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Original Article

Are Midterm Patient-Reported Outcome Measures Between Rotating-Platform Mobile-Bearing Prosthesis and Medial-Pivot Prosthesis Different? A Minimum of 5-Year Follow-Up Study

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ABSTRACT

Background: Both rotating-platform (RP) mobile-bearing and medial-pivot (MP) fixed-bearing prostheses allow axial femorotibial rotation using a highly conforming polyethylene insert. However, limited comparative data are available between the 2 designs. This study was performed to compare the midterm clinical outcomes and patient-reported outcome measures (PROMs) of RP and MP prostheses.
Methods: We retrospectively reviewed the records of 52 total knee arthroplasties using RP mobile-bearing prosthesis and 49 total knee arthroplasties using MP fixed prosthesis with a minimum follow-up period of 5 years. Clinical and radiological outcomes, failure rates, and PROMs, including the Western Ontario and McMaster Universities Osteoarthritis Index score and satisfaction, were compared.
Results: There was no difference in clinical or radiographic outcomes ($P > .1$ for all comparisons), with the exception of the larger flexion contracture (FC) in the MP group (0.3° in RP vs 2.3° in MP, $P < .01$). No failure in either group was recorded during the study period. PROMs were comparable ($P > .1$ in all comparisons), with the exception of higher satisfactions in the RP group while performing light household duties ($P < .01$) and leisure or recreational activities ($P = .014$) in patients without FC.
Conclusion: The midterm clinical results with both the RP mobile-bearing and MP fixed-bearing prostheses were satisfactory. Although both prostheses provided comparable PROMs, patients with an RP prosthesis were more satisfied than those with an MP prosthesis for highly demanding activities that are strongly associated with the presence of postoperative FC.

Total knee arthroplasty (TKA) is one of the most efficacious, successful, and cost-effective treatments for advanced knee arthritis [1-3]. As TKA is being increasingly recognized as a standard treatment option for end-stage knee disease with widespread acceptance, its use has increased substantially over the past decades, and future demand is projected to rise rapidly [4-8]. In addition, as advances in technology and understanding of the most appropriate surgical techniques for TKA have improved clinical outcomes and long-term durability, the indications for TKA have expanded toward including more active and younger patients [9-11]. Thus, numerous innovative implant designs and surgical techniques have been introduced to improve functional performance and durability and to satisfy patient expectations. However, as these innovations have been adopted rapidly in practice without sufficient evidence, several controversial issues have surfaced and no gold-standard implant design for TKA has been developed.

Over the past few decades, the early "conventional" fixed-bearing knee prosthesis design has evolved to address the inherent limitations of this design. One of the most innovative developments is the rotating-platform (RP) mobile-bearing design, which was intended to solve the kinematic conflict between low-stress articulation and free axial femorotibial rotation by allowing rotation of a highly conforming polyethylene (PE) insert [12-14]. In addition, more recently, the medial-pivot (MP) fixed-bearing design was developed, to reproduce the MP kinematics of the native knee by allowing medial-centered unrestricted axial rotation of the femoral component on a highly conforming asymmetrical PE

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insert [15-17]. Thus, although the rationales for the 2 designs were fundamentally different, both allow for more axial femorotibial rotation. In addition, although there is no cam-post mechanism of the conventional posterior cruciate ligament (PCL)—substituting prosthesis, the stabilities of both designs are increased by maximizing the conformity of PE inserts with an increased anterior buildup and deep-dish and appropriate soft-tissue balancing [17-20].

Recently, patient-reported outcome measures (PROMs), such as patient satisfaction and quality of life, are becoming increasingly accepted as an essential part of the assessment of postoperative outcome after TKA [21-24]. However, because only one previous study [25], which had several flaws [26,27], compared early clinical outcomes and satisfaction between RP mobile bearing and MP fixed bearing, it remains unclear whether differences in implant design affect clinical outcomes and PROMs. In addition, because few studies have examined the midterm clinical and radiographic outcomes of the advance-coated system (ACS; implantcast GmbH, Buxtehude, Germany) mobile-bearing prosthesis [28], whether the ACS RP mobile-bearing prosthesis provides similar midterm clinical outcomes compared with other RP mobile-bearing prostheses remains unclear.

Thus, this study was performed to compare the ACS RP mobile-bearing prosthesis and the ADVANCE MP fixed-bearing prosthesis (Wright Medical, TN) in terms of clinical and radiological outcomes, prevalence of failure, and PROMs with a minimum 5-year follow-up.

Patients and Methods

We retrospectively reviewed the medical records and radiographs of 144 consecutive patients who underwent 233 TKAs between January 2009 and January 2010. We included patients who received the RP mobile-bearing prosthesis or the MP fixed-bearing prosthesis for primary osteoarthritis but excluded those who had a diagnosis other than primary osteoarthritis, received other prostheses, and for whom the follow-up duration was less than 5 years. During the study, 140 TKAs in 80 patients were performed using the RP mobile-bearing or the MP fixed-bearing prosthesis. The first 70 TKAs in 40 patients were performed using the RP mobile-bearing prosthesis and the next 70 TKAs in 40 patients using the MP fixed-bearing prosthesis. Finally, 101 TKAs of 58 patients with a minimum follow-up time of 5 years (average, 64, range, 60-72 months) were enrolled. There were 51 (88%) female patients and 7 males. Their mean age at the time of the index TKA was 67 years (range, 55-83), and the average body mass index was 27.6 kg/m^2 (range, 20.5-36.0). This study was approved by our institutional review board (PIRB-00116 1-003).

All operations were performed by a single surgeon (one of the authors) in patients under general anesthesia using a standard medial parapatellar arthrotomy with a tourniquet. In total, 52 ACS mobile-bearing prosthesis (implantcast GmbH) TKAs were performed in 30 patients (RP group) and 49 ADVANCE MP prosthesis (Wright Medical) TKAs were performed in the 28 other patients (MP group) (Fig. 1). There was no group difference in the demographic data (Table 1). The patella was not resurfaced, and cement fixation was used for all components in all cases. In both groups, the distal femur was resected perpendicular to the mechanical femorotibial angle using an intramedullary instrumentation system, and proximal tibia resection was performed perpendicular to the long axis of tibia using extramedullary instrumentation with a 7° posterior slope. The PCL was sacrificed in every patient. In both groups, an identical sequential soft-tissue release protocol for medial, lateral, and posterior structures was used to achieve a balanced flexion/extension and medial/lateral gaps, which were defined as all gap differences ≤2 mm using a tensor device [29-31]. Meticulous bleeding control was performed after deflation of the tourniquet and an intraarticular suction catheter was inserted and removed 24 hours after the operation. All patients received the same rehabilitation protocols. Starting the day after surgery, the patients were allowed to walk using a walker and began gradually increasing range of motion (ROM) exercises in bed. Clinical information, including demographic data, postoperative outcomes, and complications, was evaluated at 6 weeks, 3 months, 6 months, 12 months, and yearly thereafter.

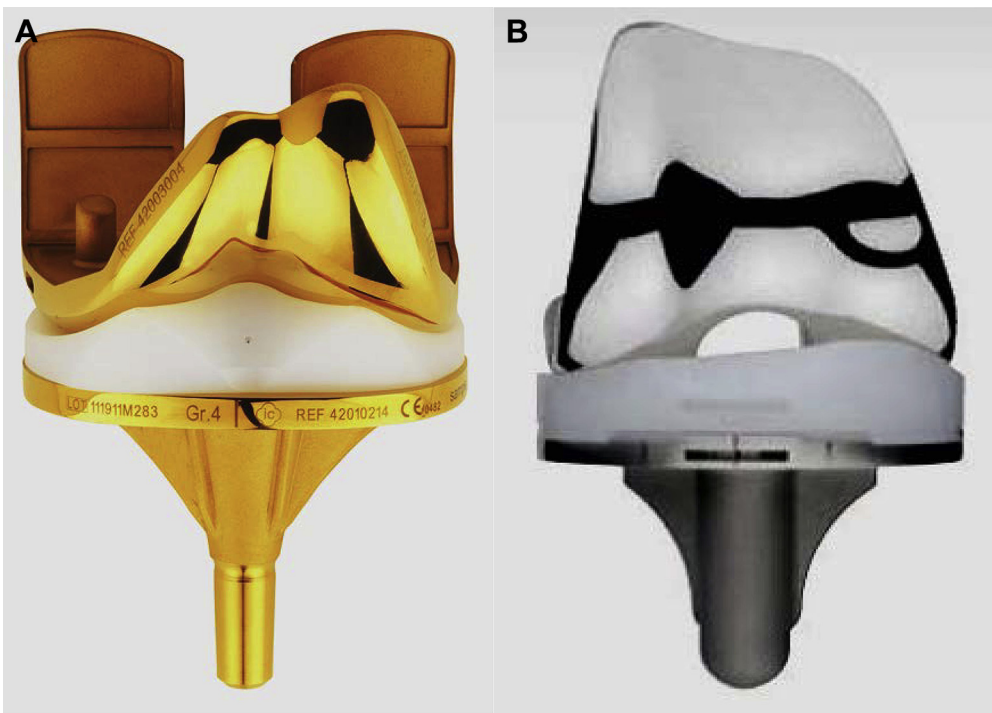

Fig. 1. Advance-coated system (ACS) rotating-platform mobile-bearing prosthesis (A) and advance medial-pivot fixed-bearing prosthesis (B).