

ORIGINAL ARTICLE

R. Elke · G. Meier · K. Warnke · E. Morscher

Outcome analysis of total knee-replacements in patients with rheumatoid arthritis versus osteoarthritis

Received: 15 February 1995

Abstract A total of 524 knees underwent a primary PCA knee arthroplasty between 1982 and 1989. Of these 415 suffered from osteoarthritis (OA) and 61 from rheumatoid arthritis (RA). They were analyzed for differences regarding the outcome. Neither survivorship analysis nor number or type of revisions revealed statistical differences among these two groups. The knee score rose in the OA group from a median of 28 to 89 points after 1 year and then dropped to 87 points between 54 and 118 months. In the RA group the median of the knee score rose from a preoperative value of 21 points to 90 points after 1 year but then dropped to 77 points at the most recent follow-up. This development was probably the result of general progression of the disease. Even in the RA group the rating was still "good" at the latest follow-up. Regarding the benefit of such a procedure in a polyarticular disease and its preservation over a long period of time, total knee arthroplasty can be recommended for patients with RA, and preferably the cemented version.

Introduction

For patients with multiple joint diseases like rheumatoid arthritis (RA) knee function is essential to preserve independence because very little help can be expected from the upper extremities when rising from a chair or climbing stairs. At the beginning of this disease, the knee joint is only involved in about 10%, but in patients with long-standing RA nearly 90% knee involvement has been described. In many of these cases both knees become symptomatic; only in about 30% does the disease remain unilateral [4, 16].

The potential benefit of a total joint replacement has to be evaluated carefully because patients suffering from a

long-standing course of RA present frequently with soft-tissue problems including important extension deficits and limited range of motion. The bone quality is reduced, and the subcutaneous tissues and skin are altered due to extended inactivity, the inflammatory character of the disease and the necessary long-term medication with corticosteroids and cytostatic drugs.

The questions are: how much benefit will patients with RA receive from a knee replacement, how long will the arthroplasty last, and what is the survival time of the implants compared with knee replacements in osteoarthritic patients?

Patients and methods

All patients who had received a primary knee arthroplasty between 1982 and 1989 were reviewed in 1992/93. In all, 394 patients received 524 knee arthroplasties during this period (Table 1). The follow-up is documented in Table 2. Osteoarthritis (OA) was the predominant diagnosis. About one-seventh of the patients suffered from RA (Table 2). In 48 cases other diagnoses led to knee replacement.

During the follow-up period the PCA knee system was used, which is an unconstrained posterior cruciate ligament (PCL)-retaining prosthesis. For all cementless tibia plateaus the pegged type of tray was implanted. In all, 424 arthroplasties were fixed with cement, 100 implantations were performed without cement, the bulk part of the cementless prostheses within the first years after the introduction of this knee system. For the cemented cases at first the pegged tibia was used; later it was replaced by the stemmed tibial component.

A survivorship analysis was performed according to the method of Kaplan-Meier. The "endpoint" was determined by a revision, whereas "death" and "lost to follow-up" were regarded as "censored data". Patients who died during the course of the study were considered for the survivorship analysis with their last documented follow-up as censored data. This approach explains the relatively low average follow-up time (4.2 years, range 3–10 years).

Clinical and radiological data were assessed according to the evaluation system of the "knee society" [5, 6]. The rating of the knee score was: excellent = 100–85 points; good = 84–70 points; satisfactory = 69–60 points; and unsatisfactory below 60 points.

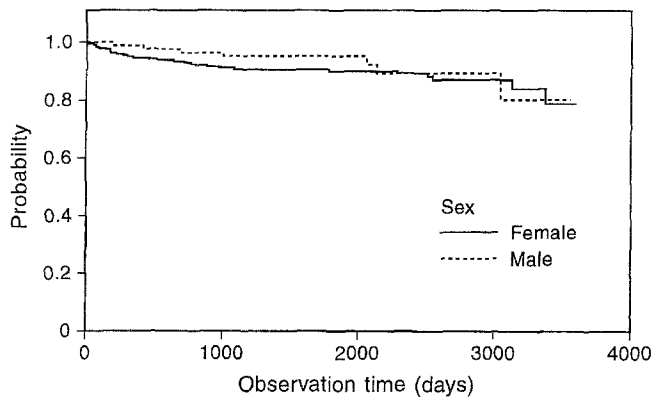
For the statistical analysis patients operated on bilaterally in one session do not provide independent data: the correlation test (Spearman correlation coefficient) revealed a correlation with $P = 0.0001$. For this reason only the first operated knee could be included in further analyses.

Table 1 Composition of study group

	No. of patients
All Patients operated on	394
Follow-up after 54–118 months possible	214
Revision necessary	38
Dead	103
Records incomplete	7
Lost to follow-up	32

Table 2 Distribution of unilaterally and bilaterally operated patients among the rheumatoid arthritis (RA) and osteoarthritis (OA) groups

No. of knees	OA	RA
Total	415	61
Unilateral operation	189	29
Bilateral operation	226	32
Single session	162 (81 patients)	16 (8 patients)
Two sessions	64 (32 patients)	16 (8 patients)

**Fig. 1** Probabilities of survival according to sex

Results

In both groups, the survivorship analysis followed almost the same pattern. The overall probability of survival of the implants at seven years was 87.6%. No differences regarding sex could be found (Fig. 1). The clinical outcome was excellent or good in 89%, satisfactory in 5% and unsatisfactory in 6%.

The implantation of the tibial component without cement was less successful than the cemented tibial implants: only 81% were rated excellent or good, whereas in 15% the result was unsatisfactory.

Radiological analysis showed the bulk part of the findings at the tibial side (loose beads and radiolucencies). Of all tibial components 65% developed radiolucent zones between the implant and bone. Of these 6% was non-progressive, 43% progressive and 16% inconclusive because of the quality of the radiographs. No statistical correlation

Table 3 Reasons for revision

No. of knees	OA	RA	Others	Total
Revisions	29	6	3	38
Problem:				
Patella	14	2	2	18
Tibia	7	1	1	9
Femur		1		1
Infection	4	2		6
Others	4			4

Table 4 Distribution by sex, age and median hospital stay

No. of patients	OA	RA
Total	300	43
Women	239	35
Men	61	8
Median age at operation (years)	75.1	68.9
Minimum	38	28
Maximum	90	82
Median hospital stay (days)	23	25

could be found between the radiological finding, clinical result and frequency of revisions.

Thirty-eight knee arthroplasties had to be revised (Table 3). The overall revision rate was therefore 7.2% during the observation period. Nearly half were due to patellar problems. The infection rate was 1.1%, and all of them were late infections.

Osteoarthritis versus rheumatoid arthritis

For reasons of statistical independence mentioned above, only the first knee of the knees operated on bilaterally in one session were evaluated. Therefore, 300 knees of the OA group and 43 knees of the RA group were compared (Table 4). The probability of survival was without statistical significant difference in both groups: after 7 years in the OA group it was 87% (SE 2.35 e-2) and in the RA group 81% (SE 7.98 e-2); after 10 years in the OA group 82% (SE 4.35 e-2) and in the RA group still 81% (SE 7.98 e-2) (Fig. 2). Regarding the Knee Society Score, the function value scattered pre-operatively and postoperatively in such a way that a statistical analysis was not sufficiently reliable. The knee score scattered less: the pre-operative median was lower in the RA group than in the OA group (21 vs 28 points) (Fig. 3). At the 3-month follow-up these values rose to a median of 89 points in the RA group and 87 points in the OA group (Fig. 4). After 1 year the OA group had 89 points and the RA group 90 points (Fig. 5). At 3 years the median in the OA group was 89 points and 85 points in the RA group (Fig. 6). At the most recent follow-up (54–118 months) the median of the knee score remained almost stable in the OA group with 87 points, whereas it dropped in the RA group to 77 points (Fig. 7).

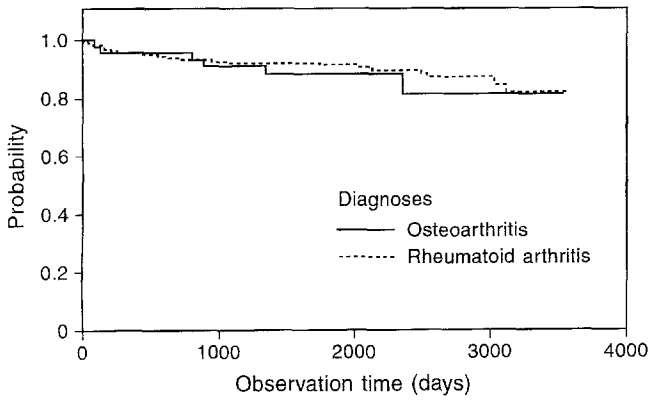


Fig.2 Probabilities of survival according to diagnosis

The range of motion (ROM) showed the following pattern. In the OA group 34% of the knees had a flexion of less than 90 deg. This dropped to 32.5% at the most recent follow-up. In patients with RA 43.2% did not reach 90 deg of flexion preoperatively. This figure dropped to 41.7% at the most recent follow-up.

The median duration of the hospital stay was 25 days for OA patients and 24 days for RA patients, about the

same in both groups. Comparing bilaterally operated knees the total hospital stay for the patients operated on was in two sessions a median of 46 days, whereas for patients operated on in one session it was a median of 28 days.

Discussion

Total joint replacement of one joint in patients with poly-articular disease like RA may not change their overall ability to function [8] but the knee joint occupies a special place regarding independence. Preservation of mobility at the knee joint is important for patients whose adjacent joints are also affected because the more the knee can flex, the less support is necessary from the upper extremities while rising from a chair or climbing stairs. Although only relatively few patients increased their flexion postoperatively in the long term, a further loss of mobility could be stopped by the joint replacement. Obviously, there is a relation between the preoperative and postoperative ROM value because in these long-term disabilities of the knee, all the soft tissue around the joint has been altered over the years. The slow decline on the knee score in RA patients after the first year is probably due to the general

Fig.3 Box plots of knee score and function score according to diagnosis: preoperative values

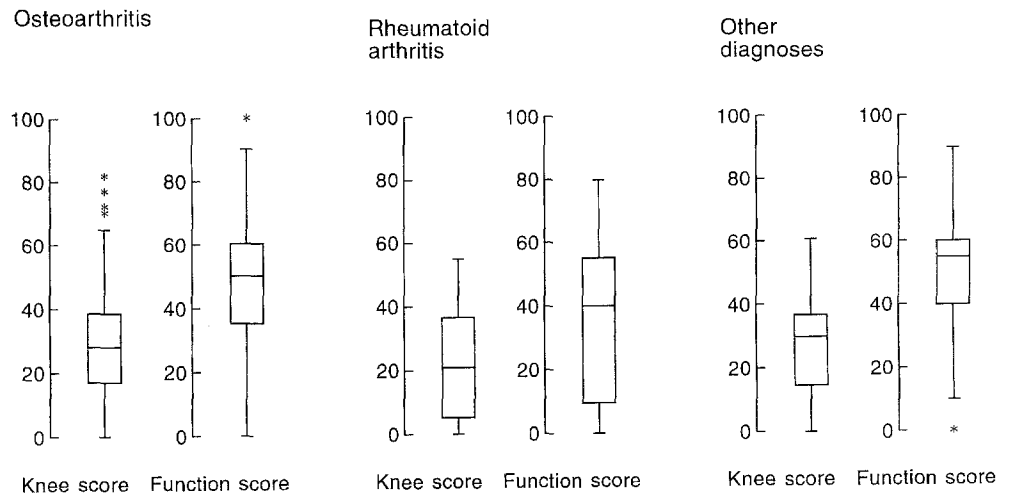


Fig.4 Box plots of knee score and function score according to diagnosis: values 3 months

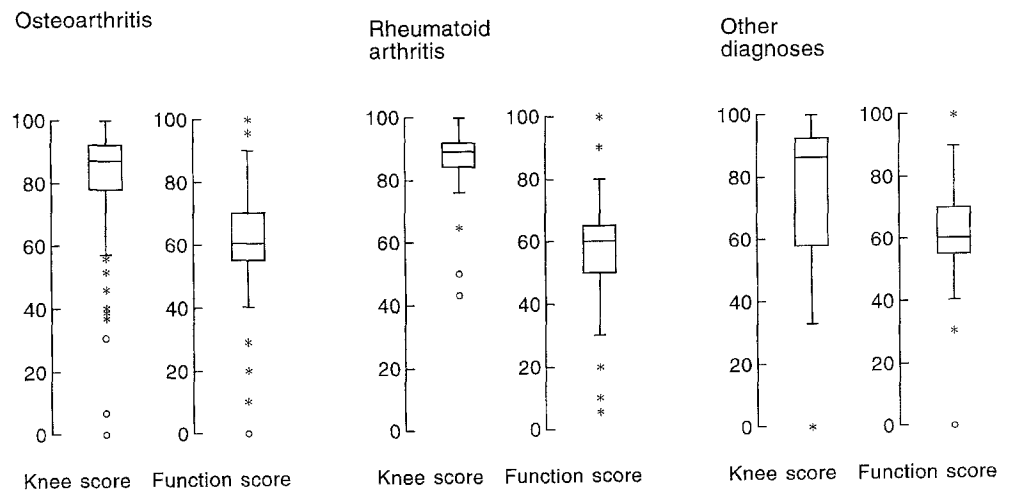


Fig. 5 Box plots of knee score and function score according to diagnosis: values 1 year post-operatively

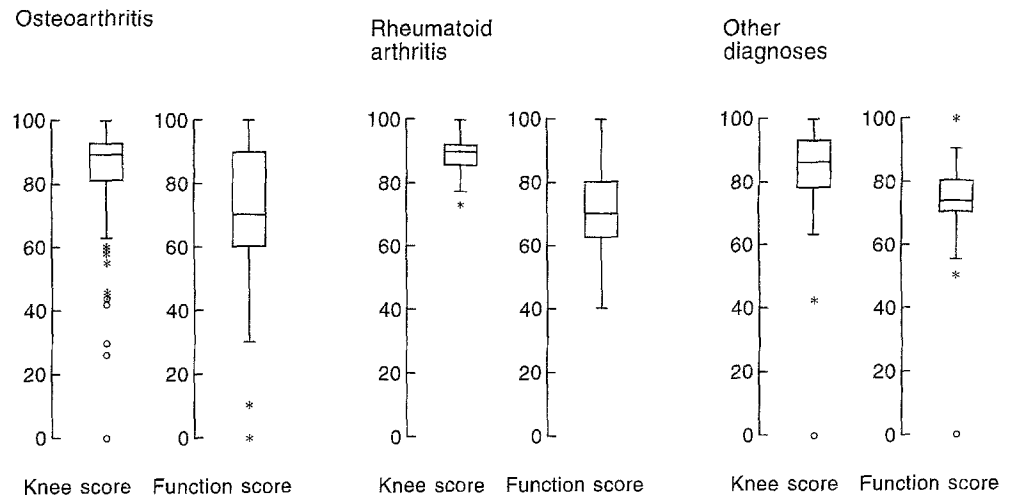


Fig. 6 Box plots of knee score and function score according to diagnosis: values 3 years post-operatively

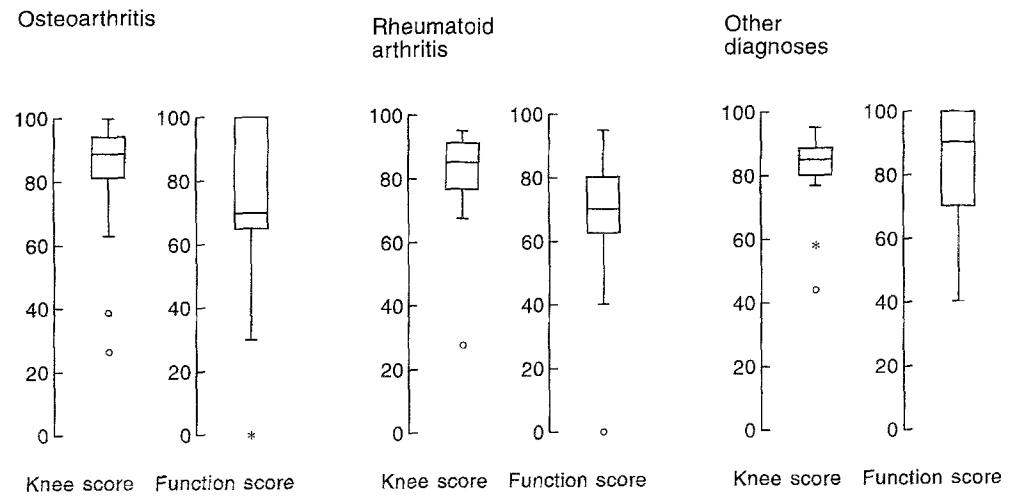
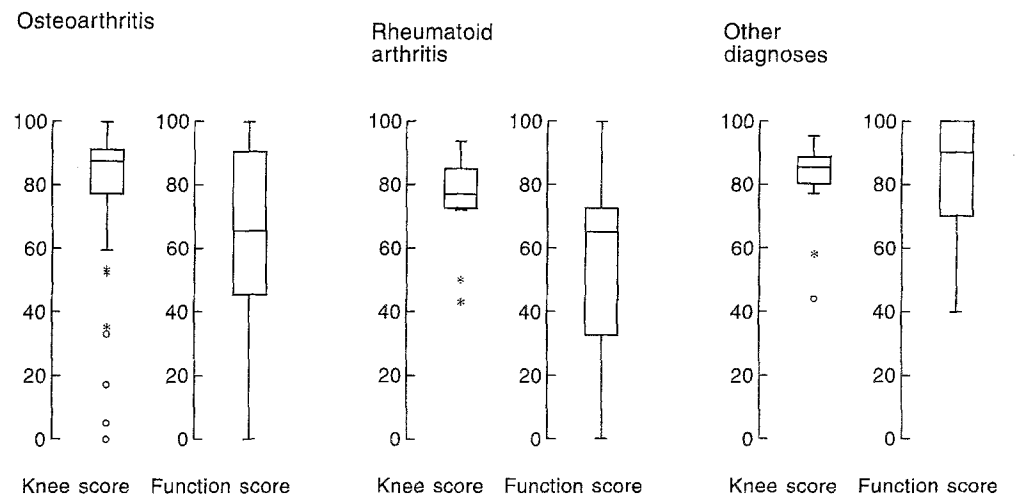


Fig. 7 Box plots of knee score and function score according to diagnosis: values at the most recent follow up (54–118 months postoperatively)



progression of the disease. Especially when progressive generalized diseases are followed, the advantage of the Knee Society rating system becomes obvious, with its possibility to distinguish between knee function and patient function [6]. The function score can be influenced by many parameters, like age-related general medical problems or progression of a polyarticular disease, that statis-

tical analysis in an inhomogenous group of patients is difficult. The evaluation of the knee score is less disturbed by these influences.

With a 87% probability of survival in the OA group and 81% in the RA group after 7 years, the difference is statistically not significant. The survivorship patterns are almost identical to those published by Rand and Ilstrup

[12] and are within the same range of the data published by Knutson et al. [7] regarding comparable types of prosthesis. Knutson and co-workers concluded that there was no statistical significant difference in the cumulative survival rate patterns of OA and RA. Rand and Ilstrup, in contrast, could show a significant difference between the survival rates of OA (80%) and RA (83%) after 10 years, implying that RA patients fared better.

Neither in number nor in type of necessary revision could a difference between OA and RA be proven. Almost half of the revisions were due to patella-associated problems. Many of them were related to the "metal-back" problem [1, 2, 9, 14, 17]. Following from increasing data from the literature and our own experience, only the cemented all-polyethylene patellar component has been used since 1988.

When first using the PCA knee in 1982, the uncemented pegged version of the tibial component was preferred; therefore, some of the lower knee score ratings in the group of cementless tibial components are probably due to a "learning curve" but other authors also reported outcome problems with the uncemented PCA tray [3, 10, 11, 13]. The cementless fixed tibial component causes more problems regarding interface stability as shown by Ryd et al. [15] using roentgen stereophotogrammetric analysis. Realizing that cement causes no important problems in knee replacement surgery, the proportion of cemented implantations was increased to over 95% in the sequel, and the stemmed tibial tray was preferred. The amount of postoperative weight-bearing needs to be examined more closely for cementless tibial fixation. RA patients need to be fully weight-bearing immediately after the operation because of their frequent upper extremity involvement. This is another reason to advocate a cemented implantation in these patients.

The duration of the hospital stay was about the same in both groups. Comparing the bilaterally operated knees, the median hospital stay was significantly lower in ones treated in one session. This reduces not only costs but also improves the success of the rehabilitation because severe bilateral deformities can be corrected at one time and no remaining flexion contraction will influence the other side during gait training, for example. Although the bilaterally operated patients required careful observation during the first postoperative days, all of them were happy at the first postoperative follow-up not to have to undergo another operation.

In conclusion, with a median knee score of 77 after a follow-up of up to 10 years, the knee function in patients with RA is not as good as that in OA patients, but it is more than twice the preoperative value and in patients with a progressive disease. The rating of total knee arthroplasty even in this group is still "good". The survivorship analysis and the revision rate did not reveal any important differences. Considering the quality of life, preservation

of independence and reduced disability over a long period of time, knee replacement can be recommended for patients with rheumatoid arthritis, and preferably in a cemented version. In cases of bilateral involvement with important deformities, a bilateral joint replacement is advocated because rehabilitation with one still deformed side limits the success of the rehabilitation and prolongs rehabilitation unnecessarily.

References

1. Bayley JC, Scott RD (1988) Further observations on metal-backed patellar component failure. *Clin Orthop* 236:82-87
2. Bayley JC, Scott RD, Ewald FC, Holmes GB (1988) Failure of the metal-backed patellar component after total knee replacement. *J Bone Joint Surg [Am]* 70:668-674
3. Cheng CL, Gross AE (1988) Loosening of the porous coating in total knee replacement. *J Bone Joint Surg [Br]* 70:377-381
4. Ebert FR, Krackow KA, Lennox DW, Hungerford DS (1992) Minimum 4-year follow-up of the PCA total knee arthroplasty in rheumatoid patients. *J Arthroplasty* 7:101-108
5. Ewald FC (1989) The Knee Society Total Knee Arthroplasty Roentgenographic Evaluation and Scoring System. *Clin Orthop* 248:9-12
6. Insall JN, Dorr LD, Scott RD, Scott WN (1989) Rationale of The Knee Society Clinical Rating System. *Clin Orthop* 248:13-14
7. Knutson K, Lindstrand A, Lindgren L (1986) Survival of knee arthroplasties - a nation-wide multicentre investigation of 8000 cases. *J Bone Joint Surg [Br]* 68:795-803
8. Liang MH, Cullen KE (1984) Evaluation of outcomes in total joint arthroplasty for rheumatoid arthritis. *Clin Orthop* 182:41-45
9. Lombardi AV, Engh GA, Volz RG, Albrigo JL, Brainard BJ (1988) Fracture dissociation of the polyethylene in metal-backed patellar components in total knee arthroplasty. *J Bone Joint Surg [Am]* 70:675-679
10. Moran CG, Pinde IM, Lees TA, Midwinter MJ (1991) Survivorship analysis of the uncemented porous-coated anatomic knee replacement. *J Bone Joint Surg [Am]* 73:848-857
11. Partio E, von Bonsdorff H (1994) Cementless synatomic total knee arthroplasty in rheumatoid and osteoarthritic knees: a clinical and radiological review with follow-up from 4 to 7 years. *J Orthop Rheumatol* 7:155-163
12. Rand JA, Ilstrup DM (1991) Survivorship analysis of total knee arthroplasty. Cumulative rates of survival of 9200 knee arthroplasties. *J Bone Joint Surg [Am]* 73:397-409
13. Rorabeck CH, Bourne RB, Nott L (1988) The cemented kinematic-II and the non-cemented porous-coated anatomic prostheses for total knee replacement. *J Bone Joint Surg [Am]* 70:483-490
14. Rosenberg AG, Andriacchi TP, Barden R, Galante JO (1988) Patellar component failure in cementless total knee arthroplasty. *Clin Orthop* 236:106-114
15. Ryd L, Lindstrand A, Stenström A, Göran S (1990) Porous coated anatomic tricompartmental tibial components - the relationship between prosthetic position and micromotion. *Clin Orthop* 251:189-197
16. Sledge CB, Walker PS (1984) Total knee arthroplasty in rheumatoid arthritis. *Clin Orthop* 182:127-136
17. Stulberg SD, Stulberg BN, Hamati Y, Tsao A (1988) Failure mechanisms of metal-backed patellar components. *Clin Orthop* 236:88-105