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A Cohort Study in Iran: Mobile-Bearing-Versus Fixed-Bearing Total Knee Arthroplasty: Are These the Same?

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Abstract

Background: Application of fix-bearing-(FB) or mobile-bearing (MB) total knee arthroplasty (TKA) is an area of controversy. Introduction of mobile-bearing implants has become an appealing option for some surgeons leading to more favorable structural and weight-bearing outcomes in TKA; however, the beneficial long-term outcome is still unclear.
Objectives: This study was carried out to compare TKA outcomes by MB-versus FB implants with respect to long-term outcome.
Methods: A total of 140 patients who met our inclusion criteria were enrolled in this retrospective cohort study from March 2015 to April 2016. They were divided into two groups of 85 patients with MB TKA and 55 subjects with FB TKA. The range of motion (ROM), knee injury and osteoarthritis outcomes score (KOOS), and patient satisfaction were compared between two groups.
Results: The ROM and KOOS scores were not significantly different between the two groups ($P > 0.05$). With regard to the patient's satisfaction, there was no significant difference between the two groups ($P > 0.05$).
Conclusions: According to our results in this retrospective cohort study, regarding the outcome of TKA by MB versus FB implants, we showed comparable mechanical and functional outcome.

Keywords: Total Knee Arthroplasty, Outcomes, Implants, Mobile-Bearing

1. Background

Total knee arthroplasty (TKA) is a common lower limb surgical procedure (1), especially in patients with knee osteoarthritis who are older than 40 years of age (2). Regarding recent medical advancement, especially in arthroplasty techniques, there has been an increasing trend in these operations (3, 4). Nowadays, nearly five percent of the general population has a TKA history (5). Approximately five percent of patients who had undergone TKA develop mortality or morbidity and another five percent may require readmission (4) mainly due to infections and instabilities (6).

The postoperative prognosis after TKA is poorer particularly in patients with severe pain, significant varus/valgus deformity over twenty degrees, considerable functional disability, mental problems, or background diseases (7). However, the preventive approaches and improvement of therapeutic outcomes may lead to better results and improved patient satisfaction (8). Introduction of mobile-bearing (MB) implants is a strategy that gives better structural and weight-bearing outcomes (9, 10). It has been suggested that MB implants provide similar axial rotation of normal knee during flexion, a more congruent articular surface, increasing the contact area and reduce contact stress and mechanical loosening of the components (11-13).

To our knowledge, no study has investigated the long-term outcomes of these procedures in Iranian patients.

2. Objectives

We carried out this study to compare the benefits and harms of the TKA by MB versus fixed-bearing (FB) implants among Iranian patients.

3. Methods

A total of 140 individuals were consecutively included in this retrospective cohort study. Patients had undergone TKA from March 2015 to April 2016 in Rasool-e-Akram Hospital, Tehran, Iran. We divided the patients into two

groups: 85 patients had undergone TKA with MB implants and 55 subjects with FB implants. Patients with local and systemic diseases such as rheumatoid arthritis, local infections, previous history of knee fracture, and those with coagulopathies or who were lost to follow-up were excluded.

We followed the patients at least for two years. The data of age, gender, body mass index (BMI), the range of motion (ROM), knee injury and osteoarthritis outcomes score (KOOS), and patient satisfaction were extracted. Reliability and validity of KOOS questionnaire had been confirmed in different studies (14, 15). Also, the Persian version of this questionnaire is available and their reliability and validity are confirmed (16). The informed written consent form was also signed by all enrolled patients. The Helsinki Declaration was respected throughout the study. ROM was measured by an orthopedic goniometer. In term of patient's satisfaction, they were requested to score their satisfaction according to their pain from zero to 10. Zero indicated no satisfaction (severe pain) and 10 indicated complete satisfaction (no pain). We categorized the patients to dissatisfied (score 0 - 4), satisfied (score 5 - 8) and very satisfied (score more than 8). Data gathering was performed by a single senior orthopedic resident and were supervised by a knee surgeon fellowship. Physical rehabilitation programs, medical therapies, and postoperative cares such as weight-bearing exercises were similar in both groups.

Data analysis was performed by SPSS (version 13.0) software [Statistical Procedures for Social Sciences; Chicago, Illinois, USA]. Chi-square, Pearson-correlation, in addition to independent-sample-*t*-tests were used and considered statistically significant at P values ≤ 0.05.

4. Results

one hundred and forty patients were enrolled in this study, 19 (13.5%) cases were male. The mean age in FB and MB groups were 67.8 ($\pm$ 6.8) and 66.4 ($\pm$ 7.3), respectively. Demographic characteristics of MB and FB groups were shown in Table 1. ROM and KOOS scores and patients' satisfaction rates between the two groups were shown in Tables 2 and 3. The KOOS scores were 84.04 $\pm$ 17.6 and 89.1 $\pm$ 14.1 in MB and FB groups, respectively. Most patients were in satisfied group (72.9% in MB versus 85.5% in FB implant).

5. Discussion

In this study, the MB versus FB implants were assessed in patients who underwent TKA and it was found that these two methods had similar functional and practical outcomes. In addition, there was no side effect in both groups. For the final assessment of the outcome, we matched the two groups in terms of demographic variables to reduce confounding effects of age. Although the MB implants were initially introduced to decrease the mechanical problems, this point was not established in many studies as well as our clinical trial.

Implants, those inserted prior to 1995, had higher rates of bearing complications and excellent results were obtained with MB TKA over two decades (17). After 1995, the bearing instability became uncommon and bearing complications were reduced probably due to surgical technique improvements (17). In this study, conducted on Iranian patients who underwent MB or FB TKA, there was no significant difference in the outcome and satisfaction between two groups. This finding was similar to other studies such as Kim et al. (18) study in South Korea, which demonstrated the same results across these two methods. The primary aim in TKA is to improve the pain but it also aims to restore normal knee function. For this purpose, the postoperative range of motion is important, especially for Asian patients who frequently squat or sit in cross-legged positions (18). In a large case-series study by Poirier et al. (19), there were no significant differences in the clinical outcomes between MB and FB implants in TKA patients as well as our study.

In the current study, there was no significant difference in KOOS scores between MB and FB groups (84.04 $\pm$ 17.6 versus 89.1 $\pm$ 14.1, P value $>$ 0.05). This was also shown in Wylde et al. study (20) that KOOS scores were 58.8 $\pm$ 25.6 and 57.7 $\pm$ 25.3 in MB and FB groups, respectively after two-year follow-up. It seems that high scores in our patients are as a result of cultural and racial differences, including various level of satisfaction in two countries.

We also obtained no statistical difference regarding ROM and patient satisfaction between MB and FB groups. In consistent with these findings, Price et al. revealed that there was no significant difference in the ROM between two groups; however, a minimal but significant clinical advantage for the MB design was reported in their study (21). Tjornild et al. demonstrated that MB implants partially absorbed the force transmitted to the metal tibial tray resulted in reduced micromotion (22). When mobile-bearing implants were introduced, the theoretical advantages were shown by more conforming articular surface, lower contact stress and backside wear, the dissipation of the stress wear in two different surfaces, an enhancement of the flexion, allowing portending knee kinematics closer to physiological gait; posterior translation, moreover, a self-correcting rotational alignment leading to increasing the patellofemoral mechanics. However, clinical studies similar to ours have not confirmed these beneficial effects and advantages.

Furthermore, improvement in kinematics during kneeling position, step-up activity, gait function and

Table 1. Background Characteristic Distribution in Two Groups

Variable	Fixed-Bearing Implant	Mobile-Bearing Implant	P Value
Age, y	67.8 ± 6.8	66.4 ± 7.3	> 0.05
Male gender, No. (%)	12 (21.8)	7 (8.2)	> 0.05
Body mass index	25.2 ± 3.2	25.3 ± 3.1	> 0.05

Table 2. Range of Motion and KOOS Score Distribution in Two Groups

Variable	Fixed-Bearing Implant	Mobile-Bearing Implant	P Value
KOOS	89.1 ± 14.1	84.04 ± 17.6	> 0.05
Range of motion ± SD	115 ± 11	117 ± 12	> 0.05

Table 3. Patients' Satisfaction Rate in Two Groups[a]

Method	Dissatisfied (0 - 4)	Satisfied (5 - 8)	Very Satisfi (9 - 10)
Mobile-bearing implant	17 (20.0)	62 (72.9)	6 (7.1)
Fixed-bearing implant	5 (9.1)	47 (85.5)	3 (5.5)
P value	> 0.05	> 0.05	> 0.05

[a]Values are expressed as No. (%).

patellofemoral kinematics were not detected, as well (23, 24).

Totally, according to the obtained results of this retrospective cohort study, TKA by MB versus FB implants would have the same mechanical and functional outcomes. However further studies with larger sample size and multicenter sampling would improve more definite results.

Footnotes

Authors' Contribution: Study concept and design: Mehdi Moghtadaei, Ali Yeganeh, Hosein Farahini, Mohsen Motalebi and Majid Abedi. Analysis and interpretation of data: Mostafa Salehpour, Alireza Poolad, Kimia Haghighifard, Majid Abedi and Mohsen Motalebi. Drafting of the manuscript: Mohsen Motalebi, Majid Abedi, Ali Yeganeh and Mehdi Moghtadaei. Critical revision of the manuscript for important intellectual content: Mohsen Motalebi, Hosein Farahini, Ali Yeganeh and Majid Abedi. Statistical analysis: Alireza Poolad, Mostafa Salehpour and Kimia Haghighifard.

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