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Survivorship analysis of the “Performance” total knee replacement – 7-year follow-up

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Abstract We present the results of a prospective study in which 32 “Performance” total knee replacements were implanted with a mean follow-up period of 6.5 years. Survival analysis showed 89% survival at 7 years. Of those knees that survived to follow-up 80% were pain free or had mild pain when climbing stairs and only 1 knee was unable to flex beyond 100°. Eighty-six percent of patients were able to walk unlimited distances and all knees had a statistically significant improvement in the knee evaluation scores at follow-up. There was no evidence of loosening or migration in the surviving knees.

Résumé Les auteurs présentent une étude prospective de 32 arthroplasties totales du genou avec une prothèse (Performance), implantée avec une période moyenne de suivi de 6,5 ans. L’analyse a montré que le pourcentage de survie après 7 ans, était de 89%. Parmi les genoux porteurs de prothèse, au dernier examen, 80% étaient indolores ou avaient une douleur légère dans les escaliers, et seul un genou ne pouvait pas fléchir à plus de 100°. 86% des opérés marchaient sans limitation de distance et tous les genoux avaient une amélioration significative dans l’évaluation de leur fonction. Parmi les genoux suivis, il n’y a pas de descellement, ni de migration des implants.

Introduction

We present the findings of 32 “Performance” total knee replacements studied prospectively during a 6- to 7-year period. The Performance Knee System has posterior cru-

ciate retaining and substituting designs. The standard tibial component consists of a metal tray with a contoured/winged central keel and cancellous bone screws (Fig. 1).

Fig. 1 Photograph of the Performance Total Knee

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Table 1 Results of the Knee Society Clinical Rating System for the Performance Knee

Criteria	Pre-operative values (A)			Follow-up values (B)			Improvement (B-A)		
	Mean value	Standard deviation	Range	Mean value	Standard deviation	Range	Difference in mean values	95% Confidence interval	P value
Pain score	19	11	0–45	48	3	40–50	29	23–34	<0.001
Knee score	45	17	14–85	92	6	74–100	47	38–56	<0.001
Function score	41	14	15–60	89	11	70–100	48	40–55	<0.001
Total score	86	27	29–135	181	12	165–200	95	80–109	<0.001

Patients and methods

From June 1990 to June 1991 32 primary total knee replacements were implanted using the Performance Modular Total Knee System (Kirschner Medical Corporation, Biomet Ltd., Swindon, UK). This prosthesis was the only implant made available for patients undergoing a standard primary total knee replacement. No comparative group was available. All the operations were performed by the senior author (J.P.H.) using the Anterior-based Performance Premier II instruments and a standard operating technique. All patellae were resurfaced and all components were fixed using Palacos R Cement (Heraeus Kulzer GmbH, Kulzer Division, Wehrheim, Germany).

Our series of 32 total knee replacements in 28 patients included 21 women and 7 men with an average age of 72 years (range 50–85 years). The primary diagnosis was osteoarthritis in 23 patients and rheumatoid arthritis in 5 patients.

All patients were clinically assessed prospectively using the Knee Society Clinical Rating System [4] in which the rating is divided into separate knee and patient function scores – the maximum scores for each assessment being 100 points. For walking distance 100 m was assessed as equivalent to 1 block. Radiological assessment was made using the Knee Society Total Knee Arthroplasty Roentgenographic Evaluation and Scoring System [3] – assessing component position, knee alignment and the cement fixation.

Patients were reviewed at 3 and 6 months post-operatively and then annually. Twenty-one knees (20 patients) were available for review at 6–7 years (mean 6.5 years). One patient (2 knees) was unwilling to attend, expressing that she had no problems with her knees. Five patients (6 knees) died before the final follow-up. Three knees were revised during this follow-up period. There were 28 patients of whom 4 had 2 knee operations each and the remaining 24 had 1 knee operation each. The results of the knee replacements were assessed by using survivorship analysis after constructing a life-table (Stata Corporation, Stata Statistical Software, Release 5.0, College Station, Tex 77840, USA). Each knee replacement was entered only once for each of the possible outcomes: success, failure or withdrawal. Success was defined as a knee still in situ irrespective of knee score. Failure was defined as a knee replacement that had to be revised for any cause prior to the end of the follow-up period or had been recommended for revision at the last evaluation. Patients who died and the 1 patient (2 knees) who withdrew were censored from the life-table at the points of death or withdrawal, respectively. The assumption is that these patients would have behaved equivalently to the remainder of the cohort, had they not died or withdrawn. The difference in the pre-operative and follow-up Knee Scores were statistically assessed by the Student's paired *t*-test. Statistical significance was accepted at the level of $P < 0.05$. The 1 patient at follow-up who had bilateral knee replacements had each knee assessed separately.

Results

The mean follow-up period was 6.5 years with 21 knee replacements available for assessment. All knees showed an improvement in the pain score at follow-up when compared to pre-operative scores. Only 1 knee had consistent but mild pain when climbing stairs but none when walking. At follow-up the mean maximum flexion in the knees was 113° (SD 12°; range 90°–125°), the mean flexion contracture was 1.9° (SD 3.7°; range 0°–10°) and the mean knee score was 92 (SD 6; range 74–100). The results are summarised in Table 1.

Eighteen patients had unlimited walking capacity and 14 were able to climb stairs normally or descend with the use of a rail. Seven patients required the use of a walking stick and 1 patient required the aid of 2 sticks. All knees improved on the pre-operative function score and the mean score at follow-up was 89 (SD 11; range 70–100). The overall mean total score for function and assessment was 181 (SD 12; range 165–200).

Plain standing antero-posterior and lateral radiographs were taken of all knees at follow-up. None of the surviving knees had evidence of migration. The degree and distribution of the transradiance were assessed using the Knee Society Radiological Evaluation Form and were not deemed as significant.

Three knees from the 32 replaced had to be revised during the follow-up period. One knee became clinically infected within 1 month of the procedure and following attempted treatment with arthroscopic washouts and antibiotics this knee was revised as a two-stage procedure 10 months after the initial total knee replacement. One knee experienced excessive wear of the lateral tibial plateau and the tibial component was revised 39 months after the initial surgery. (No operative or radiological findings suggest why this tibial component failed at such an early stage. Initial post-operative scores were comparable to other knees.) A third knee was unstable due to laxity of the medial collateral ligament and a thicker tibial tray was inserted 29 months after the initial procedure following which the patient has remained asymptomatic.

Survival analysis showed 89% survival at 7 years (95% CI, 70–96). No deaths appeared to be related to the prosthesis and no deaths occurred in those patients requiring revision. None of those patients who died had any evidence of impending failure at their final follow-

Table 2 Life-table for the Performance Knee

Time (Days)	Total knees	Fail	Net lost	Survivor function	Standard error	95% Confidence interval	
315	28	1	0	0.9643	0.0351	0.7724	0.9949
872	27	1	0	0.9286	0.0487	0.7435	0.9816
1181	26	1	0	0.8929	0.0585	0.7036	0.9641
1273	25	0	1	0.8929	0.0585	0.7036	0.9641
1670	24	0	1	0.8929	0.0585	0.7036	0.9641
1741	23	0	1	0.8929	0.0585	0.7036	0.9641
1872	22	0	1	0.8929	0.0585	0.7036	0.9641
2193	21	0	1	0.8929	0.0585	0.7036	0.9641
2202	20	0	1	0.8929	0.0585	0.7036	0.9641
2286	19	0	1	0.8929	0.0585	0.7036	0.9641
2294	18	0	1	0.8929	0.0585	0.7036	0.9641
2313	17	0	1	0.8929	0.0585	0.7036	0.9641
2346	16	0	1	0.8929	0.0585	0.7036	0.9641
2349	15	0	1	0.8929	0.0585	0.7036	0.9641
2390	14	0	1	0.8929	0.0585	0.7036	0.9641
2391	12	0	1	0.8929	0.0585	0.7036	0.9641
2419	11	0	1	0.8929	0.0585	0.7036	0.9641
2422	10	0	1	0.8929	0.0585	0.7036	0.9641
2429	9	0	1	0.8929	0.0585	0.7036	0.9641
2444	8	0	1	0.8929	0.0585	0.7036	0.9641
2454	7	0	1	0.8929	0.0585	0.7036	0.9641
2468	6	0	1	0.8929	0.0585	0.7036	0.9641
2482	5	0	1	0.8929	0.0585	0.7036	0.9641
2502	4	0	1	0.8929	0.0585	0.7036	0.9641
2503	3	0	1	0.8929	0.0585	0.7036	0.9641
2541	2	0	1	0.8929	0.0585	0.7036	0.9641
2569	1	0	1	0.8929	0.0585	0.7036	0.9641

Fig. 2 Survival curves for the Performance Total Knee with 95% confidence intervals

up. There does not appear to be any relationship between survival of the prosthesis and age, sex or original diagnosis on the data we collected. The life-table is shown in Table 2 and the survival curves in Fig. 2.

Discussion

Our series of 32 knees showed survival of 89% at 7 years. The 21 knees surviving to follow-up, however, had excellent results from knee scores. They also had an excellent range of movement, with only 1 patient able to

flex less than 100°. The overall functional outcome showed a marked and significant improvement on pre-operative ability and compares favourably with other prostheses in published series [2,5].

Radiographic analysis showed excellent position and interface in those knees surviving with no evidence of impending failure. The keeled tibial prosthesis with two cancellous screws appears to be effective in preventing migration and progression of transradiance at 6–7 years.

The cause of failure of the tibial insert has not been explained. At revision there was no evidence of third body wear (loose cement etc.) and the polyethylene was of 10 mm thickness reducing the known risks of using thin tibial inserts in non-conforming surfaces such as total knee replacements [1]. Wear has also been blamed on tightness of the posterior cruciate ligament due to incorrect choice of tibial insert causing excessive wear on the posterior aspect of the tray [6]. This would appear less likely in our case since examination of the tray showed wear throughout the surface of the polyethylene which was not isolated to the posterior surface.

This series shows that the early to mid-term clinical results for this prosthesis appear promising although the survival analysis in our study showed only 89% survival at 7 years. Larger prospective and randomised clinical trials are required before a possible explanation for the early failure of the one tibial insert may be identified and also to assess the full effectiveness of this implant against the many others on the market.

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