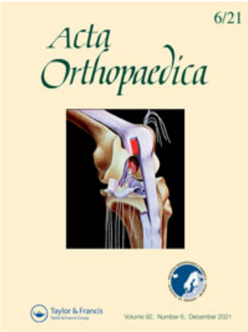

Acta Orthopaedica Scandinavica

ISSN: 0001-6470 (Print) (Online) Journal homepage: informahealthcare.com/journals/iort19

The isoelastic hip prosthesis followed for 5 years

Jean Butel & James E. Robb

To cite this article: Jean Butel & James E. Robb (1988) The isoelastic hip prosthesis followed for 5 years, Acta Orthopaedica Scandinavica, 59:3, 258-262, DOI: 10.3109/17453678809149357

To link to this article: https://doi.org/10.3109/17453678809149357

Published online: 08 Jul 2009.

 Acta Orthop Scand 1988;59(3):258–262

The isoelastic hip prosthesis followed for 5 years

Jean Butel and James E. Robb

In 1981 and 1982, 58 patients (61 hips) received an isoelastic noncemented femoral component and a bipolar cup for nontraumatic hip disease. Three patients were lost to follow-up and 8 died, leaving 47 patients (51 hips) for review after a minimum of 5 years. There were seven failures – two infections, four technical errors, and one migration of an acetabular component. Of the remaining 44 hips, 42 scored good or better at review.

Several cementless systems for hip arthroplasty are now available, most of them using immediate rigid fixation of a stiff femoral component to provide stability to promote bony ingrowth. One possible consequence of this is cortical atrophy, because the proximal femur is not subjected to physiologic loading (Brown and Ring 1985, Engh et al. 1987). Already, concern has been expressed over the fixation of porous coated prostheses and subsequent metal release (Buchert et al. 1986).

The senior author (J.B.) accordingly set out to design a nonrigid femoral component that would a) provide a unit composed of bone and prosthesis that *together* would have similar elastic properties as bone, b) allow bony ingrowth, and c) fit the natural curves of the femur and fill the medullary cavity. We report our experience with this femoral component used since 1981 in nontraumatic hip disease.

Patients and methods

Patients. Fifty-eight patients (63 hips) completed 5 years' minimum follow-up. Eight patients (nine hips) died – 1 immediately postoperatively and 7 of causes unrelated to hip surgery. Three patients were lost to follow-up. This left 47 patients (51 hips) for analysis (Table 1). The patients were evaluated prospectively using the method of Merle d'Aubigné (1970) and were seen annually. Standard anteroposterior and lateral radiographs were taken at the annual visit.

The prosthesis (Figure 1) The femoral component is made of one-piece forged stainless steel. There is the usual arrangement of stem, collar, and a 140° neck, and a 25-mm head for use with a bipolar cup. The stiffness of the stem was reduced by a rod construction that maintains volume. The surface area in contact with bone was extended by increasing stem length (Djerf and Gillquist 1987). The heads are available with three different internal lengths to provide a choice of neck length. The stem consists of four metallic rods in a range of diameters from 11 to 18 mm in 1-mm increments. The two lateral and two medial rods are linked distally and the two pairs connected by a stud. There is a 2-mm gap between the medial and lateral rods, and the gap can be obliterated by compressing the rods. This flexibility allows the component to fit the natural curves of the femur, to be firmly fitted within the femoral canal, and to permit a gliding of the medial rods in relation to the lateral rods. The proximal gap between the rods permits macro-ingrowth of bone.

Table 1. Patient details

Service d'Orthopédie Traumatologie, Centre Hospitalier Régional et Universitaire de Grenoble, BP 217 X 38043 Grenoble Cedex, France

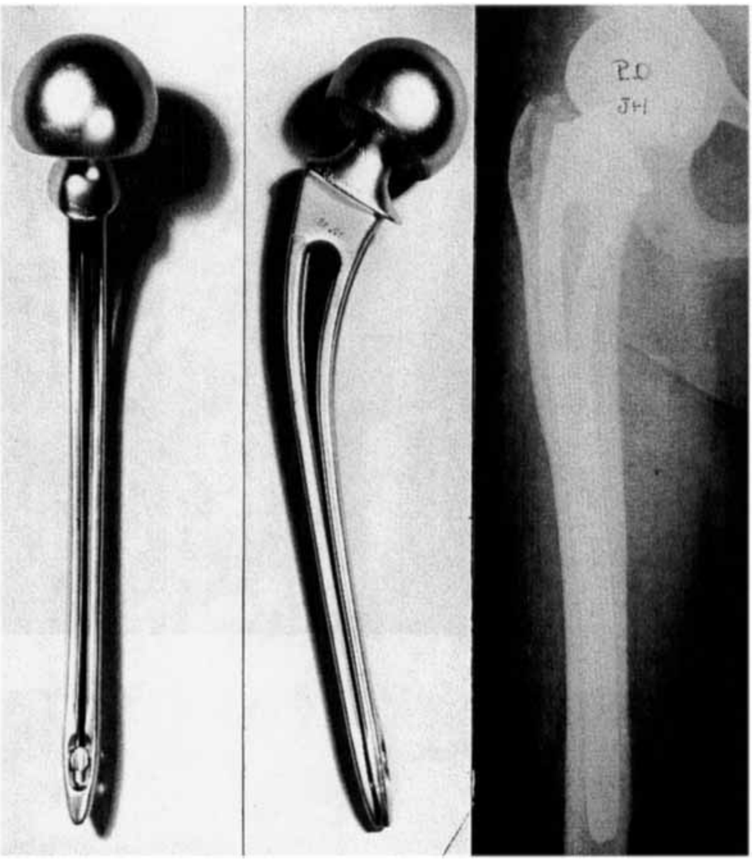

Figure 1. The Butel prosthesis with a bipolar cup and four stem rods.
The 2-mm gap between the ends of the medial and lateral rods can be obliterated by compression. The stem adapts to the femoral curve with three-point fixation between calcar, lateral cortex, and medial cortex distally.

Operative technique The posterolateral approach (Moore 1957) was used for implantation. A 1-cm stump of neck, as measured from the lesser trochanter, was left after resection. The acetabular cartilage was excised to subchondral bone and the cup size determined by a trial component. Where defects were present in the acetabular surface, autogenous cancellous grafts were used. The femoral canal was reamed with Charnley taper-pin reamers and a Moore rasp. The internal diameter of the canal was then assessed by gauges, and a stem of a diameter 2 mm greater than that observed on the gauge was inserted. An appropriate head and bipolar cup were then selected.

Normally the patient was mobilized fully weight bearing the following day. There were two exceptions to this: when an acetabular graft was used, the patient remained in bed for 4 to 6 weeks before being mobilized; and when a fissure in the calcar had occurred requiring cerclage fixation, weight bearing, but not mobilization, was delayed for 6 weeks.

Results

Disregarding the seven hips that failed, the average pain score improved from 1.5 to 5.8, range of motion 3.2 to 5.5, and walking ability 2.9 to 5.4 (Table 2). Forty-two of the 44 hips that did not fail scored good or better.

Thirty-five patients experienced postoperative discomfort in the groin, particularly when rising from a seated position. Four patients experienced postoperative thigh pain. Both types of discomfort resolved after 6 months.

Table 2. Overall postoperative scores according to Merle d'Aubigné (1970)

Total score	Result	Hips N 51
18	Excellent	17
17	Very good	11
16 15	Good	14
15 14	Fair	2
< 13	Failed	7


Figure 2. Implants in a 77-year-old man with arthrosis seen immediately postoperatively (left) and at 5 years (right). The clinical result was excellent, and there is bone ingrowth proximally between the rods.

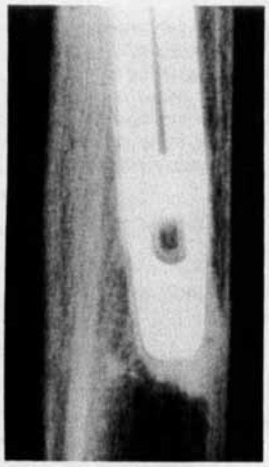

Figure 3

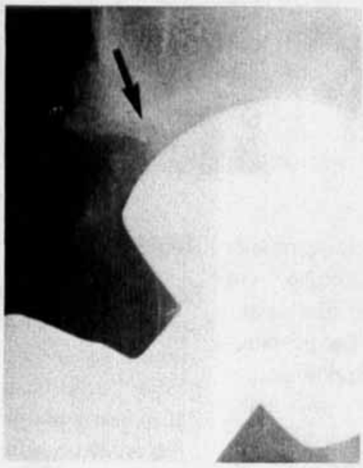

Figure 4

Figure 5

Figure 3. Condensation at the tip of the stem, bone ingrowth, and cortical thickening seen in a 76-year-old woman 5 years after replacement for osteoarthrosis. The clinical result was excellent.

Figure 4. New bone formation around the bipolar cup seen in a 72-year-old woman 6 years after replacement for osteoarthrosis. The clinical result was excellent. The arrow indicates the original acetabular margin.

Figure 5. New bone formation around the prosthetic neck seen in a 74-year-old man 5 years after replacement for arthrosis. The clinical result was very good.

The three hips that were revised to larger isoelastic stems scored on an average 17 or very good at a minimum of 4 years' follow-up. The patient who developed migration of the bipolar cup scored 14 or fair 1 year after conversion to a noncemented component. The 7 patients who died during follow-up scored on an average 16 at a mean of 3 years' follow-up.

Radiography Figures 2–5 show the normal features of the implant. The radiographic analysis of the 44 patients at 5 years' follow-up is summarized

Table 3. Radiographic assessment of the cup in 44 arthroplasties

	Number
Acetabular resorption	4
Acetabular preservation	40
New bone around cup	12
Heterotopic bone	9

Table 4. Radiographic assessment of the stem in 44 arthroplasties

	Number
Proximal bone ingrowth	31
Condensation around tip	27
Linear condensations	8
Calcar resorption	1
New bone around neck	16
Femoral atrophy	0

rized in Tables 3 and 4. Acetabular resorption, evaluated by the method of Collet et al. (1985), was 2–4 mm in 4 cases and less than 2 mm in 40 cases. Heterotopic bone was seen in 1 case only. On the femoral side, calcar resorption less than 2 mm occurred in 2 patients.

Complications. One patient died 48 hours postoperatively of massive upper gastrointestinal hemorrhage secondary to alcoholic liver disease. There were 2 patients with sciatic nerve palsies; 1 recovered partially and the other fully. There were seven failures: two due to early postoperative sepsis, four due to technical error, and one due to migration of the bipolar component. The technical errors comprised the use of too small stems in four hips resulting in persistent thigh pain in three hips and stem breakage in the fourth (Figure 6). The hips with thigh pain were either revised to a larger stem (two hips) or converted to a cemented implant (one hip). The case of stem breakage was revised to a larger stem. The seventh failure arose as a result of migration of a bipolar cup; this was exchanged with an acetabular ring 3 years after primary surgery.

Discussion

The advantage of our femoral component lies in its ability to adapt to the natural curves of the femur. Most patients experienced mild groin or thigh pain for a period postoperatively, probably

Figure 6

Figure 7

Figure 6. Bone ingrowth in the proximal part of the femoral component: The prosthesis was changed 3 years after operation because of an acetabular protrusion.

Figure 7. Technical error: stem too small for a patient weighing 85 kg; breakage after 18 months.

because of stabilization of the cup in the acetabulum and the stem in the femur. This type of postoperative discomfort is not seen after successful cemented total hip replacement and represents a disadvantage of cementless arthroplasty.

We have yet to fail to extract a stem even when bone is found between the rods (Figure 6). The low percentage of calcar resorption indicates that there is little stress shielding in this region. New bone formation comprised macro-ingrowth into the proximal rods of the femoral implant and periprosthetic new bone around the neck and cup. These are favorable signs and should be distinguished from heterotopic bone formation. Atrophy of the femoral cortex was not found in this series. Condensation of bone at the tip of the stem may occur for two reasons. First, impaction of the stem can compress medullary bone at implantation and secondly, more importantly, condensation presumably arises from gliding of the medial rods against the lateral cortex. This indicates physiologic loading of the implant and a favorable bony reaction, which should not be confused with gross movement occurring between the stem as a whole and the femur, indicating loosening.

The four technical errors occurred early on in the series until the problem of relating stem size to either the weight of the patient or to the size of his femur was recognized. Insertion of a stem too small for the patient's weight or for the medullary cavity of the femur results not only in thigh pain due to deficient anchorage, but also in loss of calcar height due to a piston effect and eventual stem breakage. As a result of these experiences, guidelines based on fatigue tests are given for the correct use of stem size in relation to the patient's weight (Table 5). The other error that occurred was that of the case with subluxation of a bipolar cup secondary to lysis of a banked bone graft – an acetabular ring should have been used instead supplemented by autogenous bone graft.

Table 5. Recommended stem sizes in relation to a patient's weight

Patient's weight (kg)	Stem size (mm)
<60	13
60–70	14
70–75	15
75–80	16
80–85	17
>85	18

The future of cementless hip replacement remains uncertain, for the length of follow-up does not yet approach that of cemented systems, which remain the gold standard for comparisons.

References

Collet C, Grosdidier G, Coudane H, Borrelly J. Anatomical basis for study of acetabular migration of the prosthetic cup used in arthroplasty of the hip: a new technique for measurement of migration. Anat Clin 1985;7(3):171–3.

Djerf K, Gillquist J. Calcar unloading after hip replacement. A cadaver study of femoral stem designs. Acta Orthop Scand 1987;58(2):97–103.

Engh C A, Bobyn J D, Glassman A H. Porous coated hip replacement. The factors governing bone ingrowth, stress shielding, and clinical results. J Bone Joint Surg (Br) 1987;69(1):45–55.

Merle D'Aubigné R. Cotation chiffrée de la fonction de la hanche. Rev Chir Orthop 1970 Jul;56(5):481–6.

Moore A T. The self locking metal hip prosthesis. J Bone Joint Surg (Am) 1957;39:811–27.