The PCA unicompartmental knee

A 1–4-year comparison of fixation with or without cement

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Totally, 93 knees were operated on with the PCA unicompartmental knee for gonarthrosis Stages I–III according to Ahlbäck. The clinical findings for 84 arthroplasties with 1–4 years' follow-up showed 82 excellent or good results. The mean postoperative flexion was 124°. The position of the tibial component was respectively 86°and 89° in the AP and lateral views. The mechanical axis was slightly undercorrected.

There were two failures, both with persistent pain on walking. One failure was among 43 uncemented knees, whereas the other was among the 41 cemented arthroplasties. Four uncemented arthroplasties had a first steps' problem but were satisfactory otherwise. There was no infection or clinical loosening. A reoperation was performed in 1 case, in which a symptomatic osteophyte was removed.

When compared with our earlier Marmor series, the PCA unicompartmental arthroplasties were better. The cemented arthroplasties had a somewhat higher frequency of complete pain relief. An uncemented arthroplasty should only be considered in special situations.

In general, the results of a unicompartmental knee arthroplasty have been satisfactory. It has a low complication rate; and after 5 years, it has more than a 95 percent prosthetic survival as estimated by the life-table method in the Swedish national survey (Bauer et al. 1987).

We report early clinical and radiographic results with the PCA unicompartmental endoprosthesis, randomized with respect to the use of cement.

Patients and methods

During the period December 1983 through November 1986, 93 consecutive primary PCA unicompartmental knee arthroplasties were performed in Lund; (Table 1). All the patients had disabling pain on weight bearing with a maximal painfree preoperative walking distance of 100–500 meters. One fourth of the patients also had disabling pain at rest. There were nine knees in 8 patients that were excluded from the clinical follow-up because of the development of rheumatoid arthritis (two knees), unsuitable because of severe neurologic disease (three knees), and death (four knees).

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Clinical follow-up was made in 59 female and 25 male knees. The average age of the patients was 73 (53–90) years. The diagnosis was femorotibial arthrosis Stages I–III (Ahlbäck 1968): viz., 75 medial and 9 lateral.

The patients were interviewed and examined according to a predetermined protocol. Postoperatively, they were examined at 6 weeks, 3 and 6 months, and then annually.

Operative technique

The operation was generally performed in a controlled air enclosure and with prophylactic antibiotics. In the cemented cases, cement with gentamycin (Palacos®) was used. A straight midline skin incision, followed by a medial parapatellar capsular incision was performed for both medial and lateral arthroplasties. The prerequisite for a uniknee was that the other femorotibial compartment and the cruciate ligament function were normal. After removal of osteophytes from the condyles and patella, the guide instruments were used in all the steps of the operation to control the position and interrelation of the components. The mechanical axis of the leg (HKA) was intentionally undercorrected by a few degrees to avoid overcorrection. The position of the prosthesis with respect to the bone was carefully checked, as well as the relation between the patella and

the femoral component. The range of motion and mediolateral stability were also checked, the latter to permit a physiologic side laxity of a few degrees.

When the spongious bone quality was good, lavage and cement injection by a pressure syringe was used; when the bone was hard and sclerotic 4–6 cement anchoring holes in different directions were made.

After Case 30, the use of cement was randomized. The randomization was done at surgery, when the bone quality was good and the position of the trial prosthesis on the bone was flush and stable during the entire range of motion. Cement was used when these requirements were not met.

Radiographic examination

The classification of arthrosis and the measurement of the deviation of the mechanical axis were based on weight-bearing films of the affected limb (Figure 1). Postoperative radiography was performed the day after surgery before the patient was mobilized. The frontal projection was obtained at a 90° angle from a true lateral exposure determined by superimposing the posterior aspects of the two femoral condyles using fluoroscopy. The medial and posterior angles between the mechanical axis of the tibia and the tangent of the articular surface of the tibial component were determined in the anteroposterior (AP) and lateral projections. The

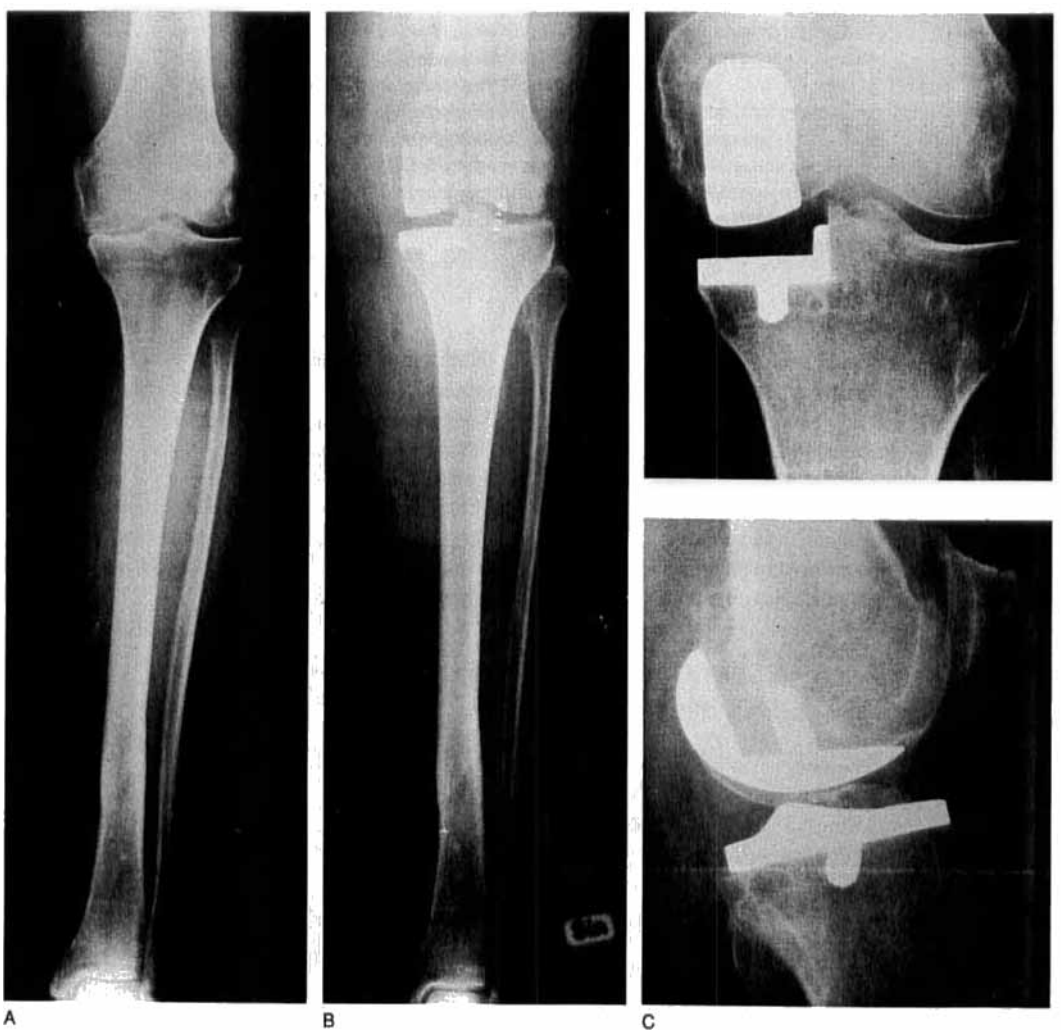

Figure 1. A 65-year-old women with Stage III medial gonarthrosis.
A. Preoperatively, weight bearing.
B. Postoperatively, uncemented arthroplasty.
C. Close-up showing optimal position with no radiolucency.

position of the femoral component was determined on short-knee radiographs. From the whole-leg examination, the alignment was determined as the lateral angle between the lines from the tibial eminence to the centers of the hip and the ankle joints, respectively . To study the interface, fluoroscopic close-up views were obtained on both AP and lateral projections; these showed a true tangential view of the undersurface of the tibial and femoral components and the interface.

Results

Two patients, 1 immediately postoperatively and 1 during the early postoperative period, became hemiparetic. One hemiparesis was stationary and one completely regressed during follow up. The early complications included one knee with a pronounced hematoma. Among late complications, one knee was reoperated on; an osteophyte was removed from the medial femoral condyle and the patient became asymptomatic. One patient sustained a supracondylar femoral fracture, which healed by closed reduction and casting; the end result was good. There were no further complications in this material; and, particularly, there were no cases of infection or loosening.

By subjective assessment, 59 knees were much improved, 23 improved and 2 unimproved. The Hospital for Special Surgery score gave a mean of 47 points before surgery and 91 points at follow up. The postoperative range of motion was 124° (70–140°). Extension was improved, having from 0° to, at most, 5° of extension defect at follow-up. Mediolateral instability was also improved, and all the patients were stable at the latest follow-up. The painfree walking distance was much improved; two thirds of the patients could walk 1 kilometer or more. There was no pain at rest after surgery.

There were two failures, one cemented and one uncemented knee arthroplasty with residual walking pain. Both failures had good position of the components. The cemented knee had a 1-mm radiolucent zone around the tibial component, and the uncemented knee had a smaller radiolucent zone. In one of these failures a reoperation is scheduled.

In the uncemented group, there were four additional knees with slight to moderate pain when the subjects started to walk the first 3–5 steps. The discomfort was constant and always disappeared after those few steps. Another few patients, both cemented and uncemented, had first steps´ notice; they felt the knee to be a little different, but they had no pain. Except for the first steps´ problem, there was no difference in the results between the noncemented and the cemented knees, neither in the randomized population nor in the total material. Even when judging the failures and adding the first steps´ problems there was no statistical difference between cemented and uncemented arthroplasties.

The position of the tibial component in the AP view was 86.3 ±2.0° and in the lateral view 89.2 ±2.8°. The position of the femoral component in the lateral projection was 73.5 ±3.7°. The mechanical axis in the medial endoprostheses was 4.4 ±4.6° in varus and, in the lateral endoprostheses 3.8 ±5.8° in valgus.

At the last follow-up, the maximum radiolucent zone value was 1 mm or more in three of the 82 cemented components, whereas the remaining ones had either a small zone or none at all. For uncemented arthroplasties, two out of 86 components had a zone value of 1 mm or more, and the remaining ones had a smaller zone or were zoneless.

In 130 of the 168 components, there were no loose beads, whereas 20 components had one loose bead, 10 two loose beads, 4 three loose beads, 4 four loose beads, and, finally, 1 five loose beads. All the loose beads were in uncemented components, except three cemented femoral components with one loose bead each. There was almost no progression of the loose beads after 1 year, nor was there any change of position.

One patient with anterior cruciate insufficiency had an asymptomatic frontal translation between the components. All the other patients had a good relationship between the components. There was no correlation between any of the above radiographic parameters and the clinical results.

Discussion

The position of the prosthetic components was close to the anatomical ideal, which is 87.5° in the AP and 90° in the lateral position for the tibial component and 75° in the lateral projection of the femoral component. These results are much better than those of Jónsson (1981) who reported the Marmor prosthesis used in our department with local tools only. Clearly, the new guide instruments permit better positioning than did our special guide for the Marmor prosthesis (Lindstrand et al. 1982). Radiographic results are generally not reported in the way we have presented them, at least not the position of the component in relation to the long mechanical axis. The arthroplasties we report here slightly undercorrected the HKA. This was done intentionally because overcorrection may cause deterioration of the contralateral compartment (Jónsson 1981, Goutallier and Hernigou 1985). It stands to rea-

Table 1. Observations in 93 unicompartment arthroplasties for gonarthrosis

1. Patient number.
2. Sex: 1 male, 2 female.
3. Age (at surgery).
4. Diagnosis: 1 primary arthrosis, 2 posttraumatic arthrosis, 3 arthrosis secondary to osteonecrosis.
5. Ahlbäck (1968) stage.
6. Compartment: 1 medial, 2 lateral.
7. Years follow-up.
8. Early complications: 0 none, 1 non evacuated haematoma, 2 evacuated haematoma, 3 wound rupture, 4 wound necrosis, 5 1-4, 6 superficial wound infection, 7 deep wound infection, 8 paresis.
9. General complications: 0 none, 1 vein thrombosis, 2 lung embolus, 3 1+2, 4 coronary infarction, 5 cerebral insult, 6 other complication.
10. Late complications: 0 none, 1 loosening, 2 secondary arthrosis, 3 subluxation/instability, 4 patellar arthrosis, 5 suture granuloma, 6 abnormal contact, 7 late infection, 8 fracture.
11. Treatment of complications: 1 none, 2 revision and exchange of component, 3 conversion to another prosthesis, 4 surgery without revision of components, 5 plaster.
12. Subjective assessment postoperatively: 1 much better, 2 better, 3 unchanged (failure), 4 worse (failure).
13. Pain at rest, before operation: 1 none, 2 only after physical activity, 3 spontaneous even at night.
14. Pain at rest, after operation: 1 none, 2 only after physical activity, 3 spontaneous even at night.
15. Walking ability, before operation: 1 >5 km, 2 3-5 km, 3 1-3 km, 4 500-1000 m, 5 100-500 m, 6 <100 m, 7 indoors only.
16. Walking ability, after operation: 1 >5 km, 2 3-5 km, 3 1-3 km, 4 500-1000 m, 5 100-500 m, 6 <100 m, 7 indoors only.
17. Flexion before operation: 1 >130°, 2 125-129°, 3 120-124°, 4 115-119°, 5 110-114°, 6 105-109°, 7 100-104°, 8 95-99°, 9 90-94°, 10 80-89°, 11 <80°.
18. Flexion after operation: 1 >130°, 2 125-129°, 3 120-124°, 4 115-119°, 5 110-114°, 6 105-109°, 7 = 100-104°, 8 95-99°, 9 90-94°, 10 80-89°, 11 <80°.
19. Extension defect before operation: 1 0°, 2 1-5°, 3 6-10°, 4 11-15°, 5 <15°.
20. Extension defect after operation: 1 0°, 2 1-5°, 3 6-10°, 4 11-15°, 5 <15°.
21. Side instability before operation: 1 0-4°, 2 5-10°, 3 11-15°, 4 <15°.
22. Side instability after operation: 1 0-4°, 2 5-10°, 3 11-15°, 4 <15°.
23. Walking aid before operation: 1 0, 2 1 stick, 3 2 sticks, 4 1 crutch, 5 2 crutches.
24. Walking aid after operation: 1 0, 2 1 stick, 3 2 sticks, 4 1 crutch, 5 2 crutches.
25. First steps problem: 1 Yes, 2 No.
26. First steps notice: 1 Yes, 2 No.
27. Hip-Knee-Ankle angle, before: >180° varus, < 180° valgus.
28. Hip-Knee-Ankle angle, after: >180° varus, <180 ° valgus.
29. PT, medial angle prosthesis - tibia, AP-view.
30. PTS , posterior angle prosthesis - tibia, Lat.
31. PFS, Posterior angle - distal femoral resection.
32. Loose beads femur.
33. Loose beads tibia.
34. Radiolucent zone femur: 0 none, 1 <1 mm, 2 1-2 mm, 3 >2 mm.
35. Radiolucent zone tibia: 0 none, 1 <1 mm, 2 1-2 mm, 3 >2 mm.
36. Cement, femur: 1 no, 2 yes.
37. Cement, tibia: 1 no, 2 yes.
38. Size femur: 1 small, 2 medium, 3 medium-large, 4 large, 5 extra large.
39. Size tibia: 1 small, 2 medium, 3 medium-large, 4 large.
40. Height tibia mm.
41. Follow-up: 1 yes, 2 no, rheumatoid arthritis, 3 no, neurologic disease, 4 no, deceased.

son, especially for the noncemented prosthesis, to position the components properly and reconstruct the HKA with high accuracy to normal or slight undercorrection.

Loose beads were not found in cemented tibial components, and only one bead each in three cemented femoral components. One third of the uncemented femoral components and about half of the uncemented tibial components had a few loose beads (average 2). They were most often loosened during surgery or during the first postoperative year, and they always remained in the same position as they were in when they were first found.

The clinical results were successful for the majority of the knees; most of the patients could hardly distinguish between the healthy and the operated on knee. The major difference between total knees of varying design and the uniknees described here is that the range of motion was close to normal for the majority in this series, i.e., between 15° and 30° more than the reported results for total knees (Freeman et al. 1983, Insall and Kelly 1986, Laskin 1986). This difference means a great deal to the patient, allowing, for example, bicycling; and it has not been sufficiently emphasized in the discussion of total knee versus uniknee replacements.

Compared with our experience with the Marmor unicompartmental prosthesis, the PCA unicompartmental knee shows better early results for both the cemented and the uncemented groups. The Marmor knee resulted in a 15 percent failure rate of which 13 percent were revised, the majority within 1 year after the arthroplasty (Jónsson 1981). The present material has a slightly shorter observation time, and only two failures were reported as regards walking pain. A main difference relates to the patella, where the PCA more anatomic design gives almost no clinical problems.

The PCA design differs from other uniknees by the metal-backed tibial component with an eminent prominence and the convex outline of the anterior flange of the femoral component. It is important to emphasize that when cement is not used very exact surgery is required; and if this is not achieved, cement should be employed. When cement is used, this should include lavage and injection of the cement with pressure, because the old cement technique has drawbacks.

The metal surfaces of our uniknees have a porous coating (Hungerford and Kenna 1983), which enhances the fixation of the cement especially in tension and shear, giving a so-called three dimensional interlock. It also makes possible the use of the endoprosthesis without cement, not previously attempted in unicompartmental replacements. When using the endoprosthesis uncemented, there was one failure due to pain on walking, as well as first steps´ problems in 4 patients. The first steps´ discomfort was rather constant and represents a clear disadvantage for the uncemented use. However, these patients were satisfied with the outcome, with results rated excellent or good. The first steps´ problem might be compared to thigh pain in hip arthroplasty. The patients operated on without cement have a slightly longer rehabilitation, as they have to unload the arthroplasty in the early postoperative period. However, as we have found somewhat more completely painfree patients in the cemented group, this should be the standard. In a recent study (Bernasek et al. 1988), some revisions after uncemented PCA unicompartmental arthroplasties were reported. This is in contrast to our findings, and can be explained by a major difference in surgical technique and in patient selection. Almost half of their patients were below the age of 60 years, which means a completely different population with a much higher activity level. Unicompartmental replacement is not intended to replace osteotomy, which is the procedure of choice for this younger age group; we do not use any knee arthroplasty in patients who plan to try vigorous sports. Further, the authors reported overcorrection of the alignment, arthrosis of the contralateral compartment already at surgery, and data indicating insufficient surgical technique.

Our choice between osteotomy and unicompartmental knee arthroplasty is largely based on the age and general condition of the patient (Bauer 1982). In medial arthrosis Stages I–III, we perform osteotomy in relatively young patients; and in patients of about 65 years of age or more, we perform a unicompartmental knee arthroplasty. In lateral arthrosis, we favor unicompartmental knee arthroplasty even in somewhat younger patients and also in more advanced arthrosis.

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