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A comparative study of functional outcome between fixed platform and rotating platform of total knee arthroplasty

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Abstract
The aim of this study was to determine whether there is a difference in functional outcome between the fixed-bearing and rotating-platform total knee replacement systems. One hundred twenty patients were randomised to receive either a fixed-bearing or rotating-platform total knee replacement. Range of movement (ROM), Oxford knee score (OKS) and Knee Society score (KSS) were assessed independently before and one year after surgery. Weight-bearing X-rays were taken immediately and one year post surgery to determine the incidence of osteolysis and loosening. At a mean follow-up of 13.4 months there was no statistically significant difference in mean ROM, OKS and KSS between the two groups. There was no evidence of osteolysis or loosening in either of the groups and no revision for infection or implant failure. This study shows that there is no statistically significant difference in functional outcome between the two types of implants at short-term follow-up.

Keywords: Fixed platform, rotating platform, total knee arthroplasty

Introduction
Mobile bearings in total knee arthroplasty have been developed with the aim to better reproduce the complex function and kinematics of the knee joint [1]. Simulator studies have shown that this significantly lowers the wear rate compared to standard fixed-bearing knee replacements [2]. It has also been suggested that mobile bearings minimise stress at the tibial bone–prosthesis interface [3]. To date, however, there has been no convincing evidence that these theoretical advantages lead to an improvement in clinical outcomes and survivorship. Various studies have been published comparing mobile- and fixed-bearing knee replacements [4-10].

In recent years a number of studies have investigated the functional outcome of the PFC Sigma fixed-bearing and PFC Sigma rotating-platform total knee replacement systems [12-17].

The designs of total knee arthroplasty systems have traditionally represented an attempt to maintain a balance between more conforming designs that reduce contact stresses and associated polyethylene wear but increase stresses at the fixation interface and less conforming designs that generate less stress across the fixation interface but result in greater contact stresses in the polyethylene secondary to a decreased contact area. The rotating-platform mobile-bearing knee prosthesis was designed to address this problem. Because the implant allows motion at the polyethylene-tibial tray interface, greater conformity between the femoral and tibial components can be accommodated without limiting the range of motion, thus decreasing contact stress [18, 19].

Clinical studies of rotating-platform knee designs have generally shown survivorship rates, Knee Society scores, and ranges of motion to be equal or superior to those reportedly associated with fixed-bearing total knee designs after similar periods of follow-up [20, 21].

Materials and Methods
The present study carried out in Yenepoya Medical College Hospital after obtaining the Ethical committee clearance of the hospital. A structured, pre-prepared case Proforma will be used to enter the clinical history,

physical examination findings and investigations findings. Those who will meet the inclusion and exclusion criteria will be included in the study. All patients who are fit to undergo total knee arthroplasty like advanced stages of osteoarthritis and rheumatoid arthritis in age group of 50-70years

Exclusion criteria

Patients with rheumatoid arthritis and patients undergoing revision arthroplasty, requiring tibial component augmentation or a femoral component augmentation or a constrained prosthesis were excluded from the study.

Results

Baseline Data

Table 1: Total no of patients

Number of Patients	20
Mean Age	63.75±6.138
Males	6
Females	14
Cases Underwent B/L Tka	9
Cases Underwent Left Sided Tka	3
Cases Underwent Right Sided Tka	8

Table 2: Statistics Rom, Knee Score

Group A Statistics										
		Post_op_rom_3M	Post_6M	Post_op_1Y	Knee_score_3M	Knee_score_6M	Post_op_knee_1year	Fun_score_3M	Fun_score_6M	Fun_score_1yr
N Valid	missing	20	20	20	20	20	20	20	20	20
		0	0	0	0	0	0	0	0	0
Mean		95.00	108.50	120.50	64.00	69.65	73.90	72.00	84.00	94.50
Median		95.00	110.00	120.00	61.00	69.00	74.00	70.00	85.00	90.00
Minimum		80	100	110	46	54	58	55	70	90
Maximum		110	120	130	77	78	85	80	90	100
Percentiles	25	90.00	100.00	112.50	59.00	66.00	70.75	70.00	80.00	90.00
	50	95.00	110.00	120.00	61.00	69.00	74.00	70.00	85.00	90.00
	75	100.00	117.50	130.00	70.00	75.00	78.00	80.00	90.00	100.00
IQR		10	17.50	17.5	11	9	7.25	10	10	10

Table 3: Statistics Rom, Knee Score

Group B Statistics										
		Post_op_3M	Post_op_6M	Post_op_1year	Knee_3M	Knee_6M	Knee_1yr	Fun_3M	Fun_6M	Fun_1Yr
N	Valid	20	20	20	20	20	20	20	20	20
	Missing	0	0	0	0	0	0	0	0	0
Mean		97.00	109.50	122.00	60.05	66.25	72.00	73.75	83.25	91.50
Median		100.00	110.00	120.00	60.00	67.00	71.50	75.00	80.00	90.00
Minimum		90	100	110	49	50	57	55	70	80
Maximum		110	120	130	69	78	84	80	90	100
Percentiles	25	90.00	102.50	120.00	59.00	63.50	69.25	70.00	80.00	90.00
	50	100.00	110.00	120.00	60.00	67.00	71.50	75.00	80.00	90.00
	75	100.00	110.00	130.00	64.75	68.00	75.00	80.00	90.00	100.00
IQR		10	7.5	10	5.75	4.5	5.75	10	10	10

Table 4: Post OP Knee Score

Ranks				
	Groups	N	Mean Rank	Sum of Ranks
Post_op_rom_3M	1.00	20	19.10	382.00
	2.00	20	21.90	438.00
	Total	40		
Post_6M	1.00	20	19.68	393.50
	2.00	20	21.33	426.50
	Total	40		
Post_op_1Y	1.00	20	19.43	388.50
	2.00	20	21.58	431.50
	Total	40		
Knee_score_3M	1.00	20	23.33	466.50
	2.00	20	17.68	353.50
	Total	40		
Knee_score_6M	1.00	20	23.60	472.00
	2.00	20	17.40	348.00
	Total	40		
Post_op_knee_1year	1.00	20	22.35	447.00
	2.00	20	18.65	373.00
	Total	40		
Fun_score_3M	1.00	20	19.33	386.50
	2.00	20	21.68	433.50
	Total	40		
Fun_score_6M	1.00	20	21.15	423.00

	2.00	20	19.85	397.00
	Total	40		
Fun_score_1yr	1.00	20	22.60	452.00
	2.00	20	18.40	368.00
	Total	40		

Table 5: Statistics in Post OP following three months to one year

Test Statistics									
	Post_op_rom_ 3M	**Post_ 6M**	**Post_op_ 1Y**	**Knee_score_ 3M**	**Knee_score_ 6M**	**Post_op_knee_ 1year**	**Fun_score_ 3M**	**Fun_score_ 6M**	**Fun_score_ 1yr**
Mann-Whitney U	172.000	183.500	178.500	143.500	138.000	163.000	176.500	187.000	158.000
Wilcoxon W	382.000	393.500	388.500	353.500	348.000	373.000	386.500	397.000	368.000
Z	-.838	-.480	-.630	-1.546	-1.688	-1.007	-.697	-.386	-1.262
Asymp. Sig. (2-tailed)	.402	.631	.528	.122	.091	.314	.486	.699	.207
Exact Sig. [2*(1-tailed Sig.)]	.461[b]	.659[b]	.565[b]	.127[b]	.096[b]	.327[b]	.529[b]	.738[b]	.265[b]
a. Grouping Variable: Groups									
b. Not corrected for ties.									

Since P value >0.05 for Post op ROM 3M,6M,1Year there is no significant difference between Group A and Group B.
P value>0.05 Knee Score 3M,6M,1year there is no significant difference between Group A and Group B.
P value>0.05 Fun Score 3M,6M,1 year there is no significant difference between Group A and Group B.

Discussion

Both mobile-bearing and fixed-bearing prostheses involving 40 total knee arthroplasties were compared in terms of performance and survival, with overall revision rates of approximately 1% per year for both types of implants. No previous controlled comparison has been able to show any advantage for a mobile-bearing over a fixed-bearing total knee prosthesis either in terms of clinical function or longevity.

The purpose of this study was to analyze the individual performance of fixed-bearing and mobile bearing knee replacements in an identical clinical setting by eliminating variables such as age, weight, and activity level. All surgeries were performed by the senior surgeon. The clinical evaluation was done by patients blinded to the type of implant in a particular knee. Patient-related bias was thus minimized.

The clinical results of both arthroplasties were similar. No benefit of the mobile-bearing knee over the fixed-bearing Knee could be seen with respect to the overall knee score, postoperative range of motion, and survival rate on the basis of the Size of the series. Excellent or good results were obtained in 90% (thirty six) of the forty patients in both groups.

Some patients had stiffness in both the groups. One patient had patellar tendon rupture following history of fall which was repaired later. No spin off or dislocation have occurred in rotating platforms.

Most *et al*., in an experimental study, showed that both mobile-bearing and fixed-bearing implants had similar kinematic patterns with regard to posterior femoral translation and tibiofemoral rotation despite the fact that their designs are different. They suggested that the mobile tibial insert stops moving at <90° of flexion and, after this point, the prosthesis performs essentially as a fixed-bearing implant. Similar findings were reported by D'Lima *et al*. The clinical results of the present study are consistent with the findings of these experimental studies. Both the fixed-bearing and the mobile bearing group had similar postoperative range of motion, which suggests that the *in vivo* kinematics of these implants may, in fact, be similar.

Dislocation is a potential complication with any mobile bearing Knee replacement and the LCS prosthesis is no exception. In our series, some patients have stiffness in the knees of both the groups. One patient had a patellar tendon rupture following history of fall. There is no spin off or dislocation of the knee in rotating platform knees. No significant difference was detected in the rates of survival between the two prostheses, with the numbers available.

The lack of statistical power is a potential drawback of this study, owing to the small number of patients evaluated and short term study.

No benefit of the mobile-bearing design over the fixed-bearing design could be demonstrated, with the numbers available.

Conclusion

We compared the functional outcome between rotating platform versus fixed platform of Total Knee Arthroplasty. Clinical and radiological follow-up was performed at 1, 3, 6 months and 1year after the operation. Pre-operative and follow-up ratings according to Knee Society Scoring system were obtained for all the patients. In addition, a visual analogue scale was used to specially assess the severity of the pain. We observed that the post operative range of motion and the Knee society functional score were same between both the groups.

There is no significant statistical difference between the two groups of Total Knee Arthroplasty in view of post operative range of motion and functional outcome owing to the short term study of 1year.

The long-term follow-up will determine if there is an increased rate of wear or loosening in either group. Based on the current results no type of bearing can be said to have a benefit over the other in this short term study.

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