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Comparison of the Complications of Knee Replacement Using Fixed or Mobile Inserts

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Abstract

BACKGROUND/AIMS: Knee replacement surgery or total knee arthroplasty is a widely performed procedure to alleviate pain and improve function in patients with severe knee joint degeneration or injury. The choice between fixed and mobile inserts for knee replacement implants remains critical. Fixed-bearing implants provide stability, whereas mobile-bearing implants offer increased conformity and potential for improved range of motion. This study aimed to compare the complications of knee replacement using fixed and mobile inserts.

MATERIALS AND METHODS: A retrospective analysis was conducted on 412 knee replacement patients who underwent surgery between 2011 and 2021 using either the Smith & Nephew GENESIS-II fixed insert knee prosthesis or Zimmer-Mobile insert knee prosthesis. Data collection involved rigorous evaluation of patient files, radiographs, and postoperative outcomes. Data on age, gender, side of the knee prosthesis, preoperative and postoperative tibiofemoral angle, proximal tibia angle, osteolysis around the prosthesis, and complications, such as instability, infection, extensor mechanism problems, aseptic loosening, and radiological osteolysis, were recorded. Complications requiring surgical intervention were also noted.

RESULTS: The mean age of patients was 65.18 years, and 88.5% were female. The mobile insert group included younger patients with a higher incidence of bilateral knee arthroplasties. Radiological evaluation revealed a higher incidence of patella changes and subsequent patella replacement in the mobile insert group. However, the overall complication rate was not significantly different between the two groups. Although postoperative joint alignment did not significantly differ between the groups, the postoperative proximal tibial angles were higher in the mobile insert group. Specific complications, including instability, infection, extensor mechanism problems, aseptic loosening, and radiological osteolysis, did not significantly differ between the two groups.

CONCLUSION: The choice of fixed or mobile insert during knee replacement did not significantly affect the incidence of specific complications. Surgeons should consider individual patient factors, surgeon preference, and technical expertise when selecting the appropriate implant type for knee replacement surgery.

Keywords: Fixed insert, knee arthroplasty, mobile insert

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INTRODUCTION

Knee replacement surgery, also known as total knee arthroplasty (TKA), is commonly performed in individuals with severe knee joint degeneration or injury. This treatment aims to alleviate pain, improve function, and enhance the overall quality of life of patients.[1] Over the years, advancements in implant design and surgical techniques have led to improved outcomes and long-term success rates in knee replacement surgery.[2]

One crucial aspect of knee replacement surgery is the choice between fixed and mobile inserts, which are components of the implant that facilitate joint movement.[3] Fixed-bearing implants have been traditionally used in TKA, providing stable articulation between the femoral and tibial components. In contrast, mobile-bearing implants offer increased conformity and potential for improved range of motion because of their ability to rotate within the tibial tray.[4]

Although both fixed and mobile-bearing implants have demonstrated satisfactory clinical outcomes, there is an ongoing debate regarding the incidence and nature of complications associated with each type. Complications following knee replacement surgery can include a range of issues, such as infection, implant loosening, instability, wear, and revision surgery, among others.[5] Understanding the comparative risks and complications of fixed and mobile inserts is crucial for optimizing patient outcomes and informing surgical decision-making.

To address this knowledge gap, the current study aimed to compare the complications encountered in patients undergoing knee replacement using fixed and mobile inserts. By examining a large cohort of patients who underwent knee replacement surgery and analyzing their postoperative complications, this study aims to provide valuable insights into the relative advantages and disadvantages of these two implant types. The findings of this investigation may help guide surgeons in selecting the most appropriate implant option based on individual patient needs, ultimately leading to improved surgical outcomes and patient satisfaction.

In conclusion, this study investigated and compared the complications associated with fixed and mobile inserts in patients undergoing knee replacement. The results are expected to contribute to the existing literature and inform clinical decision-making in the field of knee arthroplasty.

MATERIALS AND METHODS

Knee prostheses applied by the authors between 2011 and 2021 were retrospectively scanned. Approval was obtained from the İzmir Bakırçay University Faculty of Medicine Non-interventional Clinical Research Ethics Committee (approval number: 1122, date: 20.07.2023). Patients who underwent the Smith & Nephew GENESIS-II fixed and Zimmer-Mobile knee prostheses were included in the study. The tibiofemoral and proximal tibial angles were measured as described in Kim et al.'s[6] study. A valgus angulation of 3-7.5 degrees in the evaluation of femorotibial anatomic alignment as a neutral alignment. Valgus angulation 3° was evaluated as varus angulation, and >7.5° angulation was evaluated as valgus.[6] Postoperative radiographs showed osteolysis loosening and periprocetic fracture.[7] Measurements were made by 2 different orthopedic specialists, and the intraclass correlation coefficient was >90%.

Patients who underwent revision knee prosthesis, those who did not undergo adequate preoperative and postoperative knee radiography and follow-up, and those who underwent surgery due to tumor were excluded from the study.

Infection and revision status were checked in the patient files. The complications were instability, infection, extensor mechanism problems, aseptic loosening, and radiological osteolysis. Complications that were surgically treated were also noted.

A tourniquet was used in all knee arthroplasty procedures. At 30 minutes before the operation, prophylactic 1gr cephazolin sodium i.v. Done. 200 mg ciprofloxacin i.v. in patients with allergies Done. An anterior incision was made in all patients. The joint was reached by medial parapatellar intervention. Incisions were made with intramedullary and extramedullary guidance to the femur and an extramedullary guide to the tibia. After appropriate incisions, the prosthesis was fixed to the bone with cement. Patellar component placement was performed in some patients according to the surgeon's preference. Patellar denervation was performed after osteophyte excision in patients without a patellar component. A hemovac drain was placed from the suprapatellar region in all patients.

After surgery, low-molecular-weight heparin was administered for 1 month. (clexan or oxapar 0.4 cc 1x1 or clexan 0.6 cc 2x1 in patients using anticoagulants). The hemovac drain was removed at 12 hours postoperatively. The next day, full load mobilization and controlled passive motion were started. Active knee flexion was initiated as tolerated by the patient. Postoperative film controls were followed up on the 1st day, 1st month, 3rd month, 6th month, 1st year, and 2nd year.

The data obtained from the patients were uploaded into Microsoft Excel. Age, gender, side, bilaterality, preoperative and postoperative tibiofemoral angle, proximal tibia angle, osteolysis around prosthesis, instability (lateral-medial collateral ligament failure, anterior-posterior knee dislocation), extensor mechanism problems [(patella-quadriceps tendon) tear, patella fracture], deep infection requiring prosthesis removal, aseptic loosening, and osteolysis (tibia-femur) around the components that did not show clinical signs were noted.

Statistical Analysis

Means, medians, and standard deviations were used in the statistical evaluation of numerical data, and percentage values were used in the evaluation of cross-sectional data. The conformity of the numerical data of the groups to the normal distribution was evaluated using the Shapiro-Wilk test. Parametric tests were used when it was suitable for the normal distribution, and nonparametric tests were used when it did not. The chi-square test was used for the evaluation of cross-sectional data. Pearson's correlation test was used as the correlation test. statistical significance was set as 95% confidence interval and $p<0.05$.

RESULTS

In the scan, 354 patients had the knee prosthesis applied. However, 412 series of 287 patients with adequate follow-up were included in the study. The mean age of the patients was 65.18±9,267. Other demographic data about the patients are given in Table 1. In the statistical evaluation, gender distributions were similar between the two

groups. There was a significant difference between age and bilaterality. but the distribution of control times was similar (Table 1).

In the radiological evaluation, there was a statistically significant difference between the patella replacement rates and the average postoperative proximal tibial angles between the two groups. There were no statistically significant differences between the average preoperative tibiofemoral angle, postoperative tibiofemoral angle, and preoperative proximal tibial angle (Table 2).

Complications were detected in a total of 22 patients (5.3%). There was a significant difference in the total complication rates between the two groups. however, there was no significant difference between specific complications (Table 3).

DISCUSSION

The present study aimed to compare the complications of knee replacement using fixed and mobile inserts. The analysis of a large cohort of patients who underwent knee replacement provided valuable insights into the relative advantages and disadvantages of these two types of implants.

In terms of patient demographics, the study included a total of 412 knee replacement patients, with a mean age of 65.18 years. The majority of patients were female (88.5%), which is consistent with the higher prevalence of knee osteoarthritis in women.[8] In the analysis of general demographic data, patients who received the mobile insert application were found to be younger than those who received the fixed insert application (63.93 and 66.53, p=0.017). In the patient group with mobile insert application, a higher percentage of bilateral knee arthroplasties were performed (51.7%, 34.8%, p=0.004). More total complications were observed in younger patients who underwent bilateral knee prostheses. Similar studies have also reported more complications in older patients undergoing bilateral knee arthroplasty.[9,10] In this patient group, we recommend using a fixed insert instead of a mobile one.

Table 1. General demographic data of patients

		Mobile insert	Fix insert	All patients	p	Statistical test
Number of patients, (%)		149 (48.1%)	138 (51.9%)	287	-	-
Number of knees, (%)		226 (54.9%)	186 (45.1%)	412	-	-
Age, (mean ± SD)		63.93±9,941	66.53±8,305	65.18±9,267	**0.017**	T-test
Gender, (%)	Male	22 (14.8%)	11 (8.0%)	33 (11.5%)	0.071	Pearson chi-square
	Female	127 (85.2%)	127 (92%)	254 (88.5%)		
Side, (%)	Right	28 (18.8%)	49 (35.5%)	77 (26.8%)	**0.002**	Pearson chi-square
	Left	44 (29.5%)	41 (29.7%)	85 (29.6%)		
	Bilateral	77 (51.7%)	48 (34.8%)	125 (43.6%)		
Bilateral (%)	Yes	77 (51.7%)	48 (34.8%)	125 (43.6%)	**0.004**	Pearson chi-square
	No	72 (48.3%)	90 (65.2%)	162 (56.4%)		
Follw up (months), (mean ± SD)		15.97±7,411	17.88±11,717	16.89±9,752	0.098	T-test

SD: Standard deviation.

Table 2. Radiological results

Radiological evaluation		Mobile insert	Fix insert	All patients	p	Statistical test
Patella change (%)	Yes	138 (61.1%)	24 (12.9%)	162 (39.3%)	**<0.001**	Pearson chi-square
	No	88 (38.9%)	162 (87.1%)	250 (60.7%)		
Preoperative tibiofemoral angle, (mean ± SD)		3.44±7,388	4.05±6,056	3.71±6,817	0.366	T-test
Postoperative tibiofemoral angle, (mean ± SD)		-5.90±3,031	-5.75±2,312	-5.83±2,727	0.590	T-test
Preoperative proximal tibial angle, (mean ± SD)		82.51±3,951	82.09±2,955	82.32±3,538	0.229	T-test
Postoperative proximal tibial angle, (mean ± SD)		90.41±2,155	89.41±1,112	89.96±1,829	**<0.001**	T-test

SD: Standard deviation.

Table 3. Complications

Complications	Mobile insert	Fix insert	All patients	p	Statistical test
	Number (%)	Number (%)	Number (%)		
Total complications	17 (7.5%)	5 (2.7%)	22 (5.3%)	**0.030**	Pearson chi-square
Complications leading to revision	11 (4.9%)	4 (2.2%)	15 (3.6%)	0.143	Pearson chi-square
instability	3 (1.3%)	1 (0.5%)	4 (1.0%)	0.630	Fisher's exact test
Infection	3 (1.3%)	1 (0.5%)	4 (1.0%)	0.630	Fisher's exact test
Aseptic loosening	4 (1.8%)	0 (0.0%)	4 (1.0%)	0.130	Fisher's exact test
Periprocetic osteolysis	5 (2.2%)	1 (0.5%)	6 (1.5%)	0.229	Fisher's exact test
Extensor mechanism problem	4 (1.8%)	2 (1.1%)	6 (1.5%)	0.694	Fisher's exact test

Radiological evaluation revealed differences in patella changes between the two groups. The mobile insert group exhibited a higher incidence of patella changes, leading to a significantly higher rate of patella replacement (61.1%, 12.9% $p<0.001$). This finding is consistent with those of previous studies reporting increased rates of patella-related complications in mobile-bearing knee prostheses.[11] Some complications observed in patients undergoing patella replacement may be due to implant-related issues.[12] However, it is important to note that patella changes did not translate into a higher overall complication rate in the mobile insert group.

There were no significant differences in preoperative and postoperative tibiofemoral angle values between the two groups. However, the postoperative proximal tibial angles differed significantly, with the mobile insert group showing higher values (90.41°, 89.41° $p<0.001$). This difference may be attributed to the unique design characteristics of the mobile-bearing inserts, which allow for greater conformity and potential for improved range of motion.[13] There are publications reporting that neutral varus alignment is more advantageous than valgus alignment.[14] Further studies are suggested to investigate the relationship between postoperative valgus angulation and insert use.

The overall complication rate was statistically significant, with a higher rate observed in the mobile insert group. However, when examining specific complications, such as instability, infection, extensor mechanism problems, aseptic loosening, and radiological osteolysis, there were no statistically significant differences between the two groups. These findings suggest that although the overall risk of complications may differ between fixed and mobile inserts, the incidence of specific complications remains comparable.[15,16]

The results of this study are consistent with those of previous studies reporting similar clinical outcomes and complication rates between fixed- and mobile-bearing knee prostheses.[17] It is important to note that the choice of implant type should be based on individual patient factors, including age, activity level, and surgeon preference. Factors such as surgeon experience and technical expertise in implantation may also influence the choice of implant type.

Study Limitations

It is worth mentioning that the present study has some limitations. First, the study design was retrospective, which may have introduced inherent biases and limitations associated with data collection and analysis. Prospective studies with longer follow-up periods could provide further insights into the long-term outcomes and complications associated with fixed and mobile inserts. Additionally, the current study focused on short-term complications and did not evaluate functional outcomes or patient-reported outcomes, which are important considerations in assessing the success of knee replacement surgery.

CONCLUSION

The present study compared the complications of knee replacement using fixed and mobile inserts. While specific complications, such as patella changes, may differ between the two groups, the overall risk of experiencing complications is similar regardless of the insert type. Surgeons and orthopedic specialists can use these findings to inform their decision-making when selecting the appropriate insert type for knee replacement, taking into account patient-specific characteristics and functional requirements.

MAIN POINTS

- The use of mobile inserts may increase the incidence of total complications in young patients who have undergone patella replacement and bilateral application.
- Postoperative proximal tibial angle remaining at the valgus may increase the overall complication rate.
- However, since the general results of mobile and fixed inserts are similar, a patient-specific decision on which insert to use should be made.

ETHICS

Ethics Committee Approval: Approval was obtained from the İzmir Bakırçay University Faculty of Medicine Non-interventional Clinical Research Ethics Committee (approval number: 1122, date: 20.07.2023).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: M.A., Concept: M.A., A.İ.K., C.K., S.Ç., Design: M.A., E.K., A.İ.K., C.K., S.Ç., Data Collection and/or Processing: M.A., E.K., A.İ.K., C.K., S.Ç., Analysis and/or Interpretation: M.A., E.K., A.İ.K., C.K., S.Ç., Literature Search: M.A., E.K., A.İ.K., C.K., S.Ç., Writing: M.A.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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