An 8- to 10-year review of the Rotaglide total knee replacement

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Abstract Mobile-bearing knee arthroplasty (MBKA) is an alternative to fixed-bearing knee arthroplasty. This was a retrospective study of the Rotaglide Total Knee System. We present the results of the monitoring of 77 patients (85 knees) with a median duration to failure or end of follow up of 8.5 years (range 0.4 to 10.1 years). Patients were clinically and radiologically assessed at dedicated follow up clinics. The Hospital for Special Surgery (HSS) and Knee Society Score (KSS) systems were used to describe the clinical and radiological findings. The prosthesis had an estimated survival probability of 93.5% (standard error 3.4%) at 9 years. It is associated with good rates of patient satisfaction and high scores on the HSS and KSS systems. No knees were revised

for aseptic loosening. This knee replacement has a survival rate equivalent to other prostheses. It is a safe and reliable prosthesis associated with good clinical outcome.

Résumé L'arthroplastie du genou à plateau mobile est une alternative aux prothèses à plateaux fixes. Nous avons réalisé une étude rétrospective de la prothèse type Rotaglide. Matériel et méthode: nous présentons les résultats de 77 patients (85 genoux) avec un suivi moyen de 8.5 ans (de 4 à 10.1), aucun échec. Les patients ont été évalués sur le plan clinique et radiologique. Le score HSS et le score KSS ont été utilisés de même que les examens radiologiques. Résultats: cette prothèse a une survie estimée, probable de 93.5% à 9 ans (erreur standard de 3.4%). Sont associés des résultats cliniques satisfaisants avec des scores élevés. Aucun genou n'a été repris pour descellement aseptique. En conclusion: Nous pouvons assurer que le taux de survie de cette prothèse est équivalent aux autres implants. Cette prothèse peut être considérée comme relativement sûre et fiable avec un devenir clinique satisfaisant.

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Introduction

Mobile-bearing total knee replacements attempt to resolve the conflict between high conformity at the articulating surface and non-compressive force transmission to the tibial fixation interface. A highly conforming femoral surface geometry minimises the possibility of excessive linear wear or fracture of the polythene through local overloading [9]. At the same time, a freely moving interface between the tibial baseplate and the polythene bearing dissipates much of the torque on the tibial component. The aim is to achieve stable long-term fixation with minimal generation of polythene wear debris and related bone lysis [10, 11, 13, 16].

Problems which might arise specifically in mobile-bearing knee arthroplasty (MBKA) include bearing subluxation or dislocation; these could result in the sudden failure of the bearing, soft tissue impingement or increased wear of the components.

We report the results of one type of MBKA followed for 8–10 years (median 8.5 years) in our department. The Rotaglide Knee (Corin, Cirencester, UK) is a four-part posterior cruciate ligament (PCL)-preserving mobile-bearing cemented knee replacement, which has a one-piece polyethylene meniscal component that is able to glide antero-posteriorly and rotate on a highly polished tibial component. The femoral component is based on a sphere and congruency with the meniscal component is maintained from 0–120° of flexion. Two pegs on the upper surface of the tibia restrain meniscal rotation and anterior-posterior translation.

Materials and methods

Patient selection

Eighty-five consecutive Rotaglide total knee replacements were performed between March 1995 and August 1997. Patients with gross pre-operative instability were excluded from the study and received a fixed-bearing arthroplasty. This was in line with the manufacturer's recommendation that, because of the unconstrained design and mobile bearing, there is the potential for dislocation in an unstable knee. Over and above yearly routine follow up, patients were followed up in dedicated clinics at one-year post-operatively and at the time of this review (8–10 years post-operatively). A history and clinical examination, including accurate measurements of knee flexion using a goniometer, were performed by the junior author (MH). Pre-operative and post-operative Knee Society [5] and Hospital for Special Surgery [6] scores (KSS and HSS, respectively) were carried out for each patient. If it was not possible for a patient to attend the clinic, they were contacted by telephone and the assessment of implant survival and function was performed over the phone.

The mean age at operation was 71 (range 44–88) years. There were 25 male and 52 female patients. The aetiologies for surgery were: primary osteoarthritis in 73 knees (86%), secondary osteoarthritis in five knees (6%) and rheumatoid arthritis in seven knees (8%). Eighty-three knees had patella resurfacing (97.7%).

Surgical approach

All of the knees were implanted by the senior surgeon (DP) or under his supervision. A midline skin incision with a medial parapatellar approach was used. Balancing was done at the trialling stage, with any imbalance being treated with ligament release. Any flexion–extension imbalance was treated with a femoral recut or by increasing the femoral size to increase the posterior offset. All components were cemented in using third-generation cementation techniques. The posterior cruciate ligament was preserved in all cases. The patella was routinely resurfaced in all but two cases (2.3%), owing to the senior author's preference (DP) at the time of surgery. A lateral release was performed if it was felt that patello-femoral tracking was not satisfactory at the end of the procedure.

Radiographic evaluation

Patients underwent standard weight-bearing antero-posterior and lateral radiographs. They underwent radiographs from their first post-operative follow up to the time of this review. The digital radiographs were evaluated by an independent surgeon using the Knee Society Total Knee Arthroplasty Roentgenographic Evaluation and Scoring System [3]. The thickness of lucent lines was recorded using a digital millimetre rule. The focus of the evaluation was on lucent lines around the tibia, femur and patella. The lucency was measured and correlated with clinical outcome in order to measure its significance.

Statistical analysis

Descriptive statistics and tabulations have been used to describe KSS pain and function scores, HSS scores, flexion

Table 1 Follow up status

End-of-study status	Patients	Knees	Failure (knees)		Patient follow up (yrs) to failure, death or end of study	
			Complete	Partial	Median	Range
Alive	57	63	3	1	8.8	1.8–10.1
Clinic contact	45	51	1	1	8.7	7.4–10.0
Telephone contact	12	12	2	0	9.2	1.8–10.2
Died	19	21	0	1	5.6	0.4–9.1
Left study	1	1	1	0	2.2	–
Total	77	85	4	2	8.5	0.4–10.1

Table 2 Radiographic lucencies

Radiolucencies (mm)	Lateral femur	AP tibia	Lateral tibia	Lateral patella
0	44	43	45	49
5		2	1	
10	1	2	2	1
20	1	3	1	
30	2		1	
40	2			
Total	50	50	50	50

and radiographic lucency outcomes. Survival probabilities were estimated using the Kaplan-Meier method. The analysis was undertaken using SPSS version 13.

Results

Follow up status

In the period from operation to the end-of-study review, 19 of the 77 patients died, all of whom had been seen from the initial follow up clinics to the time of their deaths and the status of the knee replacement was known in all cases. Of the remaining 58 patients, 45 were seen in the end-of-study

review clinics. A further 12 were interviewed over the telephone as they were unable to attend the clinic for a variety of reasons (ill health in six cases; travelling distance in three cases; and declined without reason in three cases). One patient who had a revision declined further follow up after the surgery and withdrew from the study. Details of follow up by review status are given in Table 1.

Clinical outcome

At a median follow up of 8.5 years, the median KSS—knee pain score had improved from 44 pre-operatively to 93 post-operatively (range 21–100). The pre-operative median KSS—function improved from 33 to 65 post-operatively (range 0–100). The pre-operative median HSS improved from 47 to 101 post-operatively (range 41–131). The median pre-operative range of motion improved from 80° to a median post-operative value of 100°. Surviving patients were asked whether or not they were satisfied with the outcome for the specific knee(s) at the last review. A response of “satisfied” was stated for 60 out of 63 knees (94%).

Radiographic outcome

A full set of X-rays was available for 50 knees and were evaluated using the TKA scoring system (Table 2). The

Table 3 Further surgery, including revision

Case	Gender	Age at primary operation (years)	Original pathology	Months to revision or further surgery	Remarks	Current situation	Remarks
1	F	70	Osteoarthritis	58	Patellar instability requiring tibial tuberosity transfer and later full revision.	Pain-free but limited range of motion and mobility secondary to gross obesity.	Post-operative pain and instability. Initial exchange of insert with soft tissue rebalancing. Revised.
2	M	67	Osteoarthritis	22	Two-stage revision for deep infection.	Later above-knee amputation for unrelated reasons.	Two-stage revision for deep infection.
3	M	60	Osteoarthritis	13	Two-stage revision for deep infection.	Mobility acceptable but patient has chronic pain.	Two-stage revision for deep infection.
4	F	76	Osteoarthritis	105	Fractured meniscus associated with ruptured collateral ligament. Revised.	Good range of motion and pain-free.	Fractured meniscus associated with deficient collateral ligament. Revised.
5	M	80	Osteoarthritis	6	Instability treated with ligament rebalancing and exchange of insert.	Excellent range of motion and no pain.	Instability treated with ligament rebalancing and exchange of insert.
6	F	59	Osteoarthritis	7	Pain and instability treated with soft-tissue procedure and patella resurfacing.	Chronic pain associated with RSD.	Pain and instability treated with soft-tissue procedure and patella resurfacing.

majority of patients had 0 mm of lucency in all zones, as described in the Knee Society Total Knee Arthroplasty Roentgenographic Evaluation and Scoring System. For those patients that had lucency, there was no evidence of progressive lysis on review of previous films. There was no correlation between the few patients that had lucency and adverse clinical outcome.

Complications and complication-free survival

Six patients (7%) developed early post-operative complications. These included: deep vein thrombosis proven on Duplex Doppler in two (2.3%); superficial skin infection that resolved with anti-biotics alone in three (3.5%) and post-operative stiffness that necessitated MUA in one (1.1%).

Six (7%) of the knees had a late complication that required further surgery.

At the last follow up, four knees had been revised, two for deep infection and one each for patellar instability and collateral ligament rupture. A further two knees had soft tissue rebalancing and exchange of insert or patella button because of pain and instability (Table 3).

The Kaplan-Meier method was used to estimate the survival probabilities at 5 and 9 years with the end-points of either complete revision surgery only (complete revision) or further surgical procedures, including complete revision (complete+partial revision) (Figs. 1 and 2). The survival probability at 9 years based on the end-point of complete revision was 0.935 (standard error 0.034). The survival probability at 9 years with re-operations of any type was 0.897 (standard error 0.044) (Table 4).

Fig. 1 Survival with end-point of revision of all components

Fig. 2 Survival with end-point of further surgery

Discussion

We found this mobile-bearing knee replacement to be safe and reliable. There were no instances of bearing dislocation using this semi-constrained design and no known instances of the mobile bearing causing significant soft tissue or patellar tendon impingement [8]. The one case of fracture of the polythene occurred in a patient who developed medial collateral ligament laxity at 8 years post-total knee replacement.

Patients with gross ligamentous laxity were excluded from this series. We did not encounter any technical problems in achieving adequate flexion–extension balance in this series of patients and we would not consider this MBKA to be technically any more demanding than a fixed-bearing knee arthroplasty [18].

Because of the highly conforming surface geometry of this design, we would expect linear wear to be minimal over this follow up period [15, 12]. Some concern has been expressed that mobile polythene bearings may result in increased volumetric wear associated with wear at both the superior and inferior surfaces of the bearing. We did not encounter any radiological evidence of lytic lesions, progressive lucent lines or the aseptic loosening of components

Table 4 Survival probabilities

Follow up	Survival probabilities (standard error)	
	Complete failure	Complete+partial failure
5 years	0.963 (0.021)	0.951 (0.024)
9 years	0.935 (0.034)	0.897 (0.044)

during the follow up period but longer term follow up will be required to define this further. The authors appreciate the fact that osteolysis after total knee replacement is often underdiagnosed.

A Cochrane Collaboration did not reveal any superiority of MBKA over a fixed-bearing knee arthroplasty in terms of range of motion and or function. This has been supported by similar findings in clinical and radiostereometric studies [2, 4, 7, 17]. The literature has, however, shown that the survival of a MBKA is comparable to a fixed-bearing knee replacement [1, 14]. It remains to be seen whether MBKA will show long-term superiority in terms of polythene wear, bone lysis and aseptic loosening.

We acknowledge the fact that there were certain limitations to this study. Some of the patients were not able to attend the follow up clinics and telephone contact had to suffice. This was a retrospective non-controlled and non-comparative study. There are no conflicts of interest related to this study.

In this series, the clinical results are good to excellent, with little radiographic evidence of failure through osteolysis. The prosthesis is safe and reliable. This has previously been proven at 5 years [19]. Patient satisfaction was high, with good knee function, as shown by the KSS and HSS scores.

This study only looked at one type of knee arthroplasty. It does, however, satisfy the needs of the surgeon and the patient group who under went knee arthroplasty. The benefits of this arthroplasty are likely to be in terms of longevity but this will have to be re-evaluated in time.

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