RESEARCH ARTICLE

Comparison in quality of life and pain between fixed and mobile bearing implants in total knee arthroplasty

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Abstract

Objective: To compare the outcomes of fixed versus mobile platform total knee arthroplasty in terms of postoperative pain, function and quality of life.

Method: The retrospective, comparative study was conducted at the Shifa International Hospital, Islamabad, Pakistan, and comprised data from January 2023 to June 2024 of patients requiring total knee arthroplasty. Based on the prosthesis type implanted, the patients were divided into fixed-platform Group A, and mobile-platform Group B. The patients were assessed at 6 months and 1 year post-intervention for pain, function and quality of life using visual analogue scale, Western Ontario and McMaster University Arthritis Index and Short Form Health Survey, respectively. Data was analysed using SPSS 22.

Results: Of the 62 patients, 31(50%) were in Group A; 23(74.19%) female and 8(25.81%) male with mean age 62.68±5.46 years. The remaining 31(50%) patients were in Group B; 20(65.52%) female and 11(35.48%) male with mean age 68.87±5.72 years. Mean scores on all the parameters were significantly different between the groups at 12-month follow-up ($p<0.05$).

Conclusion: Mobile-platform total knee arthroplasty provided much better outcomes at short-term follow-up compared to fixed-platform total knee arthroplasty.

Key Words: Arthroplasty, Knee joint, Quality of life, Visual analogue scale.

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Introduction

In recent decades, osteoarthritis (OA) has developed as a major public health threat due to the advancing age of people everywhere and the corresponding alterations in the structure of the musculoskeletal system.[1] OA, a degenerative joint cartilage condition, causes elderly people to experience a decrease in their independence and ability to move about, which significantly lowers their quality of life (QOL).[2,3] In order to improve these parameters in the affected patients, one of the interventions that has revolutionised the outcome of such patients is total knee arthroplasty (TKA).[4]

As communities become older due to improvements in their life longevity, there has been a dramatic spike in the number of TKA procedures undertaken over the past few years.[5] The major goal of TKA is to improve the individual's discomfort and functionality because both of these are the two most important aspects of any individual's QOL. TKA outcomes can be assessed by using treatment-related questionnaires, like the 36-item Short Form Health Survey (SF-36) and the Western Ontario and McMaster University Arthritis Index (WOMAC).[6, 7] These surveys have been effective in measuring changes in older patients' abilities and QOL.

There are two distinct kinds of TKA, distinguished by their tibial component; fixed-platform TKA and mobile-platform TKA. Although conventional, or fixed-platform, TKA can yield great outcomes, it also increases the likelihood of failure and repeated procedures due to polyethylene wear and stress concentrations at the tibial component's posterior region.[8] Many of these issues can be remedied by switching from a fixed-platform TKA to mobile-platform TKA which has been conceived with the main aim of lowering polyethylene wear, post-procedural pain and osteolysis subsequent to surgery. However, whether this technique actually provides any improvements in the aforementioned parameters has yet not been established or demonstrated.[8,9] In the similar vein, it is still not established whether there is any difference in the outcome of TKA with mobile-platform versus fixed-platform in terms of post-procedural pain, functionality and QOL.[9]

The current study was planned to compare the outcomes

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of fixed-platform versus mobile-platform TKA in terms of postoperative pain, function and QOL.

Materials and Methods

The retrospective, comparative study was conducted at the Shifa International Hospital, Islamabad, Pakistan, and comprised data from January 2023 to June 2024. After approval from the institutional ethics review board, the sample was raised employing non-probability consecutive sampling technique. The sample size was calculated using OpenEpi calculator[10] with 95% confidence interval (CI), 80% power, anticipated mean pain VAS score after fixed-platform TKA 28.83±19.40[11] and anticipated mean pain VAS score after mobile-platform TKA 16.57±18.97.[11]

Those included were patients of either gender aged >55 years, had symptomatic Kellgren and Lawrence grade 4[12] tricompartmental knee OA necessitating TKA, and did not have any neurological or vascular disease of the limbs. Patients who had bleeding or clotting disorders, those who had ongoing knee infection, previous history of procedure to the knee joint, varus or valgus deviation at the knee joint of ≥25 degrees, pre-existing gait abnormality, and those who had a deformity of knee in flexed and fixed position of 15 degrees or more were excluded, and so were those with incomplete data.

Baseline demographics of all the participants were documented, including age, gender and body mass index (BMI). Based on the prosthesis type implanted, the patients were divided into fixed-platform Group A, and mobile-platform Group B. No randomisation was done. Allocation criteria could not be determined since clinical records used for data collection lacked this information.

In patients of both the groups, TKA was performed by the same orthopaedic surgical team. This was ensured to remove operator bias. Each patient had an epidural block postoperatively for pain for 48 hours. Standard preoperative care with prophylactic antibiotics was given to the patients. Pneumatic tourniquet was used in each case. Procedure was performed using the anterior route for access with medial parapatellar approach. Anterior and posterior cruciate ligaments were sacrificed during the procedure. Eversion, resurfacing and replacement of patella was performed in all the patients. Femoral bone cut was done first, followed by tibial cut. Respective prosthesis was placed as per the assigned group, followed by its stabilisation. A single drain with suction was left in place for 24 hours. As a part of standard postoperative care package, all the patients were given antibiotics for 24 hours, analgesics and thromboprophylaxis. Once the drain was removed, the patients were encouraged to mobilise as early as possible and a comprehensive plan of rehabilitation with consultation of hospital physiotherapist was provided to the patients. All the patients were discharged by day five after the surgery with strict instructions to complete their rehabilitation programme. The patients were then called up for routine post-surgery follow-ups at six and 12 months after the procedure to assess visual analogue scale (VAS) score for pain that was scored 0-10, WOMAC score for pain, function and stiffness[7] and SF-36 score for QOL assessment.[6] The total WOMAC score ranged 0-96, with the pain component scored 0-20, stiffness 0-8 and functionality 0-68. Higher scores indicated poor status. SF-36 score was scored 0-100, with higher scores indicating better QOL.[6,7]

Data was analysed using SPSS 22. Quantitative variables were represented using mean with standard deviation after checking normality distribution by quantile-quantile (Q-Q) graph. Qualitative variables were represented using frequencies and percentages, and they were compared using the chi-square test. Comparison of baseline and post-treatment scores was done using paired sample t-test, while intergroup comparison of baseline, 6-months post-procedure and 12-months post-procedure scores was done using independent sample t-test (for individual scores comparisons) and repeated measures analysis of variance (ANOVA). P≤0.05 was taken as statistically significant.

Results

Of the 78 patients initially enrolled as per sample size calculation, 16(20.51%) were excluded since their complete post-procedural follow-up data was not available, and the final sample comprised 62(79.48%) patients, with 31(50%) in each group. There were 23(74.19%) females and 8(25.81%) males in Group A

Table-1: Intergroup comparison of baseline characteristics (n=62).

Characteristic	Fixed-platform TKA Group(n = 31)		Mobile-platform TKA Group(n = 31)		p-value
Mean age	62.68 ± 5.46 years		68.87 ± 5.72 years		< 0.001
Gender	**Male**	**Female**	**Male**	**Female**	
	8 (25.81%)	23 (74.19%)	11 (35.48%)	20 (65.52%)	0.409
Mean BMI	29.29 ± 7.03 kg/m²		31.81 ± 8.99 kg/m²		0.225

BMI: Body mass index, TKA: Total knee arthroplasty.

Table-2: Intragroup comparison of baseline and post-procedural VAS and WOMAC scores.

		Pain VAS		
Group	**Baseline**	**Post-procedural**		**p-value**
Fixed platform TKA	7.97 ± 0.65	**6-months**	3.13 ± 0.67	< 0.001
		12 months	2.16 ± 0.77	< 0.001
Mobile platform TKA	8.03 ± 0.65	**6-months**	1.84 ± 0.63	< 0.001
		12 months	0.84 ± 0.82	< 0.001
		WOMAC pain		
Fixed platform TKA	13.32 ± 0.90	**6-months**	3.52 ± 0.50	< 0.001
		12 months	2.61 ± 0.49	< 0.001
Mobile platform TKA	13.32 ± 1.07	**6-months**	3.35 ± 0.48	< 0.001
		12 months	2.06 ± 0.57	< 0.001
		WOMAC function		
Fixed platform TKA	45.42 ± 1.40	**6-months**	14.06 ± 1.20	< 0.001
		12 months	10.23 ± 0.88	< 0.001
Mobile platform TKA	44.55 ± 1.99	**6-months**	10.03 ± 0.87	< 0.001
		12 months	8.03 ± 0.79	< 0.001
		WOMAC stiffness		
Fixed platform TKA	4.90 ± 0.79	**6-months**	1.61 ± 0.61	< 0.001
		12 months	0.84 ± 0.45	< 0.001
Mobile platform TKA	4.97 ± 0.79	**6-months**	1.26 ± 0.44	< 0.001
		12 months	0.48 ± 0.50	< 0.001

TKA: Total knee arthroplasty, VAS: Visual analogue scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.

Table-3: Intergroup comparison of VAS and WOMAC scores.

Characteristic	**Fixed-platform TKA Group(n = 31)**		**Mobile-platform TKA Group(n = 31)**		**p-value**
Pain VAS	Baseline	7.97 ± 0.65	Baseline	8.03 ± 0.65	0.701
	Six months	3.13 ± 0.67	Six months	1.84 ± 0.63	< 0.001
	12 months	2.16 ± 0.77	12 months	0.84 ± 0.82	< 0.001
	p-value	< 0.001	p-value	< 0.001	
WOMAC pain scores	Baseline	13.32 ± 0.90	Baseline	13.32 ± 1.07	1.000
	Six months	3.52 ± 0.50	Six months	3.35 ± 0.48	0.207
	12 months	2.61 ± 0.49	12 months	2.06 ± 0.57	< 0.001
	p-value	< 0.001	p-value	< 0.001	
WOMAC function scores	Baseline	45.42 ± 1.40	Baseline	44.55 ± 1.99	0.052
	Six months	14.06 ± 1.20	Six months	10.03 ± 0.87	< 0.001
	12 months	10.23 ± 0.88	12 months	8.03 ± 0.79	< 0.001
	p-value	< 0.001	p-value	< 0.001	
WOMAC stiffness scores	Baseline	4.90 ± 0.79	Baseline	4.97 ± 0.79	0.750
	Six months	1.61 ± 0.61	Six months	1.26 ± 0.44	0.012
	12 months	0.84 ± 0.45	12 months	0.48 ± 0.50	0.005
	p-value	< 0.001	p-value	< 0.001	

TKA: Total knee arthroplasty, VAS: Visual analogue scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.

Table-4: Intragroup comparison of baseline and post-procedural individual SF-36 scores.

		Functional capacity		
Group	**Baseline**	**Post-procedural**		**p-value**
		12 months	65.48 ± 2.12	< 0.001
Mobile platform TKA	20.06 ± 1.80	6-months	58.61 ± 1.33	< 0.001
		12 months	74.87 ± 2.50	< 0.001
		Physical aspects		
Fixed platform TKA	15.16 ± 1.69	6-months	70.16 ± 1.29	< 0.001
		12 months	75.23 ± 3.26	< 0.001
Mobile platform TKA	15.65 ± 1.53	6-months	66.87 ± 1.20	< 0.001
		12 months	70.77 ± 2.15	< 0.001
		Pain		
Fixed platform TKA	38.87 ± 1.43	6-months	80.84 ± 1.00	< 0.001
		12 months	75.29 ± 1.03	< 0.001
Mobile platform TKA	39.16 ± 1.21	6-months	78.55 ± 1.09	< 0.001
		12 months	83.77 ± 2.48	< 0.001
		General health		
Fixed platform TKA	70.13 ± 1.45	6-months	75.19 ± 1.13	< 0.001
		12 months	77.19 ± 0.87	< 0.001
Mobile platform TKA	69.19 ± 1.37	6-months	80.68 ± 1.07	< 0.001
		12 months	74.74 ± 1.12	< 0.001
Vitality				
Fixed platform TKA	67.10 ± 1.49	6-months	78.03 ± 2.82	< 0.001
		12 months	79.77 ± 1.45	< 0.001
Mobile platform TKA	67.55 ± 1.23	6-months	78.48 ± 2.52	< 0.001
		12 months	76.52 ± 1.52	< 0.001
		Social aspects		
Fixed platform TKA	46.74 ± 1.39	6-months	80.97 ± 1.11	< 0.001
		12 months	82.00 ± 1.69	< 0.001
Mobile platform TKA	48.19 ± 4.83	6-months	85.26 ± 1.29	< 0.001
		12 months	87.52 ± 1.36	< 0.001
		Emotional aspects		
Fixed platform TKA	45.35 ± 2.75	6-months	71.90 ± 2.41	< 0.001
		12 months	78.87 ± 1.47	< 0.001
Mobile platform TKA	45.03 ± 6.06	6-months	79.84 ± 2.00	< 0.001
		12 months	87.23 ± 1.38	< 0.001
		Mental health		
Fixed platform TKA	69.23 ± 2.24	6-months	74.71 ± 0.86	< 0.001
		12 months	75.84 ± 1.36	< 0.001
Mobile platform TKA	69.55 ± 2.07	6-months	77.03 ± 1.42	< 0.001
		12 months	77.52 ± 1.36	< 0.001

TKA: Total knee arthroplasty, SF: Short Form Health Survey.

compared to 20(65.52%) females and 11(35.48%) males in Group B (p=0.409). The mean age in Group A was

Table-5: Intergroup comparison of SF-36 scores.

Characteristic	Fixed-platform TKA Group(n = 31)		Mobile-platform TKA Group(n = 31)		p-value
"Functional capacity"	Baseline	20.45 ± 1.33	Baseline	20.06 ± 1.80	0.341
	Six months	56.74 ± 0.89	Six months	58.61 ± 1.33	< 0.001
	12 months	65.48 ± 2.12	12 months	74.87 ± 2.50	< 0.001
	p-value	< 0.001	p-value	< 0.001	
"Physical aspects"	Baseline	15.16 ± 1.69	Baseline	15.65 ± 1.53	0.244
	Six months	70.16 ± 1.29	Six months	66.87 ± 1.20	< 0.001
	12 months	75.23 ± 3.26	12 months	70.77 ± 2.15	< 0.001
	p-value	< 0.001	p-value	< 0.001	
"Pain"	Baseline	38.87 ± 1.43	Baseline	39.16 ± 1.21	0.393
	Six months	80.84 ± 1.00	Six months	78.55 ± 1.09	< 0.001
	12 months	75.29 ± 1.03	12 months	83.77 ± 2.48	< 0.001
	p-value	< 0.001	p-value	< 0.001	
"General health"	Baseline	70.13 ± 1.45	Baseline	69.19 ± 1.37	0.012
	Six months	75.19 ± 1.13	Six months	80.68 ± 1.07	< 0.001
	12 months	77.19 ± 0.87	12 months	74.74 ± 1.12	< 0.001
	p-value	< 0.001	p-value	< 0.001	
"Vitality"	Baseline	67.10 ± 1.49	Baseline	67.55 ± 1.23	0.199
	Six months	78.03 ± 2.82	Six months	78.48 ± 2.52	0.509
	12 months	79.77 ± 1.45	12 months	76.52 ± 1.52	< 0.001
	p-value	< 0.001	p-value	< 0.001	
"Social aspects"	Baseline	46.74 ± 1.39	Baseline	48.19 ± 4.83	0.113
	Six months	80.97 ± 1.11	Six months	85.26 ± 1.29	< 0.001
	12 months	82.00 ± 1.69	12 months	87.52 ± 1.36	< 0.001
	p-value	< 0.001	p-value	< 0.001	
"Emotional aspects"	Baseline	45.35 ± 2.75	Baseline	45.03 ± 6.06	0.788
	Six months	71.90 ± 2.41	Six months	79.84 ± 2.00	< 0.001
	12 months	78.87 ± 1.47	12 months	87.23 ± 1.38	< 0.001
	p-value	< 0.001	p-value	< 0.001	
"Mental health"	Baseline	69.23 ± 2.24	Baseline	69.55 ± 2.07	0.560
	Six months	74.71 ± 0.86	Six months	77.03 ± 1.42	< 0.001
	12 months	75.84 ± 1.36	12 months	77.52 ± 1.36	< 0.001
	p-value	< 0.001	p-value	< 0.001	

TKA: Total knee arthroplasty, **SF:** Short Form Health Survey.

62.68±5.46 years compared to 68.87±5.72 years in Group B (p<0.001). Mean BMI in Group A was 29.29±7.03kg/m^2, while it was 31.81±8.99kg/m^2 in Group B (p=0.225) (Table 1).

Mean VAS scores at baseline, six months and 12 months in Group A were 7.97±0.65, 3.13±0.67 and 2.16±0.77, respectively, while in Group B these were 8.03±0.65, 1.84±0.63 and 0.84±0.82, respectively (p=0.701, p<0.001 and p<0.001, respectively). The WOMAC pain scores at the three time points in Group A were 13.32±0.90, 3.52±0.50 and 2.61±0.49 compared to 13.32±1.07, 3.35±0.48 and 2.06±0.57 in Group B (p=1.000, p=0.207 and p<0.001, respectively). WOMAC function scores at the three time points in Group A were 45.42±1.40, 14.06±1.20 and 10.23±0.88 compared to 44.55±1.99, 10.03±0.87 and 8.03±0.79 in Group B (p=0.052, p<0.001 and p<0.001, respectively). WOMAC stiffness scores at the three time points in Group A were 4.90±0.79, 1.61±0.61 and

0.84±0.45, while in Group B the corresponding values were 4.97±0.79, 1.26±0.44 and 0.48±0.50 (p=0.750, p=0.012 and p=0.005, respectively). While both the groups showed significant improvement (Table 2), Group B showed better results compared to Group A (Table 3), and the same was the case with SF-36 scores (Tables 4-5).

Discussion

The knee joint plays a pivotal role in facilitating daily activities, enabling individuals to engage in locomotion, such as walking, running, ascending stairs, and performing a range of movements.[13] Nevertheless, various variables, like the natural process of aging, the presence of OA and rheumatoid arthritis (RA), physical damage and hereditary susceptibility, can contribute to the degeneration of the cartilage in the knee joint.[14,15] This degeneration subsequently results in symptoms, such as pain, stiffness and limited range of motion (ROM).[16,17] TKA is an orthopaedic operation that aims at restoring functionality and alleviating discomfort in persons suffering from significant knee joint damage or degenerative ailments.[18,19] The outcomes of TKA have been greatly enhanced due to notable progressions in surgical methodologies, implant configurations and material innovations. The current study found that most of the patients in both the groups had higher female representation. This may be due to the fact that degenerative disease of knee joint affects female individuals much more compared to the male population.[20,21] There was no difference of statistical significance between patients who had fixed-platform TKA or mobile-platform TKA in terms of baseline pain VAS, WOMAC scores for stiffness, function and pain, and components of SF-36 scores. This was similar to an earlier study.[11] However, upon comparison of these outcome parameters at six and 12 months after the procedure, the current study found that patients who had mobile-platform TKA had significantly lower values for pain VAS and WOMAC scores compared to those who had fixed-platform TKA. Similarly, scores related to various aspects of QOL showed that patients who had mobile-platform TKA had much better QOL.

Nacca et al.[11] reported that pain VAS, WOMAC scores and various components of SF-36 scores at short-term follow-up periods were significantly better in patients who had mobile-platform TKA compared to those who underwent fixed-platform TKA. In contrast, there are several studies that found no clear-cut benefit on the outcome of TKA based on the type of platform used. In contrast to the findings of present study, Sohn et al.[22] revealed no significant disparities between the two groups in terms of pain levels, functional abilities, joint's degree of movement and QOL scores. Similar were the findings reported in various other researches.[23, 24] One study[25] showed that the use of fixed-platform had relatively better outcomes clinically than by the use of mobile-platform during TKA surgery.

The current study has some limitations, such as a small sample size, and a short follow-up period. Besides, other variables of knee ROM and polyethylene wear were not addressed. Radiological comparison in terms of the superiority of one implant over the other was also not done.

Conclusion

The mobile-platform TKA exhibited significantly improved outcomes compared to the fixed-platform TKA in terms of pain, stiffness, function and QOL at both six and 2 months post-surgery. Mobile-platform TKA approach was found to be a far more effective modality for achieving optimal pain relief and functional outcomes in patients with abnormal knee function who require TKA.

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HM: Writing and final approval.
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SH: Supervision and operating surgeon.
AS: Data collection.
MA: Data analysis and interpretation.