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Results of a single total knee prosthesis compared with multiple joint replacement in the lower limb

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Abstract We present the clinical results of total knee replacement (TKR) in 133 patients who had two or more major joints of the lower limbs replaced, and compare them to the outcome in 406 patients with an isolated TKR. 383 patients had osteoarthritis (OA) and 136 had rheumatoid arthritis (RA) and these were assessed separately. A meniscal bearing prosthesis was used. The functional score was high and there was no statistically significant difference in the incidence of complications between the two groups.

Résumé On présente les résultats cliniques de l'arthroplastie totale du genou sur 133 patients qui ont dû se faire remplacer deux ou trois articulations des membres inférieurs, en comparaison aux résultats de 406 patients qui ont subi une simple arthroplastie du genou. 383 patients souffraient d'arthrose et 136 de rhumatisme et ont été examinés séparément. La prothèse du genou était du type *meniscal bearing*. Le score fonctionnel était élevé dans tous les groupes. Il n'y avait pas de différence statistiquement importante du pourcentage des complications post-opératoires entre les deux groupes.

Introduction

A number of studies have reported satisfactory results following multiple hip and knee replacement in severely disabled patients [3–6, 9, 11, 12, 15, 16]. However, most of these studies have been restricted to rheumatoid patients using a prosthesis which was either constrained or unconstrained. Although these results were encouraging a number of patients continued to complain of pain and revision rates as high as 19% within 5 years have been reported [10]. The aim of this study was to investigate

possible differences in the outcome after an isolated Total Knee Replacement (TKR) compared with patients who underwent multiple hip and knee replacement. We used a meniscal bearing prosthesis in both osteoarthritis and rheumatoid patients, and these two groups were assessed separately.

Patients and methods

Between 1982 and 1994, 596 TKRs were performed in 519 patients. A meniscal bearing prosthesis with congruent surfaces which allowed rotation and gliding was used. The patella was resurfaced in 435 knees (73%). The hip prosthesis used was a Charnley in 50 hips and a Muller in 17 hips. 406 patients had one TKR and 113 had bilateral TKRs or knee and hip replacements (Table 1). 12 patients (2.3%) were lost to follow-up and were not included in this study. The OA/RA ratio was 3.6/1 in patients with a single TKR, 1.8/1 with two replacements and 0.5/1 with more than two replacements. The mean follow-up period from the last knee replacement was 86 (24 to 167) months (Table 1). The mean age at operation in patients undergoing isolated TKR was 68 years in OA and 64 years in RA. In the multiple replacement group the mean age at the time of the most recent knee replacement was 74 years for OA and 63 years for RA (Table 1).

All patients were reviewed at three and six months and thereafter at yearly intervals. Plain radiographs were taken and the British Orthopaedic Association Knee Assessment Chart [1] completed at each visit. The details were recorded on a database. Satisfaction, pain relief, range of movement and complications were recorded. Statistical analysis was performed using the chi-square test, the student's t-test and one way analysis of variance (ANOVA) and Kaplan-Meier curves for survival analysis. Patients with 3 or 4 replacements were combined in the same group as were those with one TKR and one THR (Table 2).

Results

The pain relief was high in all groups with no statistically significant difference associated with the number of joints replaced or aetiology of the arthritis (Table 2). Patient satisfaction was particularly high in cases with one TKR and one THR and those who had 3 or 4 replacements, although there was no statistical difference (Table 2). All patients with 3 and 4 replaced joints were

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Table 1 Clinical characteristics of the patients

Replacement	Underlying disease	Number of patients	Mean age (years)	Male/Female	Follow-up (months)
Single TKR	OA	318	68	113/205	83
	RA	88	64	11/77	88
Bilateral TKR	OA	41	72	7/34	72
	RA	18	63	1/17	75
One TKR – ipsilateral THR	OA	6	70	0/6	73
	RA	3	67	0/3	104
One TKR – contralateral THR	OA	9	74	5/4	72
	RA	10	62	1/9	74
One TKR – bilateral THR	OA	5	77	1/4	37
	RA	3	63	0/3	113
Bilateral TKR – one THR	OA	3	80	0/3	65
	RA	10	65	2/8	107
Bilateral TKR – Bilateral THR	OA	1	78	0/1	37
	RA	4	59	0/4	93

Table 2 Clinical results and complications

Replacement	Underlying disease	Pain relief (%)	Satisfaction (%)	Flexion (degrees)	Functional score	Deep vein thrombosis	Pulmonary embolism	Late infection	Component loosening	Patella fractures	Patella implant loosening
Single TKR	OA	95	94	98.1	44.1	17	4	2	4	2	3
	RA	97	95	98.0	42.9	5	2		2	3	1 (septic)
Bilateral TKR	OA	95	93	95.9	43.9	3	1	1	1	1	
	RA	89	83	96.5	41.7						
One TKR – One THR	OA	93	100	102.9	42.1		1				
	RA	92	92	98.4	42.9	1					
Three or four replacements	OA	89	100	102.4	44.7						1
	RA	82	100	96.9	41.2	1			1		

satisfied with their operations, although some had persistent discomfort. The average range of flexion in all groups was more than 95° with no significant difference between the groups. This improvement was also satisfactory when compared to pre-operative flexion in all groups (average 14° for OA patients and 19° for RA with a single TKR, and 13° and 17° for the multiple replacement group). It was better for RA patients (except for cases with one TKR and one THR) and this difference was statistically significant for single and bilateral TKR ($P<0.05$). A post-operative flexion contracture of 5–10° was seen more often in RA than in OA patients ($P<0.01$). There was no relationship between flexion contracture and the number of prostheses.

There was no statistically significant relationship between the functional score and the number of replacements in RA or OA patients. In all groups (except for one TKR and one THR) OA patients did better than RA patients (Table 2) and in the single TKR and the 3 or 4 replacement groups the difference was statistically significant ($P<0.1$, $P=0.05$ respectively). There was no significant difference in complication rate between the single TKR and the multiple replacement group when considering thromboembolism, infection, aseptic loosening or patellar problems.

Discussion

These results indicate that the outcome of total knee replacement in patients with multiple joint replacements in the lower limbs is very satisfactory and compares favourably to a single total knee replacement, and the incidence of complications is not increased. Flexion improved considerably which is of particular significance in the multiple replacement group, as it is essential to have combined hip and knee flexion of 190° in order to climb stairs and rise from a chair [4]. Although OA is the commonest aetiology in patients requiring THR/TKR [14], the majority of patients with more than two replacements suffer from RA. The functional score in RA patients was lower reflecting generalised disability with involvement of ankles and feet. No relationship was found between the incidence of complications and the number of replaced joints. Johnson [5] reported good pain relief in 73% of 11 rheumatoid patients with bilateral TKR and bilateral THR. McDonald [11] presented a series of 26 rheumatoid patients with four lower limb arthroplasties in whom there was complete pain relief in 50%, mild discomfort in 35% and a tibial loosening rate of 15% after a mean follow-up of 42.7 months. McElwain and Sheehan [12] in a similar group of 19 rheumatoid patients with a mean follow-up of 29.4

months found that only 9 patients were pain-free. Marks [9] reported that only 59% of 21 rheumatoid patients with multiple replacements were pain-free. Walker et al. [15] in a series of 36 patients with 3 or more joints replaced and a mean follow-up of 20 months recorded that 49% of patients had only moderate or slight improvement of pain and McDonagh et al. [10] reported further on this group indicating that 7 knees required revision after a mean of 3 years. Hoekstra et al. [3] reported on 14 rheumatoid patients with 4 joint replacements and a mean follow-up of 71 months with pain relief in all patients and no loosening. McDonald [11], McElwain and Sheehan [12], and Marks [9] showed no improvement in knee flexion and Johnson [5] and Yoshino et al. [16] reported a reduction in flexion. Walker et al. [15] reported an improvement of 8° and Hoekstra et al. [3] an improvement of 26° but this was in patients whose average pre-operative flexion was only 54°. Our results are similar to Hoekstra's and better than other author's, both in pain relief and function, with a longer follow-up. A possible explanation for this difference is the use of a less constrained prosthesis with more congruent surfaces and less polyethylene wear. The majority of total condylar prostheses are partially congruent in extension; the relatively small articulating surfaces may be associated with early polyethylene wear [2, 7, 8, 13].

In conclusion, TKR may be successfully performed in patients with OA or RA who have previously undergone contralateral TKR or single or bilateral THR. The functional result is equally good to that of an isolated TKR and the post-operative complication rate is no higher. We recommend the use of an unconstrained prosthesis with congruent surfaces.

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References

1. Aichroth P, Freeman MAR, Smillie IS, Souter WA (1978) A knee function assessment chart. *J Bone Joint Surg [Br]* 60: 308–309
2. Engh GA, Durgen KA, Hanes CK (1992) Polyethylene wear of metal-backed tibial components in total and unicompartmental knee prostheses. *J Bone Joint Surg [Br]* 74: 9–17
3. Hoekstra HJ, Veth RPH, Nielsen HKL, Veldhuizen AG, Visser JD, Nienhuis RLF, Hoekstra AJ (1989) Bilateral total hip and knee replacement in rheumatoid arthritis patients. *Arch Orthop Trauma Surg* 108: 291–295
4. Jergesen HE, Poss R, Sledge CB (1979) Bilateral total hip and knee replacement in adults with rheumatoid arthritis. *Clin Orthop* 137: 120–128
5. Johnson KA (1975) Arthroplasty of both hips and both knees in rheumatoid arthritis. *J Bone Joint Surg [Am]* 57: 901–904
6. Kageyama Y, Miyamoto S, Ozeki T, Hiyoshi M, Kushida K, Inoue T (1998) Outcomes for patients undergoing one or more total hip and knee arthroplasties. *Clin Rheumatol* 17:130–134
7. Landy MM, Walker PS (1988) Wear of ultra-high molecular polyethylene components of 90 retrieved knee prostheses. *J Arthroplasty* 3 [Suppl]: 73–85
8. Lindstrand A, Ryd L, Stenstrom A (1990) Polyethylene failure in two total knees; wear of thin metal-backed PCA tibial components. *Acta Orthop Scand* 61: 273–274
9. Marks JS (1984) Benefits of multiple joint replacement in rheumatoid arthritis. *Scand J Rehabil Med* 16: 43–46
10. McDonagh JE, Ledingham J, Deighton CM, Griffiths ID, Pinder IM, Walker DJ (1994) Six-year follow-up of multiple joint replacement surgery to the lower limbs. *Br J Rheumatol* 33: 85–89
11. McDonald I (1982) Bilateral replacement of the hip and knee in rheumatoid arthritis. *J Bone Joint Surg [Br]* 64: 465–468
12. McElwain JP, Sheehan JM (1985) Bilateral hip and knee replacement for rheumatoid arthritis. *J Bone Joint Surg [Br]* 67: 261–265
13. Rostoker W, Galante JO (1979) Contact pressure dependence of wear rates of ultra-high molecular weight polyethylene. *J Biomed Mater Res* 13: 957–964
14. Thompson M, Anderson M, Wood WHN (1974) Locomotor disability, a study of need in an urban community. *Br J Prevent Soc Med* 28: 70–71
15. Walker DJ, Usher K, O'Morchoe M, Sandles L, Griffiths ID, Pinder IM (1989) Outcome from multiple joint replacement surgery to the lower limbs. *Br J Rheumatol* 28: 139–142
16. Yoshino S., Fujimori J, Morishige T, Ushida S (1984) Bilateral joint replacement of hip and knee joints in patients with rheumatoid arthritis. *Arch Orthop Trauma Surg* 103: 1–4