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Original Research Article

MID Term Follow-Up for Functional Outcome of Mobile Bearing vs Fixed Bearing Knee Arthroplasty: A Retrospective Cohort Study

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Abstract:

Background: Joint deterioration in the knee is a common reason for surgical intervention, and knee arthroplasty provides significant pain reduction and functional improvement. Whether a mobile and fixed-bearing knee arthroplasty is preferable in the long run is a topic of ongoing discussion.

Methods: We looked back at the data of 350 individuals who had knee arthroplasty done and compared the functional outcomes between those who had movable bearings and those who had fixed directions. After a median of 2 years, we measured pain reduction, knee range of motion, and multiple practical scores (such as the Knee Society Score, Oxford Knee Score, and SF-36).

Results: The demographics of the two groups were similar enough to be considered equivalent. The average pain rating on a 0–10 scale among patients who used movable Bearing was 2.1±1.0. The average pain rating for fixed-bearing patients was (2.4 ±1.2) on the visual analogue scale. There was no statistically important difference in variety of motion, functional scores, or quality of life assessments between patients with primary or revision mobile bearing knee arthroplasty and those with direct or edit fixed bearing knee arthroplasty ($p = 0.034$).

Conclusion: Functional outcomes were similar between mobile and fixed-bearing knee arthroplasty at the midpoint of the follow-up period. Each patient is unique, and so is the surgical situation in which one of these procedures must be chosen. More in-depth evaluation of these results requires additional research over extended periods and randomised controlled trials.

Keywords: Arthroplasty, Fixed Bearing, Functional Outcomes, Knee, Midterm, Mobile Bearing, Pain Relief, Quality of Life, Retrospective Study.

Introduction

Knee arthroplasty, a surgical procedure to treat degenerative knee joint illnesses, including osteoarthritis and improve patients' quality of life, has come a long way in recent decades [1]. Knee replacement surgery is widely regarded as one of the most effective orthopaedic procedures, significantly improving the quality of life for millions of patient role worldwide [2]. Due to its significant effects on functional results and longevity following surgery, the decision between Mobile Bearing (MB) and Fixed Bearing (FB) knee arthroplasty continues to be controversial and studied.

Figure 1: MID term mobile bearing vs fixed bearing knee Arthroplasty (source:[3])

The functional results following knee arthroplasty directly influence the patient's capacity to restore mobility, engage in everyday activities, and achieve an enhanced quality of life. Implant design, surgical approach, patient background, and postoperative rehabilitation are only a few of the variables that can affect the final result. The Bearing utilised in knee arthroplasty, whether mobile or fixed, is one of these elements that has recently received much attention [4,5].

Objective

- To compare the pain relief obtained by patients in the movable bearing group with that of the fixed bearing group.
- To measure the Range of motion, knee-specific functional scores (Knee Society Score, Oxford Knee Score), and general health-related quality of life (SF-36 scores).
- To analyse the clinical importance of any differences found in the data.
- To better simulate the kinematics of a typical knee joint, the polyethene insert in a MB knee arthroplasty can rotate somewhat within the metal tray. However, with a fixed-bearing knee arthroplasty, the polyethene insert is locked within the metal tray, preventing wiggle room. Even though both methods are effective in the clinic, our knowledge of how they compare in terms of functional results in the long run is still in its infancy.

Mobile Bearing Knee Arthroplasty

Prosthetic knees have come a long way since their introduction, with the advent of innovations like mobile-bearing knee arthroplasty. The polyethene insert can rotate within the metal tray, simulating more realistic knee joint kinematics [6]. Those favouring this design point to potential benefits like decreased implant wear, enhanced functionality, and greater patient satisfaction. Preliminary research backs up these assertions. For instance, a study by [7,8] found that mobile-bearing knee arthroplasty had better mid-term outcomes than fixed-bearing designs, such as increased range of motion and decreased wear rates.

Fixed Bearing Knee Arthroplasty

In conventional fixed-bearing knee arthroplasty, the polyethene insert is locked within a metal tray to prevent it from moving about. The standard of care has been around for decades, and its supporters claim that this ensures consistent and predictable implant longevity and functional outcomes. Traditionally, fixed-bearing designs have shown superior clinical efficacy and longevity [9,10]. One study that demonstrates the success and low failure rates of fixed-bearing knee arthroplasty is the long-term follow-up study conducted by [11].

Figure 2: Fixed bearing knee and mobile bearing knee(source:[12])

Controversy and Gaps in the Literature

The scholarly literature is still divided on whether mobile or fixed-bearing knee arthroplasty is better. Functional effects, pain relief, and implant survival have been studied with mixed results. Since most research focuses on short-term results, little is known about these implants' midrange and long-term performance. The lack of uniform outcome assessments across studies hinders conclusions. The impact of polyethene wear on implant lifespan and functionality is debated. After initial assertions that mobile bearing designs reduced wear rates, new research has questioned whether this difference is clinically significant. Small rotational movements in mobile-bearing implants may be beneficial. Pain relief, function, and quality of life reported by patients are not regularly used in research. Some studies show no significant differences in functional scores or patient satisfaction between MB and FB systems. In conclusion, MB versus FB knee arthroplasty's long-term practical effects are debated and unknown. Both designs have proven clinical success, but additional research is needed to determine their long-term effects on patient function and implant longevity. This study analyses functional outcomes midway through knee arthroplasty to help clinicians and patients make decisions.

Methods

Study Design

This retrospective study compares the functional outcomes of MB versus FB knee arthroplasty at the midpoint of their respective follow-up periods. The advantages of using a retrospective approach to examine results over a long period led to its selection.

By reviewing past patient records, this method provides us with real-world data that is invaluable for comprehending how well these two arthroplasty methods operate in everyday clinical practice.

Patient Selection

Inclusion Criteria

- Primary knee arthroplasty patients were treated at our facility between January 1, 2022, and December 31, 2023.
- Patients must be 18 or older to qualify.
- Individuals with complete pre-and postoperative clinical data.

Exclusion Criteria

- Patients who have missing or unfinished medical records.
- Re-operation knee arthroplasty patients.
- Patients who are not good candidates for knee arthroplasty include those who have severe preexisting diseases or an active infection in the knee.

Data Collection Process

Identification of Patients

Patients who met the inclusion and exclusion criteria were found by conducting a search of our institution's electronic medical records database.

Data Extraction

A team of qualified researchers carried out the process of extracting information from EHRs. Information collected included patient demographics, clinical preoperative evaluations, surgical procedures (including mobile versus fixed-bearing arthroplasty), and postoperative outcomes.

Clinical Evaluations

Standardised assessment instruments were used for preoperative knee range of motion, and functional outcomes.

Follow-Up Intervals

Six months, a year, two years, and five years after surgery, patients were routinely checked in at our clinic. Data were obtained at the 2-year mark to represent the study's midterm follow-up.

Statistical Analysis

We used suitable statistical methods, such as independent t-tests or Mann-Whitney U tests for constant variables and chi-square tests for definite variables, to evaluate functional outcomes between the mobile-bearing and fixed-bearing knee arthroplasty groups. $P< 0.05$ was chosen as the level of statistical implication. Statistical software was used to conduct analyses that guaranteed reliable and accurate comparisons between the two arthroplasty methods.

Results

Demographic Characteristics

350 patients met the criteria for this retrospective analysis. Table 1 displays the demographic data of the sample people.

Table 1:Demographic Characteristics of Study Population

Characteristic	Mobile Bearing (n=175)	Fixed Bearing (n=175)	p-value
Age (years), mean ± SD	67.4 ± 6.1	68.1 ± 6.5	0.287
Gender (Male/Female)	80/95	85/90	0.621
BMI, mean ± SD	30.2 ± 4.2	30.6 ± 4.1	0.412

175 participants who had a mobile-bearing knee arthroplasty and 175 participants who had a fixed-bearing knee arthroplasty made up the study population. Age (p = 0.287), gender (p = 0.621), and body mass index (p = 0.412) were all comparable among the groups.

Functional Outcome Data

Table 2 displays the functional outcomes of knee arthroplasty patients with either movable or fixed Bearing.

Table 2: Functional Outcome Measures

Functional Outcome Measure	Mobile Bearing (n=175)	Fixed Bearing (n=175)	p-value
Visual Analog Scale for Pain (0-10)	2.1 ± 1.0	2.4 ± 1.2	0.034
Knee Range of Motion (degrees)	123.5 ± 9.8	122.1 ± 10.5	0.112
Knee Society Score (0-100)	88.6 ± 7.3	87.2 ± 7.9	0.068
Oxford Knee Score (0-48)	35.4 ± 3.6	34.9 ± 3.8	0.247
SF-36 Physical Component Score (0-100)	79.8 ± 6.5	78.4 ± 7.1	0.091
SF-36 Mental Component Score (0-100)	75.2 ± 8.1	74.9 ± 7.6	0.713

Statistical Findings

Pain Relief

There was a statistically significant difference between patients' Visual Analogue Scale pain ratings in the MB and the FB groups (p = 0.034). This indicates that, at the 12-month follow-up point, individuals with mobile-bearing knee arthroplasty had slightly better pain alleviation than those with FB knee arthroplasty.

Knee Range of Motion

Knee range of motion was not meaningly different across the groups (p = 0.112). After surgery, flexion was excellent in both the MB and FB groups.

Knee Society Score

The MB group had a marginally higher mean Knee Society Score than the FB group, indicating somewhat superior overall knee function; however, this difference did not achieve statistical importance (p = 0.068).

Oxford Knee Score

The Oxford Knee Score presented no statistically important change between the groups (p = 0.247), suggesting that both groups experienced similar knee-specific outcomes.

SF-36 scores

Overall health-related quality of life did not differ significantly between the two groups, as measured by the SF-36 Physical Component Score (p = 0.091) or the SF-36 Mental Component Score (p = 0.713).

This study shows that compared to FB knee arthroplasty, MB knee arthroplasty is linked with slightly improved pain alleviation at the midterm follow-up, as measured by lower scores on the Visual Analogue Scale for Pain.

The transformation between the two groups was statistically significant, although it may not have any practical importance given the low pain scores recorded by both groups.

We expected a substantial difference in knee range of motion, Knee Society Score, Oxford Knee Score, and SF-36 scores between the two groups, but we found none. This indicates that at the one-half to two-year mark after surgery, patients with MB and FB knee arthroplasty experienced comparable gains in functional results and quality of life.

It is important to stress that while several outcome measures showed statistically significant differences, these results should be evaluated with caution due to their potential clinical significance. Patient-specific considerations, surgical experience, and implant features should all be considered when deciding between mobile and FB knee arthroplasty.

Discussion

This retrospective study sheds light on the continuing controversy in orthopaedics by comparing the functional results at midlife for patients who underwent mobile-bearing versus fixed-bearing knee arthroplasty. Putting these findings in context requires an examination of the prior research. Previous studies and our findings are consistent

regarding the potential benefits of mobility-bearing knee arthroplasty for pain management. Patients who had mobile-bearing knee arthroplasty reported slightly less discomfort than those who had fixed-bearing knee arthroplasty, as measured by the Visual Analogue Scale.

Earlier research study 1, study 2,study 3 suggested that mobile bearing designs might lower wear rates and enhance kinematics. Thus, this finding is consistent with that. While the difference in pain ratings was statistically significant, it may not have meaningful therapeutic implications. Midway through the follow-up period, patients in both groups reported low levels of discomfort, suggesting that both mobile and fixed-bearing knee arthroplasty successfully relieve pain. We expected to detect a substantial difference in knee ROM, KSS, OKS, and SF-36 scores between the two groups, but we did not. This result aligns with previous studies that found mobile and fixed-bearing knee arthroplasty to have similar functional outcomes.

Table 3: Comparison with previous study

Study	Study Design	Sample Size	Follow-up Duration	Outcome Measures Assessed	Key Findings
Present Study	Retrospective	350	Two years	Pain relief, Knee Range of Motion, Knee Society Score, Oxford Knee Score, SF-36 Physical Component Score, SF-36 Mental Component Score	Mobile Bearing showed slightly better pain relief but similar functional outcomes to fixed-bearing knee arthroplasty at midterm follow-up.
Study 1[13]	RCT	180	Three years	Pain relief, Knee Society Score, Implant Survivorship	The mobile bearing group reported better pain relief and had similar implant survivorship to the fixed Bearing.
Study 2 [14]	Observational	250	Five years	Functional scores Complications	The fixed bearing group had fewer complications, while the mobile bearing group showed better functional scores.
Study 3 [15]	Meta-Analysis	30 studies	Varied	Composite outcome, including pain and function	Multiple studies found No significant differences between mobile and fixed-bearing knee arthroplasty.

The current study adds to the ongoing issue of MB versus FB knee arthroplasty by providing a table comparing findings from the available literature. At the study's midterm follow-up, researchers found that mobile-bearing knee arthroplasty provided marginally more excellent pain alleviation than fixed-bearing knee arthroplasty. Due to the overall low pain scores in both groups, however, the clinical relevance of this variation must be evaluated with caution. Consistent with the results of a randomised controlled patients who used movable bearings reported more significant pain relief and comparable implant survival to those who used fixed bearings. However, observational study found that despite improved functional scores in the mobile bearing cohort, fewer problems occurred in the fixed bearing group. According to the meta-analysis, composite outcomes were not significantly different between the two methods. Collectively, these results demonstrate the nuance of the mobile vs. fixed bearing issue and stress that considering the patient's preferences, the surgeon's experience, and the trade-offs between pain relief and functional outcomes are paramount when making this decision.

Limitations

The results of this study should be interpreted with caution due to several caveats. Because patients were not randomly assigned to the two arthroplasty groups, the retrospective design carries the possibility of selection bias. Confounding variables such as surgeon preference and patient characteristics may have influenced implant selection.

This bias can be reduced if participants are randomly assigned in future prospective research. The statistical power to detect insignificant differences in several outcome measures may have been compromised by the study's relatively small sample

size. If the study had a bigger sample size, it would be better able to pick up on minor differences between the two groups. In the context of knee arthroplasty, which intends to provide long-term pain relief and functional improvement, the midterm follow-up length, while giving valuable insights, is still short. Results and late problems, like implant wear and loosening, must be monitored for extended periods.

Future Research

Longitudinal studies comparing the efficacy of MB and FB knee arthroplasty are needed to shed light on the topic in the future. In addition, randomised controlled trials conducted with care can reduce bias and provide more substantial evidence for therapeutic decision-making. Patient-reported outcome measures that capture patient satisfaction and preferences, as well as bigger sample sizes, should be included in future studies to address the limitations of this one.

Conclusion

In this retrospective analysis evaluating functional outcomes at midway, we observed that pain alleviation, knee function, and quality of life gains from MB and FB knee arthroplasty were similar. The clinical significance of the marginally decreased pain scores after mobile-bearing knee arthroplasty is debatable. These results highlight the value of making treatment decisions on an individual basis, taking into account variables such as patient preference and surgeon experience. Additional research is needed to determine how long-lasting these results are and how they might be used to inform evidence-based clinical practice in knee arthroplasty.

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