

Cementless total hip arthroplasty with a threaded acetabular cup

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Summary. *Eighty cementless total hip arthroplasties, using smooth threaded cups (Lord universal model), were carried out between 1985 and 1988. Sixty of these patients were available for clinical and radiological study with a mean follow up of 6 years. Five cups were revised for aseptic loosening and another 6 are awaiting revision, so 18% of the cups have failed. Fixation was classified as stable, fibrous-stable and unstable on radiographs. Twenty-six (43%) had fibrous-stable fixation and most were satisfactory clinically. This type of fixation must be carefully watched for signs of osteolysis, especially around the threads, as this precedes failure. Smooth threaded cups have good short term results, but deteriorate because of deficient osteointegration and later from wear debris. This type of cup does is not a good alternative to cemented cups.*

Résumé. *Etude rétrospective de 80 arthroplasties totales par prothèse non cimentée utilisant une cupule vissée lisse (de type LORD) faite entre 1985 et 1988. 60 cupules vissées ont pu faire l'objet d'une étude clinique et radiologique avec une durée d'observation moyenne de 6 ans (4 à 10). 5 cupules ont été reprises pour un descellement aseptique et 6 autres doivent être révisées prochainement. Si l'on considère ces deux groupes, il y a donc 18% d'échec pour ces cupules. Une classification radiologique de la fixation de la cupule a été retenue en 3 types: fixation stable, fixation fibreuse stable et fixation instable. Seulement 23 hanches (38%) montraient radiologiquement une*

fixation stable de la cupule. 26 (43%) avaient une fixation fibreuse stable correspondant à un bon résultat clinique dans la majorité des cas. Ce type de fixation doit être observé attentivement en recherchant des signes discrets d'ostéolyse notamment le long du filtage, car c'est habituellement un stade précédant l'échec de fixation. D'après notre étude, nous pensons que les cupules lisses vissées permettent un bon résultat clinique et radiologique à court terme mais que la qualité de la fixation se détériore rapidement, probablement à la suite de défaut d'intégration puis comme résultat de la réaction aux débris d'usure. Au total, nous pensons que ce type de cupule ne constitue pas une bonne alternative aux cupules cimentées.

Introduction

Failure of cemented total hip arthroplasties (THA) [4, 5], led to the use of cementless implants which achieved the same initial rigid fixation. Acetabular cups were at first porous coated, and later threaded for immediate fixation. This type had a smooth surface and an interference fit was obtained with the threads. Good results were reported initially [14, 17], but there has been a high incidence of failure with a 3- or 4-year follow up [3, 7, 10, 11].

This study reports the clinical and radiological results with smooth threaded cups with an average follow up of 6 years with the aim of determining their stability and efficacy.

Table 1. Merle D'Aubigne global scores before operation and at the final examination. Each parameter with its average scores (preoperatively and at the final visit) is also shown

	Preoperative	Final
Mean (SD)	8.4 (1.7)	14.3 (3.1)
Minimum/maximum	3 / 12	4 / 18
	Preop pain	Final pain
Mean (SD)	1.9 (0.8)	4.7 (1.1)
	Preop motion	Final motion
Mean (SD)	3.8 (1.1)	5.1 (1.1)
	Preop walking	Final walking
Mean (SD)	2.7 (0.7)	4.5 (1.3)

Patients and methods

Eighty primary cementless THAs were performed in 65 patients in our hospital between 1985 and 1988. The threaded cups have a smooth surface and are shaped like a truncated cone with a hole at the centre of its base, and deep screw threads on the outer surface. They are made of chrome-cobalt alloy and contain an interchangeable polyethylene liner (Lord universal model); a Roy Camille cementless stem was used (both components from Howmedica International Ltd, UK).

Sixty threaded cups in 50 patients were available for study with an average follow up of 6 years (range 4 to 10 years). Nine patients had both hips operated on. Two patients died at 2 and 3 years after operation from unrelated causes and were excluded. One patient with dysplasia had a revision after 14 months, when another threaded cup was inserted; this has been included.

The mean age at operation was 60.8 years (range 36 to 78 years). The primary diagnosis was osteoarthritis in 34, aseptic necrosis of the femoral head in 11, hip dysplasia in 7, ankylosing spondylitis in 3, fracture of the femoral neck in 2, rheumatoid arthritis in 1, Paget's disease in 1, and pigmented villonodular synovitis in the other.

Surgical technique

The operations were performed with the patient supine, using an anterolateral approach. A complete capsulectomy was carried out. The acetabulum was reamed down to bleeding bone and to the exact size of the cup, which was screwed in by hand. All the cups were fixed rigidly at the operation. Cancellous chip grafts were needed in 5 cases to fill cysts; in 2 cases with dysplasia an anterior superior graft was used.

Each patient was given antibiotics and antithrombotic prophylaxis. Partial weightbearing with crutches began at the 10th day, and full weightbearing was allowed at 8 weeks.

Clinical and radiological evaluation

This was carried out at 6 weeks, 3, 6, and 12 months, and then annually. Merle d'Aubigné hip rating scores [16] were recorded at each visit with special attention to pain.

Standard anteroposterior and lateral radiographs were taken after operation and at each follow-up; they were reviewed by the same observer (JFG). The lateral acetabular opening was related to a horizontal line drawn tangentially to the ischial tuberosities. Vertical and medial migration was also recorded.

Table 2. Correlation of the mean clinical score with patient diagnosis

Diagnosis	n-number	Mean
Osteoarthritis	34	15; 23
Avascular necrosis	11	14; 63
Rheumatoid arthritis	1	18; 00
Hip dysplasia	7	12; 00
Ankylosing spondylitis	3	11; 00
Hip fracture	2	10; 50
Other	2	13; 00

Table 3. Relation between the grade of cup fixation and the clinical score

Cup fixation	n	Mean (SD)
Stable	23	16; 00 (1; 53)
Fibrous stable	26	14; 57 (2; 58)
Unstable	11	10; 36 (3; 72)

Signs of reaction or bony remodelling of the acetabulum in relation to the cup were divided into 3 zones [6]: 1 – the superior threaded area; 2 – the base; 3 – the inferior threaded area. Reactive lines and the corresponding areas of radiolucency around the threads and base were recorded, as were areas of radiolucency that progressed or were greater than 2 mm. Osteolysis or bone resorption was carefully observed and recorded. Subsequently, radiographic fixation was classed as: (1) stable, with no reactive lines or osteolysis, and with only a slight change in position ($<4^\circ$); (2) fibrous-stable, with reactive lines, radiolucent areas up to 2 mm without progression, and change in position $<4^\circ$, and (3) unstable, with radiolucencies greater than 2 mm, progressive osteolysis or resorption, or a change in cup position $>5^\circ$. This classification was made by using Engh's criteria for femoral implants [8, 9], and heterotopic calcification was recorded by Brooker's grading [2].

Statistical methods

The goal was to compare the influence of different factors in the final outcome. A nonparametric analysis of variance, the Kruskal-Wallis test, was used. The results were significant at $P = 0.05$ or less.

Results

The average Merle d'Aubigné score at the last examination was 14.3 (SD = 3.2) with 47% of patients having a score of 16 or more after a mean follow-up of 6 years. The average preoperative score was 8.4 (sd-1.8). Three patients were worse than before operation.

Table 1 shows the Merle d'Aubigné scores before operation and at the final follow up. The patients did well at the end of the first year, but one

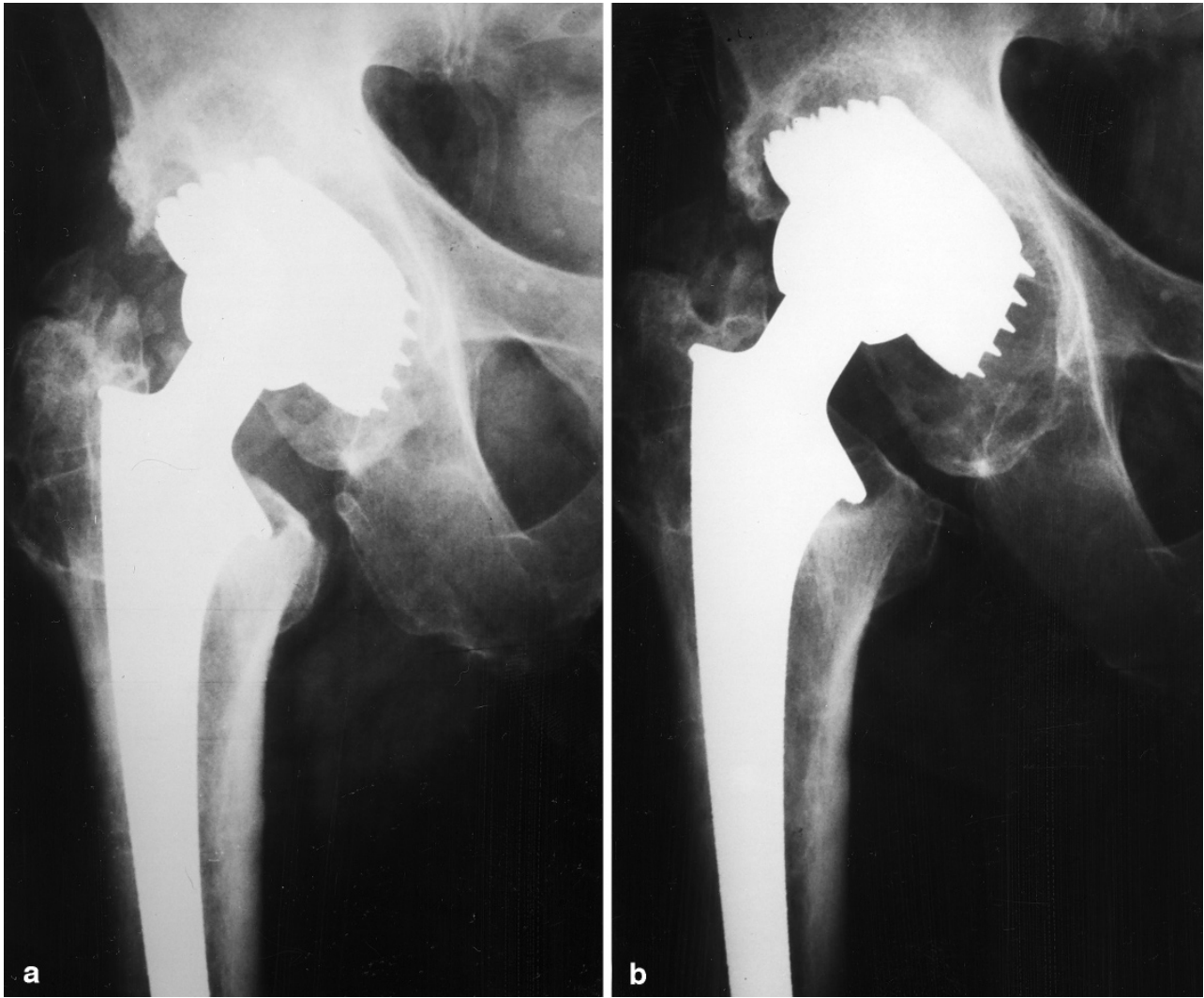


Fig. 1. a Radiograph of the hip of a man, 65 years of age, 4 years after THA. There is an area of osteolysis around the outer threads in zone 1, and also around the femur. The clinical result was satisfactory at this time. **b** One year later, the

osteolysis has progressed in zones 1 and 3, and the cup has migrated superiorly. Both components were revised 5 months later

needed a cup revision for aseptic loosening at 14 months.

Patients with osteoarthritis had significantly better clinical scores than the others ($P = 0.042$) (Table 2), except for the one with rheumatoid arthritis. There was a significant correlation between the final score and the type of cup fixation ($P = 0.0002$) (Table 3). There was no association with age ($P = 0.171$) or sex ($P = 0.121$). The grade of heterotopic ossification did not have any significant influence on the outcome, but those with grades 1 and 2 had higher clinical scores ($P = 0.192$).

Five cups have been revised, and 6 show marked signs of loosening and are awaiting revi-

sion. Seven cups with a fibrous-stable fixation have moderate symptoms, but are not yet bad enough to need revision. The other cups are satisfactory; 23 (38%) have stable fixation and 26 (43%) fibrous-stable fixation. These patients are free of pain or have only slight intermittent pain.

Revisions

Two of the 5 revisions had dysplasia and needed autogenous bone grafts from the femoral head to cover the cup. The first was a woman, 61 years of age, whose hip dislocated 3 weeks after THA and required revision with a hemispherical cup at 2 years. The second was revised at 14 months for

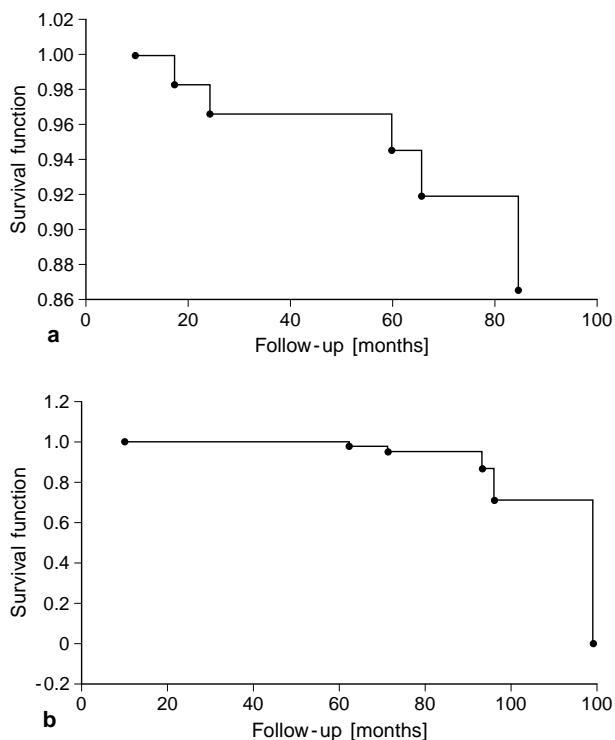


Fig. 2. **a** Kaplan-Meier survivorship curve, with 95% confidence intervals, showing the 5 threaded cups removed for loosening as the end points. **b** Similar curves with the 6 cups awaiting revision as the end points

aseptic loosening. The grafts had not fused and another threaded cup was inserted with new bone grafts, resulting in fibrous-stable fixation with slight symptoms at the last visit. The third patient, 75 years of age, had avascular necrosis and developed osteolysis in zone 2 which progressed to zone 3 with loosening; revision was carried out at one year.

The last two patients had osteoarthritis. A man, 65 years of age, needed revision 5½ years after operation because of progressive osteolysis in zones 1 and 3, with loosening (Fig. 1 a, b). The other, a woman, 54 years of age, had radiolucencies in zone 1 and osteolysis in zone 3; at revision the polyethylene was broken with signs of considerable wear.

Kaplan-Meier curves were used to describe survival in relation to the cups removed for loosening (Fig. 2a) and with the 6 awaiting revision as end points (Fig. 2b).

Radiological findings

Immediate postoperative radiographs showed a lateral opening of the cup (LOC) of 52.5°, range 32° to 70° (SD = 8.5) with 32 hips (53.3%) in the optimum position of from 35° to 55°. The contact fit was good in 80% of the cups. At the last visit, the overall average LOC was 49.9°, range 10° to 80° (SD = 13.9); 22 cups (36%) had migrated.

Reactive lines appeared in 74.6% of the cups; these were present in all 3 zones in 13 cases, 9 having a fibrous-stable fixation and 4 unstable fixation. Osteolysis was present in 13 cases, with gross progression in 5. The final fixation was stable in 23, fibrous-stable in 26, and stable in 11, which correlates with the clinical scores.

Complications

The most important complication was thromboembolism in 4 cases which needed treatment with anticoagulants for 6 months. There were no deep infections. Four dislocations occurred within the first 6 weeks. Two were treated by closed reduction, but the others needed further operation, the femoral component being changed in one, and both components were removed in the other following repeated dislocation. Fracture of the greater trochanter occurred in one and was treated by wire fixation.

Discussion

Various reports have indicated that threaded cups without a porous-coated surface, or without a biological substance enabling bony ingrowth, have good short term results which deteriorate with time [1, 3, 7, 10, 11, 19]. Aseptic loosening with the Lord cup has been recorded in 6.5% of cases after 4 years [11]. With a different type of smooth threaded cup, Engh et al. found radiological signs of instability in 21% of 130 patients with symptoms in 25% at a mean follow up of 3.9 years [7]. Fox et al. revised 17 cups (25%) at an average of 5.2 years, and had 9 additional cases awaiting revision (primary and revision THAs were included) [10]. Brujin et al. reported migration in 25% of another type of threaded cup with a follow up of 4.5 years, 6% being revised [3]. Roentgen-stereophotogrammetric analysis has shown that all threaded cups migrated, and that this began immediately after operation [20]. It has been suggested that high and continuous stress near the threads may not allow bony ingrowth [12], and may produce ischaemia and necrosis [13]. The

space created could be replaced by fibrous tissue which may be associated with loosening. A fibrous-stable type of fixation occurred in 43% of our patients, most of whom had a good clinical result, but in subsequent years they may develop loosening with polyethylene wear debris contributing to osteolysis [15, 18]. Only 23 cups were radiologically stable in our series.

Patients with osteoarthritis had significantly better scores than those with other diagnoses, with the exception of one patient with rheumatoid arthritis. Patients with dysplasia have not done well.

Other studies have shown that sex was a factor influencing the results of threaded smooth cups [3, 22], but we did not find any differences in clinical and radiological results. Four of the 5 patients revised were women, and there are 2 women in the 6 patients awaiting revision.

We have shown that smooth threaded cups do not give good clinical or radiological results after an average 6 year follow up, and have a relatively high incidence of failure. The radiological appearance deteriorates with time without an initial clinical correlation. Reactive lines do not necessarily mean loosening, but these cases should be watched carefully. Osteolysis indicates that failure will occur [21]. Our results at 6 years show that smooth threaded cups are not a good alternative to cemented implants and, in particular, this type of cup is not a good choice for dysplastic hips.

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