not secure ; if there is too much, the femur splits. In retrospect, we feel that prophylactic cerclage wiring would have improved the situation.

Of these patients, 25% had had prior major surgery. In view of these factors and the young age of the patients and therefore high demand,

the results are reasonably acceptable, especially as the smooth threaded acetabular component has not given spectacular results in the long term (9).

One clear design error was the incorporation of longitudinal grooves on the stem which extended through the taper. These provided two channels for the passage of polyethylene debris through the taper to the distal stem, even in those cases where there was no lucency in the threaded-sleeve zone. This groove was removed from the second version of the stem, and since that time, only two cases of distal osteolysis have been seen, both in cases with radiolucency in the ingrowth zone of the sleeve which provided a channel for distal passage of polyethylene.

While the results could obviously have been improved with more experience and the elimination of insertion errors, the technical difficulties and long learning curve with this implant indicated that it was not really suited for general release. A porous-coated press fit sleeve was subsequently developed which is much easier to insert (3), along with other modifications such as elimination of the longitudinal grooves and fluting of the distal end of the stem for additional rotatory stability. The threaded sleeve version of this implant is therefore no longer in use.

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SAMENVATTING

H. U. CAMERON. Bespreking van de resultaten na 2 tot 8 jaar, van proximaal niet gecimenteerde geschroefde modulaire totaalprothese van de heup.

De auteurs beschrijven 50 totale arthroplastieken van de heup, met een modulaire, proximaal niet gecimenteerde steel.

De basistechniek was fixatie met een in het bot geschroefde proximale schede. De gemiddelde follow-up was 5,2 jaar.

Er gebeurden 6 revisies, waarvan 2 voor loslating van de steel. Bij 69% van de gevallen was het resultaat uitstekend, bij 14,3% goed, bij 11,9% aanvaardbaar en bij 4,8% slecht. Bij 2 gevallen was er een distale transparentie, i.v.m. polyethylene debris, die kunnen uitgesijpeld zijn langs de vertikale gleuven.

De resultaten lijken behoorlijk, maar de plaatsing van de geschroefde schede is zeer moeilijk, reden van oriëntatie naar een alternatieve oplossing. De longitudinale gleuven bleken nadelig en werden ook afgeschaft.

RÉSUMÉ

H. U. CAMERON. Résultats d'arthroplastie totale de hanche par prothèse modulaire, filetée, non cimentée. Revue des résultats avec recul de 2 à 8 ans.

Les auteurs revoient 50 arthroplasties totales de hanche, pratiquées à l'aide d'une prothèse fémorale, non cimentée, modulaire en sa partie proximale. Le principe de base est l'utilisation d'un segment fémoral proximal, modulaire, vissé. Le recul moyen est de 5,2 ans.

Six cas durent être repris, dont 2 pour descellement fémoral. Les résultats des 44 autres cas sont évalués comme suit : 69% excellents, 14,3% bons, 11,9% acceptables et 4,8% mauvais. Dans 2 cas on notait une transparence de l'extrémité distale de la prothèse, due à la présence de débris de polyéthylène, qui peuvent s'être écoulés le long des gouttières verticales, du système de blocage.

Les auteurs concluent que les résultats sont encourageants, mais que la pose du manchon fileté est trop difficile, ce qui oriente vers une technique de fixation différente. Les tranchées longitudinales étaient une erreur de conception et furent supprimées.