Comparison of Fixed and Mobile-Bearing Total Knee Arthroplasty at a Mean Follow-up of 116 Months

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Background: The superiority of mobile-bearing total knee arthroplasty implants over fixed-bearing implants, or vice versa, is still debated.

Methods: A series of patients with similar clinical and radiographic characteristics were treated consecutively with 100 fixed-bearing followed by 100 rotating-platform implants. Patients underwent prospective clinical and radiographic evaluation.

Results: The mean duration of follow-up was 116 months (range, sixty-one to 144 months). Clinical, radiographic, and implant survival outcomes were compared. No significant differences between the mobile-bearing and fixed-bearing groups were found with respect to the clinical outcome or cumulative implant survival at the time of the latest follow-up. Three of the fixed-bearing implants and one of the rotating-platform implants had required revision surgery.

Conclusions: No differences between mobile-bearing and fixed-bearing designs were demonstrated at a mean of 116 months of follow-up.

Level of Evidence: Therapeutic Level II. See Instructions for Authors for a complete description of levels of evidence.

Fixed-bearing total knee arthroplasty has demonstrated a high degree of clinical success[1-5], with reported survivorship rates of 90% to 98% at ten to fifteen years of follow-up[6,7] in both young[8] and elderly patients[9]. However, issues of polyethylene wear and osteolysis[10] resulting in loosening and failure have been noted with conventional fixed-bearing total knee arthroplasty designs, and mobile-bearing designs were developed to address these problems.

Mobile-bearing designs theoretically have certain advantages over fixed-bearing designs. First, total knee arthroplasty with mobile-bearing implants potentially reproduces and can accommodate a more physiologic pattern of movement. There is anteroposterior translation of the femur and internal rotation of the tibia with deep knee flexion[11]. Second, mobile-bearing designs could potentially reduce wear and stress transfer to the polyethylene, reducing osteolysis and catastrophic wear[12]. Third, a mobile-bearing articulation potentially reduces the forces transferred to the tibial component and lessens the stresses at the implant-bone-cement interfaces, reducing the risk of loosening[13,14]. Finally, in another effort to reduce wear, the mobile-bearing total knee arthroplasty design aims to achieve high congruency between the femoral component and the polyethylene articulation[15]. Consequently, mobile-bearing total knee arthroplasty designs can theoretically lead to improved knee kinematics, improved polyethylene wear profiles, and reduced transfer of forces to the implant-bone-cement interfaces compared with conventional fixed-bearing designs.

Despite these theoretical advantages[16], higher cost and reported problems of joint stiffness and failure due to instability are among the barriers to wide adoption of mobile-bearing knee designs[17]. Furthermore, mobile-bearing total knee arthroplasty has not been shown to be clinically superior or more durable compared with fixed-bearing total knee arthroplasty[18-21]. However, some of these previous studies comparing mobile-bearing with fixed-bearing total knee arthroplasty

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TABLE I Demographics and Outcome Measures According to Implant Type

Parameter	Preoperative		
	Fixed Bearing (N = 100)	Mobile Bearing (N = 100)	P Value
Age* *(yr)*	69.58 ± 7.27 (43-87)	70.46 ± 5.94 (57-83)	0.42
Sex	19 M, 81 F	17 M, 83 F	0.71
Diagnosis	7 rheumatoid arthritis, 3 osteonecrosis, 90 osteoarthritis	5 rheumatoid arthritis, 7 osteonecrosis, 88 osteoarthritis	
Body mass index* *(kg/m²)*	27.01 ± 4.43	27.42 ± 5.09	0.27
Deformity*	5° varus (2°-7° varus)	5° varus (2°-7° varus)	0.89
HSS knee score*			
Total	54.03 ± 7.14 (33.0-66.0), IQR 51-59	55.44 ± 6.69 (33.0-66.0), IQR 51-61	0.17
Pain	6.24 ± 3.27 (0-10)	6.35 ± 3.09 (0-10)	0.81
Function	6.17 ± 2.66 (0-10)	6.58 ± 2.54 (0-10)	0.30
Stair climbing*	2.13 ± 0.61 (2-5)	2.24 ± 0.81 (2-5)	0.31
Range of motion* *(deg)*	67.18 ± 8.92 (56-80), IQR 56-72	66.9 ± 8.56 (56-80), IQR 56-72	0.87
BOA satisfaction* *(%)*			
Enthusiastic	—	—	—
Satisfied	—	—	—
Noncommittal	—	—	—
Disappointed	—	—	—

*The values are given as the mean and the standard deviation, with the range in parentheses. The IQR is also reported for the total HSS score and range of motion.

involved relatively short-term follow-up[19,20]. Therefore, the purpose of the present study was to prospectively compare the intermediate-term results of fixed-bearing and mobile-bearing total knee arthroplasty at a mean of nearly ten years of follow-up. A consecutive series of patients was treated with NexGen LPS fixed-bearing or rotating-platform total knee arthroplasty implants (Zimmer, Warsaw, Indiana). We compared survivorship, the prevalence of radiolucent lines and osteolytic lesions, and pain and function scores in the two groups.

Materials and Methods

The study was approved by our institutional review board and was carried out in accordance with the World Medical Association Declaration of Helsinki. All patients met with a surgeon for an interview prior to surgery and were informed about the risks and benefits of total knee arthroplasty. Patients who accepted surgery were asked to provide informed consent for the surgery and for participation in the study. Patients could withdraw from the study at any time.

From January 1998 to September 2002, 200 consecutive knees in 163 patients (136 female and twenty-seven male) were treated with the NexGen implants, with thirty-seven of the patients undergoing bilateral total knee arthroplasties six to twelve months apart. The first 100 consecutive knees, in seventy-five patients (the FB group), were treated with fixed-bearing implants, and the second 100 knees, in eighty-eight patients (the MB group), were treated with mobile-bearing implants. The mean patient age was seventy years (range, forty-three to eighty-six years) at the time of the index surgery. Since we prefer the lateral surgical approach for valgus knees, patients with preoperative valgus deformities were excluded. The indication for total knee arthroplasty in the FB group was osteoarthritis in ninety knees, rheumatoid arthritis in seven, and osteonecrosis in three; the indication in the MB group was osteoarthritis in eighty-eight, rheumatoid arthritis in five, and osteonecrosis in seven. The two groups were homogeneous and had similar preoperative deformity, knee motion, demographics, and clinical characteristics (Table I). One surgeon (M.C.) performed or supervised all of the total knee arthroplasties, and all arthroplasties in both groups utilized the same surgical technique.

The implants evaluated in this study were the NexGen Legacy Knee Posterior Stabilized (LPS) and NexGen LPS-Mobile Bearing Knee Systems. These two implant designs have similar femoral geometries, with two convex spherical condyles. The primary differences are in the tibial components: the fixed-bearing tibial implant possesses a flat metallic surface shaped to lock the polyethylene liner, whereas the mobile-bearing tibial implant is flat and polished and has a central post to allow up to 25° of rotation of the polyethylene insert on the coronal axis. Both knee implants were of a posterior cruciate substituting design, and a patella with a concave and elliptical design was used in all knees that underwent patellar resurfacing.

A medial parapatellar approach to the knee was used. After removal of osteophytes and excision of the anterior and posterior cruciate ligaments, the distal cut on the femur was made with use of an intramedullary guide. The tibia was cut perpendicular to its long axis, and the ligaments were balanced to achieve equal flexion and extension gaps with use of a measured resection technique. The patella was selectively resurfaced when it was deformed by arthritis, when erosion of the native articular cartilage involved >50% of the surface (Outerbridge grade III or IV), and when there was maltracking of the patella either preoperatively or following insertion of the femoral and tibial trial

TABLE I (*continued*)

Final Follow-up		
Fixed Bearing (N = 91)	Mobile Bearing (N = 81)	P Value
80.53 ± 7.45 (53-98)	79.22 ± 5.92 (65-90)	0.10
18 M, 73 F	15 M, 66 F	0.68
4° valgus (2° varus-5° valgus)	3° valgus (3° varus-6° valgus)	0.61
85.16 ± 6.43 (58.0-98.0), IQR 82-89	86.84 ± 6.11 (71-98), IQR 83-90	0.06
12.08 ± 2.51 (8-15)	12.36 ± 2.51 (10-15)	0.43
10.90 ± 1.04 (8-12)	10.92 ± 1.00 (10-12)	0.90
4.29 ± 1.28 (2-5)	4.39 ± 1.21 (2-5)	0.57
113.6 ± 17.6 (80-144), IQR 96-128	115.0 ± 16.20 (96-144), IQR 104-128	0.59
16	17	0.98
69	69	0.98
11	11	0.98
4	3	0.98

components. Postoperatively, patients were allowed immediate knee motion and weight-bearing, and low-molecular-weight heparin was administered for deep venous thrombosis prophylaxis.

Patients were evaluated at regularly scheduled intervals (two weeks, three months, six months, one year, and yearly thereafter). Clinical outcomes were evaluated with use of the HSS (Hospital for Special Surgery) knee score, which includes pain and function components (including the ability to climb stairs)[22]. Patient satisfaction was also evaluated with use of the British Orthopaedic Association (BOA) patient satisfaction outcome[23], which has four possible responses: enthusiastic, satisfied, noncommittal, and disappointed. These responses were obtained as part of a survey and were recorded by a research assistant. Radiographic evaluation was performed with use of the Knee Society evaluation and scoring system[24]. Alignment and the presence of radiolucent lines were evaluated for each patient. An implant was defined as loose when there was progression of radiolucency, a change in component position, and/or circumferential radiolucent lines with a thickness of >2 mm in all zones.

A power analysis was conducted prior to the study to ensure that the study would be adequately powered and error and bias would be minimized. The power analysis confirmed that a sample size of 100 knees in each group would provide >90% power, at a $p < 0.05$ level, to detect a difference of 5 points in the knee score improvement and a difference of 10° in the knee motion improvement. It would provide 80% power to detect a difference of 5% in the survivorship rate at the time of the latest follow-up. Changes in the HSS knee and function scores and the postoperative range of motion were compared between the FB and MB groups with use of the Student t test, with correction for clustering of data since the analysis was performed on the basis of knees rather than patients. Survivorship of the fixed-bearing knees was compared with that of the mobile-bearing knees with use of the log-rank test and Kaplan-Meier survivorship curves.

Source of Funding

There was no external funding source for this study.

TABLE II Alignment of the Femoral and Tibial Components According to Implant Type

Parameter	Fixed Bearing (N = 100)* *(deg)*	Mobile Bearing (N = 100)* *(deg)*	P Value
Femoral component			
Anteroposterior	96.26 ± 1.67	96.65 ± 1.67	0.12
Sagittal	3.77 ± 2.70	3.75 ± 2.42	0.97
Tibial component			
Anteroposterior	89.02 ± 2.30	88.86 ± 2.47	0.67
Sagittal	88.74 ± 2.67	88.15 ± 2.54	0.12

*The values are given as the mean and the standard deviation.

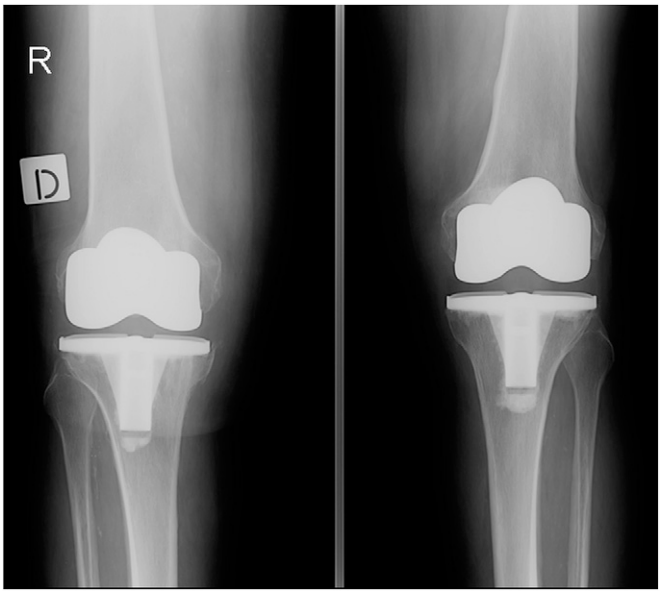

Fig. 1

Anteroposterior radiographs of a sixty-five-year-old man made eleven years after bilateral total knee arthroplasty with NexGen LPS fixed-bearing knee implants show that the implants appear well-fixed, with no evidence of loosening. The right patella was not resurfaced.

Results

The patients were followed for a mean of 116 months (interquartile range [IQR], 100 to 131 months; range, sixty-one to 144 months). The mean duration of follow-up was 129 months (IQR, 126 to 136 months; range, sixty-one to 144 months) for the FB group and 102 months (IQR, ninety-six to 109 months; range, seventy-seven to 116 months) for the MB group. Eight patients (ten knees) died prior to ten years postoperatively; none of these patients had required revision arthroplasty. Two of these patients (two knees) were in the FB group and six (eight knees) were in the MB group. Eighteen patients (eighteen knees) were lost to follow-up; seven of these patients (seven knees) were in the FB group and eleven (eleven knees) were in the MB group. The overall intermediate-term follow-up rate was 86% (172 knees).

Survivorship Analysis

Subsequent revision arthroplasty was required for three knees (one with aseptic loosening and two [in the same patient] with instability) in the FB group and one knee (with aseptic loosening) in the MB group. In the patient with bilateral knee instability, both the femoral and tibial components were well fixed at the time of surgery. Kaplan-Meier analysis with revision as the end point indicated the cumulative survivorship at a mean of nearly ten years was 96.7% for the FB group and 98.8% for the MB group. There was no difference in survival rate between the FB and MB groups ($p = 0.33$, log-rank test).

Radiographic Evaluation

The mean duration of radiographic follow-up was 116 months (range, sixty-one to 144 months). The preoperative femorotibial angle did not differ significantly between the two groups, averaging 5° (range, 2° to 7°) of varus in each group. The postoperative femorotibial angle averaged 4° (IQR, 3° to 5°; range, 1° to 8°) of valgus in the FB group and 3° (IQR, 2° to 4°; range, 0° to 8°) of valgus in the MB group ($p = 0.12$). The anteroposterior and sagittal positions of the femoral and tibial components did not differ significantly between the groups (Table II). Nonprogressive radiolucent lines (<2 mm) were present in twelve knees (seven in the FB group and five in the MB group). No osteolytic lesions were present in either group. Two knees (one in each group) had progressive radiolucent lines and required subsequent revision for aseptic loosening. Figures 1 and 2 show bilateral total knee arthroplasty with NexGen LPS fixed-bearing and mobile-bearing knee implants, respectively.

Clinical Evaluation

The mean HSS knee score increased from 54.0 points in the FB group and 55.4 points in the MB group ($p = 0.17$) preoperatively to 85.2 points in the FB group and 86.8 points in the MB group ($p = 0.06$) at the time of the latest follow-up. The mean range of motion increased from 67.2° in the FB group and 67.0° in the MB group ($p = 0.87$) preoperatively to 113.6° in the FB group and 115.0° in the MB group ($p = 0.59$) at the time of the latest follow-up (Table I). No patients in either group had a flexion contracture of >10°, and no patients required manipulation for stiffness. The patella was resurfaced in sixty-nine knees in the FB group and sixty-four knees in the MB group. There were no differences in the HSS total knee score, pain subscore, function subscore, or range of motion between patients with resurfaced

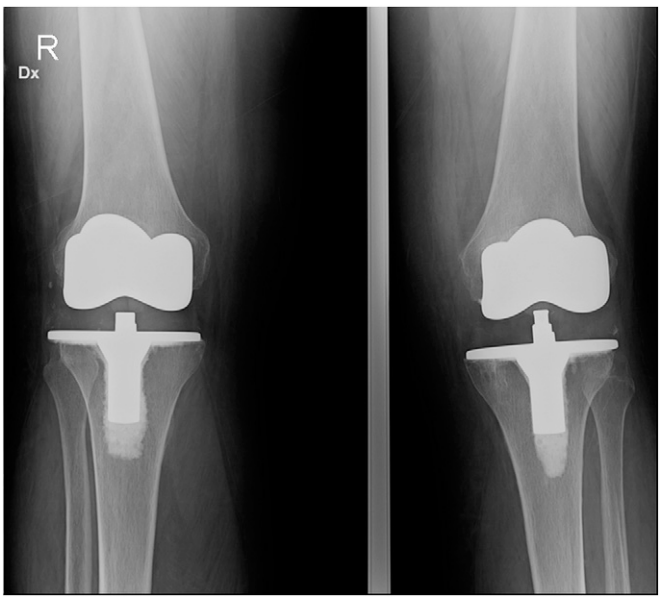

Fig. 2

Anteroposterior radiographs of a sixty-one-year-old woman made nine years (right) and ten years (left) after bilateral total knee arthroplasty with NexGen LPS mobile-bearing knee implants show that the implants appear well-fixed, with no evidence of radiolucent lines or loosening. The left patella was not resurfaced.

TABLE III Outcome Measures for each Implant Type According to Patellar Resurfacing

	Fixed Bearing			Mobile Bearing		
Parameter	Resurfaced (N = 69)*	Nonresurfaced (N = 31)*	P Value	Resurfaced (N = 64)*	Nonresurfaced (N = 36)*	P Value
Preoperative						
HSS knee score						
Total	54.2 ± 7.2 (33-66)	53.7 ± 7.2 (33-64)	0.75	56.0 ± 6.2 (37-66)	54.5 ± 7.5 (38-66)	0.36
Pain	6.1 ± 3.3 (0-10)	6.5 ± 3.3 (0-10)	0.60	6.6 ± 2.7 (0-10)	5.9 ± 3.6 (0-10)	0.34
Function	6.4 ± 2.7 (0-10)	5.7 ± 2.5 (0-8)	0.25	6.7 ± 2.5 (0-10)	6.4 ± 2.7 (0-10)	0.55
Stair climbing	2.1 ± 0.6 (2-5)	2.1 ± 0.6 (2-5)	0.73	2.3 ± 0.9 (2-5)	2.2 ± 0.7 (2-5)	0.61
Range of motion *(deg)*	66.9 ± 9.2 (56-80)	67.7 ± 8.3 (56-80)	0.69	67.0 ± 8.4 (56-80)	66.9 ± 8.9 (56-80)	0.96
Final follow-up						
HSS knee score						
Total	85.6 ± 5.5 (71-93)	84.2 ± 8.1 (58-98)	0.40	86.6 ± 6.1 (71-98)	87.3 ± 6.1 (71-98)	0.61
Pain	12.4 ± 2.5 (10-15)	11.4 ± 2.4 (8-15)	0.08	12.3 ± 2.5 (10-15)	12.4 ± 2.5 (10-15)	0.85
Function	10.9 ± 1.0 (10-12)	10.9 ± 1.1 (8-12)	0.85	10.9 ± 1.0 (10-12)	11.0 ± 1.0 (10-12)	0.73
Stair climbing	4.3 ± 1.3 (2-5)	4.3 ± 1.3 (2-5)	0.96	4.5 ± 1.2 (2-5)	4.3 ± 1.3 (2-5)	0.48
Range of motion *(deg)*	114.3 ± 18.3 (96-144)	112.2 ± 16.5 (80-144)	0.58	115.9 ± 16.2 (96-144)	113.5 ± 16.2 (96-144)	0.50

*The values are given as the mean and the standard deviation, with the range in parentheses.

TABLE IV Outcome Measures for each Patellar Treatment According to Implant Type

	Resurfaced			Nonresurfaced		
Parameter	Fixed Bearing (N = 69)*	Mobile Bearing (N = 64)*	P Value	Fixed Bearing (N = 31)*	Mobile Bearing (N = 36)*	P Value
Preoperative						
HSS knee score						
Total	54.2 ± 7.2 (33-66)	56.0 ± 6.2 (37-66)	0.14	53.7 ± 7.2 (33-64)	54.5 ± 7.5 (38-66)	0.66
Pain	6.1 ± 3.3 (0-10)	6.6 ± 2.7 (0-10)	0.36	6.5 ± 3.3 (0-10)	5.9 ± 3.6 (0-10)	0.49
Function	6.4 ± 2.7 (0-10)	6.7 ± 2.5 (0-10)	0.49	5.7 ± 2.5 (0-8)	6.4 ± 2.7 (0-10)	0.33
Stair climbing	2.1 ± 0.6 (2-5)	2.3 ± 0.9 (2-5)	0.37	2.1 ± 0.6 (2-5)	2.2 ± 0.7 (2-5)	0.60
Range of motion *(deg)*	66.9 ± 9.2 (56-80)	67.0 ± 8.4 (56-80)	0.90	67.7 ± 8.3 (56-80)	66.9 ± 8.9 (56-80)	0.60
Final follow-up						
HSS knee score						
Total	85.6 ± 5.5 (71-93)	86.6 ± 6.1 (71-98)	0.33	84.2 ± 8.1 (58-98)	87.3 ± 6.1 (71-98)	0.09
Pain	12.4 ± 2.5 (10-15)	12.3 ± 2.5 (10-15)	0.90	11.4 ± 2.4 (8-15)	12.4 ± 2.5 (10-15)	0.11
Function	10.9 ± 1.0 (10-12)	10.9 ± 1.0 (10-12)	0.98	10.9 ± 1.1 (8-12)	11.0 ± 1.0 (10-12)	0.90
Stair climbing	4.3 ± 1.3 (2-5)	4.5 ± 1.2 (2-5)	0.42	4.3 ± 1.3 (2-5)	4.3 ± 1.3 (2-5)	0.93
Range of motion *(deg)*	114.3 ± 18.3 (96-144)	115.9 ± 16.2 (96-144)	0.61	112.2 ± 16.5 (80-144)	113.5 ± 16.2 (96-144)	0.77

*The values are given as the mean and the standard deviation, with the range in parentheses.

and nonresurfaced patellae or between the FB and MB groups at the time of the latest evaluation (Tables III and IV). According to the BOA patient satisfaction score, 85% of patients in the FB group reported being "satisfied" or "enthusiastic" compared with 86% in the MB group (Table I).

Discussion

In theory, mobile-bearing total knee arthroplasty designs offer improved knee kinematics, improved polyethylene wear profiles, and reduced transfer of forces to the implant-bone-cement interfaces compared with conventional fixed-bearing designs. Despite these theoretical advantages, studies with relatively short-term follow-up have not shown mobile-bearing designs to result in superior function and durability compared with fixed-bearing designs. Kim et al. reported on a group of 174 patients who were undergoing simultaneous bilateral total knee arthroplasty; one knee was randomized to receive a fixed-bearing implant and the other to receive a mobile-bearing implant. At a mean of 5.6 years of follow-up, there were no differences in knee motion, pain or function scores, or the prevalence of osteolysis between the two groups of knees[19]. The purpose of the present study was to prospectively compare intermediate-term survivorship and clinical function after total knee arthroplasty with fixed-bearing and mobile-bearing implants.

Survivorship of the fixed-bearing and mobile-bearing designs was similar at intermediate-term follow-up in the present series. Kaplan-Meier survivorship analysis revealed a ten-year survivorship of 96.7% in the FB group and 98.8% in the MB group ($p = 0.53$) with implant revision for any reason as the end point. Three knees in the FB group required revision surgery (one for aseptic loosening and two [in the same patient] for instability) compared with one knee in the MB group (for aseptic loosening). The failures due to instability could be considered to represent a mistake in the choice of implant rather than a failure of the implant, as the patient demonstrated multiple lax joints (presumably as a result of a disease involving collagen, although the cause was not studied).

Although the study was underpowered with respect to implant survival, our findings that mobile-bearing total knee arthroplasty yielded excellent survivorship at nearly ten years of follow-up but did not demonstrate increased longevity compared with fixed-bearing total knee arthroplasty are consistent with previously published reports comparing mobile and fixed-bearing designs. Carothers et al. reported a cumulative fifteen-year survivorship of 96.4% in a meta-analysis of mobile-bearing knee arthroplasties[25]. In another study, Kim et al. reported on a series of 146 patients undergoing simultaneous bilateral total knee arthroplasties with use of an anatomic modular fixed-bearing design (AMK; DePuy, Warsaw, Indiana) in one knee and an LC RPS mobile-bearing design (DePuy) in the other. They reported survivorship of 99% for the fixed-bearing design and 100% for the mobile-bearing design at a mean follow-up of 13.2 years; the end point for the analysis was aseptic loosening or revision surgery (or a recommendation for revision surgery) for any reason[26].

Our results also did not demonstrate a reduction in the occurrence of radiolucent lines or osteolytic lesions in the MB group compared with the FB group at intermediate-term follow-up. Nonprogressive radiolucent lines were present in seven fixed-bearing knees compared with five mobile-bearing knees. Although reduction in wear and stress transfer to the polyethylene is a theoretical advantage of mobile-bearing knee designs, other authors have also failed to observe a reduction in the occurrence of radiolucencies or osteolytic lesions, which can be considered a proxy for wear. Kim et al. noted no difference in the prevalence of radiolucent lines in their series of 146 patients who underwent simultaneous bilateral total knee arthroplasties with mobile-bearing and fixed-bearing designs[26]. Garcia et al. evaluated a series of patients who retrieved ultra-high molecular weight polyethylene tibial inserts and correlated their results with intraoperative and radiographic findings. They reported that greater wear of the superior and inferior surfaces was associated with mechanically loose implants and with evidence of osteolysis, and they concluded that mobile-bearing designs were not immune to wear of the superior surface[27]. Consequently, despite its theoretical wear advantage, the mobile-bearing knee design in their series did not result in a reduction in radiolucent lines or osteolytic lesions compared with the fixed-bearing design.

Our clinical results showed that, at a mean intermediate-term follow-up of nearly ten years, mobile-bearing and fixed-bearing knee implants functioned equally well in similar groups of patients undergoing total knee arthroplasty for knee arthritis. There were no differences in the HSS knee scores and knee flexion between the two groups. Low rates of flexion contractures occurred after surgery. In addition, there were no significant differences in pain, function, or the rate of patient satisfaction between the two groups. Gioe et al. reported similar results in a prospective randomized trial comparing mobile-bearing with fixed-bearing designs at a mean follow-up of 3.5 years[28]. Using the Cochrane Database, Jacobs et al. performed a review of randomized controlled trials or controlled clinical trials in which a functional or clinical outcome measure was used to compare mobile-bearing with fixed-bearing knee implants; they reported no superiority of either knee design over the other[29]. Thus, the use of mobile-bearing knee implants did not result in increased knee flexion or function compared with fixed-bearing knee implants in a similar group of patients undergoing total knee arthroplasty.

The present study has several limitations. First, it represents a prospective comparison of two similar cohorts undergoing total knee arthroplasty with use of two different designs in a sequential fashion. Although the groups were similar in age, sex, clinical characteristics, and preoperative function, a prospective randomized study would have limited bias and other potentially confounding variables. Second, according to the power analysis performed prior to initiation of the study, the sample size of 100 total knee arthroplasties per group was expected to be able to provide 90% power to detect small changes in clinical function and 80% power to detect a 5% change in survivorship. Therefore, it may not have been sufficiently powered to detect significant differences between the two groups that were smaller than these limits (type-II error). In addition, a post hoc analysis indicated that the study actually had 84% power to detect the specified changes in clinical function and 73% power to detect the change in survivorship. Therefore, although we acknowledge that a study of this size using these outcome measures may be partially limited in its ability to fully discern true differences between these two implant types, other studies on the same subject have included fewer patients in the compared groups and/or shorter follow-up[30-32]. Consequently, the data do allow a glimpse into the successes and failures of these implants over time. Third, surgical bias can be introduced when a trial with one implant is completed prior to the initiation of use of another implant. However, the surgical instrumentation for the fixed-bearing and mobile-bearing knee systems is identical. In addition, the surgical procedures were performed by surgeons experienced in performing total knee arthroplasty with use of other mobile-bearing designs, thereby reducing issues related to the learning curve and the risk of surgical bias. Fourth, because the patient satisfaction surveys were not self-reported but rather recorded by a research assistant, there is a risk of biased responses. Finally, other issues such as unexplainably low preoperative knee flexion and selective patellar resurfacing in both groups could have affected the results. However, an examination of the effect of patellar resurfacing revealed that, on the basis of the numbers available, clinical outcomes did not differ significantly within the same implant group according to whether or

not the patella was resurfaced, nor did they differ significantly between patients with similar patellar treatment according to the implant group. Furthermore, because the proportion of patients with poor preoperative flexion and the proportion who did not undergo patellar resurfacing were both equal in the two patient groups, these factors should not preclude valid comparisons between the groups.

In summary, the fixed-bearing and mobile-bearing total knee arthroplasty designs yielded comparable clinical, radiographic, and survivorship results at a mean of nearly ten years postoperatively. ■

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