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SURFACE REPLACEMENT ARTHROPLASTY OF THE HIP

Experience with the ICLH Method

P. HERBERTS, O. LANSINGER and B. ROMANUS

Department of Orthopaedic Surgery II. East Hospital, University of Göteborg, Göteborg, Sweden

Fifty-six ICLH-surface replacement arthroplasties of the hip were followed up prospectively for 1 to 6 years postoperatively, mean 2.5 years. Fifty-one hips had osteoarthritis and five rheumatoid arthritis. Pain, motion, walking ability, and function were considerably improved after surgery. It is our impression that the clinical results were equal to those obtained by conventional stemmed hip arthroplasties. Complications were recorded in nine hips, with femoral neck fracture in two, loosening of both components in two, and loosening of the acetabular component in five. Three of the failures occurred in the five hips with rheumatoid arthritis. The high failure rate is disturbing, and we now limit the indications for this procedure to patients with osteoarthritis, 40–60 years of age, and with good bone stock.

Key words: arthroplasty; hip joint; prosthesis; resurfacing arthroplasty

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Surface replacement arthroplasty has been advocated as an alternative to conventional total hip replacement in younger patients. Although some of the early proponents of the concept have abandoned the procedure because of reported failure rates as high as 58% (Furuya et al. 1978), others still prefer it in selected cases (Wagner 1978, Amstutz 1982, Freeman & Bradley 1982).

The principle of resurfacing arthroplasty is to replace only the diseased surface of the hip, while preserving more normal anatomy and biomechanical function of the joint. This type of conservative arthroplasty offers several advantages compared to conventional total hip procedures. The preservation of the femoral neck and head permits satisfactory salvage procedures in case of failure. The relative ease of salvage has led to gradual expansion of the indications for the operation to include patients younger than those undergoing conventional total hip replacement. Other advantages are that the medullary canal is not violated and a smaller amount of artificial material is implanted. Moreover, surface replacement may be more adaptable to certain anatomical situations, such as a previously osteotomized or fractured femur, which had healed with improper alignment.

The purpose of this paper is to report our results and complications with the ICLH (Imperial College – London Hospital) resurfacing hip prosthesis, and to evaluate possible reasons for the failures.

PATIENTS AND METHODS

The ICLH resurfacing hip prosthesis consists of a metal femoral component which caps the prepared femoral head, and a polyethylene acetabular component (Figure 1). Both components are fastened with polymethylmethacrylate.

Sixty-three hips in 57 patients were replaced with the ICLH prosthesis at the Department of Orthopaedic Surgery, East Hospital, Göteborg from October 1978 through October 1982. An additional patient, operated on in 1976 by M. A. Freeman when he introduced the

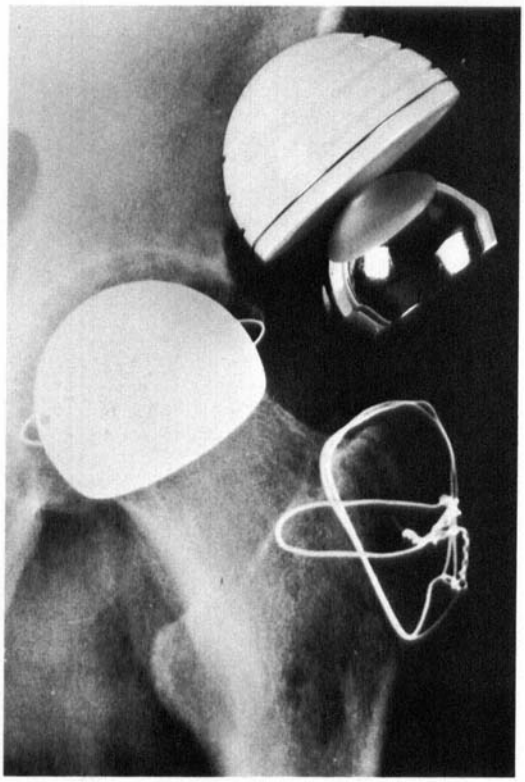


Figure 1. Radiograph of the left hip in a 60-year-old man 1 year after resurfacing hip arthroplasty with a superimposed ICLH prosthesis.

method to us, has been included in the material, which thus comprised 64 surface replacement arthroplasties. Thirty-three patients were women and 25 men, with a mean age of 57 (35–72) years.

Twenty-nine of the 58 patients had bilateral hip disease, and six patients had both hips replaced with the ICLH prosthesis. Another six patients had earlier been operated in the contralateral hip: four with total hip replacements, one with osteotomy, and one with arthrodesis. Four patients had been operated upon previously in the ipsilateral hip: two with osteotomies, and two with osteomyelotomies.

Indications

The general indications were degenerative changes in the hip joint associated with severe pain and functional disability. However, compared to conventional total hip replacement, the selection of patients was largely limited to those with radiographic evidence of good bone stock in the femoral head and acetabulum. Age at operation was another consideration; we used the procedure primarily in younger patients, and in patients who were otherwise healthy and lived fairly active lives.

The diagnosis was osteoarthritis in 52 hips, rheumatoid arthritis in 5, posttraumatic arthritis in 1, congenital dysplasia in 4, and non-traumatic necrosis in 2 hips.

Surgical procedure

The operative procedure was standardized by using a specific set of instruments, and carefully following the description of the method (Freeman et al. 1975). Two surgeons performed all the operations in a conventional operation theatre. Prophylactic antibiotics were given routinely. The patients were placed in the supine position with the hip slightly elevated. A posterolateral incision was used. In the first 50 operations the hip joint was approached from the front as well as from the back without osteotomy of the greater trochanter. Later, we changed our technique; in the last 14 operations a shallow trochanteric osteotomy was made. The trochanteric osteotomy greatly facilitates the procedure, which demands a precise and careful technique for preparation, cementing and positioning of the implants.

Follow-up

Five hips have had revision arthroplasties for femoral neck fracture in two and implant loosening in three hips. One patient has been excluded because she did not cooperate. Two patients were recently operated upon and have only been followed for 6 months. There were thus 56 functioning ICLH hips in 50 patients which have been followed postoperatively for at least 1 year with a mean of 2.5 years.

Radiographic examination

Radiographic examination with standardized anteroposterior and lateral projections was performed together with the clinical examination. The width of the dark zone of demarcation between the cement and the bone of the acetubulum was measured in the radiographs without correction for 10% magnification (DeLee & Charnley 1976). The width usually varied at different sites; it was recorded at the widest location as less than 1 mm, 1–2 mm, and over 2 mm, and its distribution around the circumference of the socket was divided into three zones. On the femoral side only changes of the position of the metal cup were recorded.

RESULTS

The results were evaluated by the 1–6 point score system (d'Aubigné & Postel 1954) with respect to pain, walking capacity and hip motion (Table 1).

Table 1. Effects of surface hip arthroplasty on pain and function

Preoperatively			Points	Postoperatively		
Pain	Walking	Motion		Pain	Walking	Motion
–	–	–	6	44	30	22
–	1	1	5	6	7	21
1	1	21	4	6	11	11
4	15	22	3	–	2	1
12	33	9	2	–	–	1
39	–	3	1	–	–	–

Fifty patients were free from *pain.* The *functional ability* was considerably improved; 37 patients had a good walking capacity. Ten of the 13 patients with less then 5 points had bilateral hip disease. Forty-three hips had good *motion.* Heterotopic bone had formed in 7 of the 13 hips with less than 5 mobility points; in four of these hips it was severe.

Radiographic evaluation

In 37 hips, the demarcation zone was less than 1 mm, in 14 hips 1–2 mm, and in five hips the zone was over 2 mm. Three of the latter scored 4 points for hip pain (Table 2); two of these are scheduled for reoperation. The zone of demarcation was distributed around the whole circumference of the socket in all hips but two, where it was located in the superolateral part.

Heterotopic bone formation was observed in 14 hips, mild in five, moderate in five, and severe in four hips. Changes leading to a significant final limitation of motion were observed in one hip only.

Table 2. Radiographic demarcation and hip pain following surface arthroplasty

Zone of demarcation (mm)	Pain points 6	5	4	No. of hips
<1	31	5	1	37
1–2	11	1	2	14
>2	2	–	3	5

Complications

Only six patients had early complications, including four with thrombotic disease without pulmonary embolism, and two with transient femoral nerve palsies.

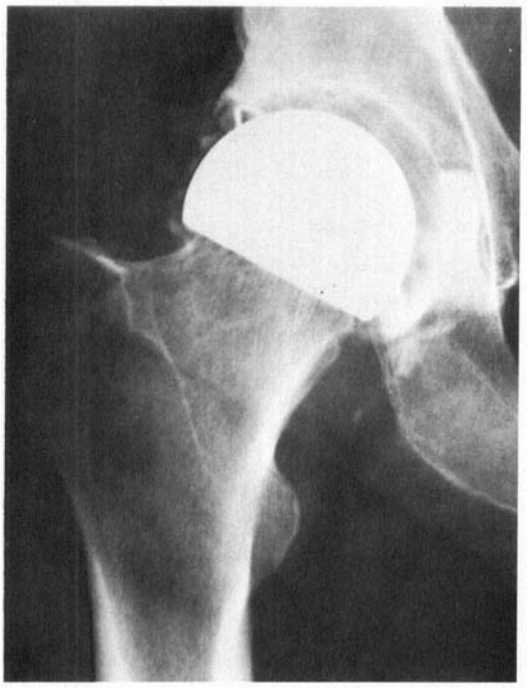
Late prosthetic complications (Table 3) are presented as case reports.

Femoral neck fractures. Two patients sustained femoral neck fractures. One was a 62-year-old woman with rheumatoid arthritis, and the other a 56-year-old man with osteoarthritis, liver disease and spherocytosis. Both had osteoporotic bone and sustained their fractures 3 months postoperatively without preceding trauma. Both hips were converted to Charnley arthroplasties and have made uneventful recoveries with follow-ups of 2 and 3 years, respectively.

Prosthetic loosening. Revision arthroplasty for prosthetic loosening was required in four hips.

Table 3. Late complications following surface hip arthroplasty. (Osteoarthritis (OA) 51 hips; Rheumatoid arthritis (RA) 5 hips.)

Complication	No. of hips OA	RA
Femoral neck fracture	1	1
Prosthetic loosening		
Acetabular cup	3	2
Acetabular and femoral cups	2	–
Total	6	3



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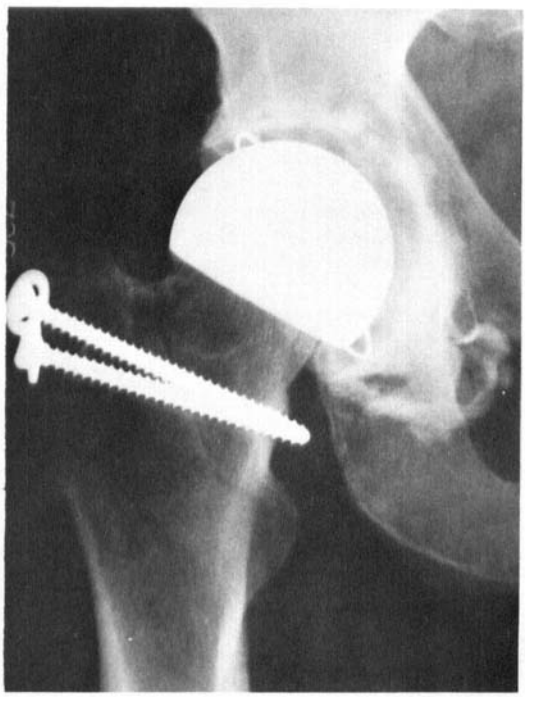

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Figure 2. A: Radiograph of the right hip in a 56-year-old woman (Case 2) with rheumatoid arthritis 3 months after the arthroplasty. B: One year after the operation the radiograph showed loosening of the acetabular cup. C: Three years after reoperation. No sign of loosening. The patient was pain-free on normal walking.

Case 1. A 37-year-old man with osteoarthritis secondary to an acetabular fracture developed increasing hip pain 6 months after the arthroplasty. After 1 year the radiogram showed a radiolucent zone of 2 mm around the cement in the acetabulum. He was reoperated with a cementless total hip replacement. At the operation it was obvious that the acetabular cup was loose; however, no loosening of the femoral component could be detected.

Case 2. A 56-year-old woman with rheumatoid arthritis had a loose acetabular component after 1 year. She subsequently developed increasing hip pain. The acetabular cup was reimplanted with success. Three years after the reoperation she was pain-free on normal walking and showed no sign of demarcation (Figure 2).

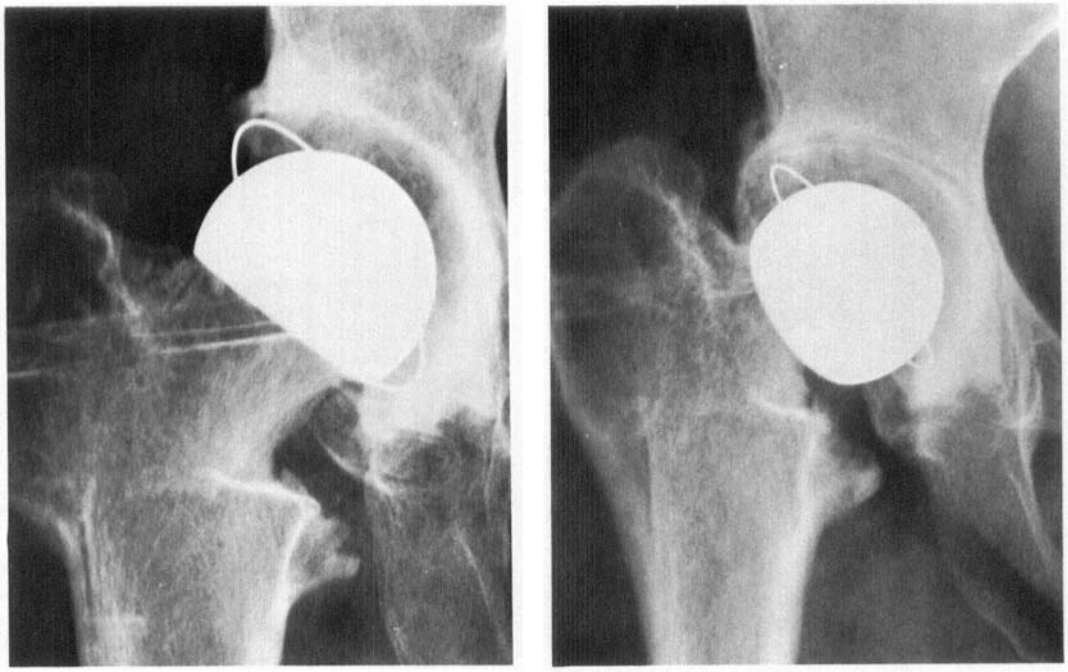

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Figure 3. A: Radiograph of the right hip in a 58-year-old woman (Case 4) with osteoarthritis 3 weeks after the arthroplasty. B: Two years after the operation, the radiograph showed a demarcation over 2 mm around the whole socket and loosening of the femoral component.

Case 3. A 55-year-old woman with osteoarthritis developed increasing hip pain 1 year postoperatively, and a 2.5 mm zone around the whole circumference of the socket was observed. At the reoperation, it was verified that both components were loose, and a Charnley prosthesis was implanted without difficulty. After 2 years, she was doing well, without hip pain.

Case 4. A 58-year-old woman with osteoarthritis, who 4 years earlier had undergone femoral osteotomy, developed increasing hip pain and functional disability 2 years after the double cup arthroplasty. The radiogram showed a demarcation zone over 2 mm around the whole circumference of the socket and also loosening of the femoral component. She was reoperated after 2.5 years. Both prosthetic components were loose. A Charnley prosthesis was implanted without difficulty. She was doing well 1 year after the reoperation and had no pain (Figure 3).

Another three patients, one with rheumatoid arthritis and two with osteoarthritis, had clinical and radiographic evidence of loosening of the acetabular component; two of these patients are scheduled for reoperation.

Reoperations. We have reoperated six patients, and another five have radiolucent lines of more than 2 mm. Two of these patients are pain-free with non-progressive radiolucent lines and they have not been classified as failures. Altogether, nine hips have failed.

DISCUSSION

With the application of current knowledge of materials, the double cup method has appealed to a number of orthopaedic surgeons. From 1971 to 1975, five relatively different designs appeared: those of Patrinieri & Trentani, Freeman, Eicher & Capello, Wagner, and Amstutz, which all combined cup arthroplasty and conventional total hip surface replacement (Capello et al. 1978). As longer follow-up studies of surface arthroplasties have begun to appear, it has become evident that the initial good results have not lasted (Capello & Trancik 1981, Trentani & Vaccarino 1981, Amstutz 1982, Freeman & Bradley 1982).

Failures after surface replacement are most commonly reported on the femoral side. Many reasons for these failures have been proposed, such as improper operation technique, necrosis of the femoral head, and inadequate bone stock (Jolley et al. 1982). Amstutz et al. (1981) and Freeman & Bradley (1982) attributed many of their early failures to faulty patient selection and technical errors. Scoring of the femoral neck as the head is reamed weakens the neck and increases its susceptibility to fracture. A varus position tends to increase the compressive and shear stresses at the rim of the prosthesis, and increases the risk of fracture of the femoral neck, and of loosening. Most authors stress the importance of a valgus position of the femoral component (Capello et al. 1978, Freeman 1978, Wagner 1978). Inadequate cementing technique also contributes to early loosening.

It is not entirely clear how much necrosis of the femoral head contributed to failure of surface replacements. (Head (1981) reported a failure rate of 34%, and concluded that this was due to damage to the retinacular vessels during reaming of the femoral head. Freeman (1978), on the other hand, stated that the major blood supply to the femoral head in an adult arthrotic hip is derived from intraosseous vessels within the femoral neck. In our series there was evidence of necrosis of the femoral head in two of our six reoperations.

The failures in our series were on both the acetabular and the femoral side. Loosening of the acetabular cup may in time become more frequent. Wear of the relatively thin acetabular component may become an increasing problem. Since the procedure is often used in younger people who are expected to be quite active for many years, this problem may soon be more than just a potential one. The lesser rigidity of the thinner acetabular cup may also lead to undesirable stress transmission to the thin cement and bone-cement interface, resulting in fatigue failure of the bone, and loosening (Carter et al. 1981, 1982). The acetabular component used in this study was hemispherical; this leads to impingement problems and gripping of the femoral component.

One important requirement for surface replacement is an adequate bone stock on both the femoral and acetabular side. Osteonecrosis and conditions that result in osteoporosis and resorption of bone, such as inflammatory arthritis, are therefore relative contraindications. Three of the nine failures in our series occurred in the five hips with rheumatoid arthritis. Others have had the same experience. Freeman & Bradley (1982) noted that 15% of the failures occurred in patients with rheumatoid arthritis and 20% in patients with rapidly progressing osteoarthritis with an associated inflammatory reaction. Capello et al. (1980) and Jolley et al. (1982) found that more complications occurred in patients with inflammatory arthritis, and Trentani & Vaccarino (1981) did not recommend surface replacement for patients with advanced osteoporosis and rheumatoid arthritis.

We conclude that our results with the ICLH resurfacing hip prosthesis are as good as with conventional total hip replacement with respect to pain and function. However, we have noticed a significant number of complications relatively early; several of them are specific to the method. Our failure rate of 14% is too high with this short follow-up. The method must be improved, especially on the acetabular side. This has also been recognized by the inventors; the ICHL-acetabulum cup has now been redesigned (Freeman 1982).

The surgical technique is demanding, especially the cementing technique on the acetabular side. For the past 2 years, we have made several minor holes in the bone and also have used low viscosity cement and a cementing gun to intrude the cement into the trabecular bone. The introduction of metal backing on the acetabular component might improve the fixation, as suggested by Harris & White (1982). The use of cementless fixation with porous titanium (Hedley et al. 1982) or polyethylene acetabular components (Freeman 1982, Morscher et al. 1982) might prove to give reliable fixation of the acetabular implant.

The selection of patients is very important, and the quality of bone must be good. We now feel that the most suitable patients are those between 40 and 60 years of age, with osteoarthrosis grade

I–II (Wroblewski & Charnley 1982) and mainly loss of cartilage, but grossly normal anatomy and bone quality.

At present, we feel that this method of surface replacement of the hip joint needs further improvement and careful evaluation at special centres. It is our impression that the surgical technique is demanding and less forgiving to the surgeon than conventional hip arthroplasties. With improved fixation of the acetabular cup, we feel that a cautious optimism is warranted. It is our experience that surface replacement allows a unique second line of defense when a reoperation is necessary.

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Correspondance to: Peter Herberts, M.D., Ph.D., Department of Orthopaedic Surgery II, Sahlgren Hospital, S-413 45 Göteborg, Sweden