

A STUDY TO COMPARE FIXED BEARING AND MOBILE BEARING TOTAL KNEE ARTHROPLASTY IN TERTIARY MEDICAL CENTRE, MUMBAI



Orthopaedics

Dr Amol K Salve* SMO, Department of Orthopaedics, VN Desai hospital, Mumbai.
*Corresponding Author

Dr Vinod Kumar Yadav Senior resident, Department of Orthopaedics, KEM Hospital Mumbai.

Dr Ajay M Wankhade Senior resident, Department of Orthopaedics, KEM Hospital Mumbai.

Dr Tanay Nahatkar Senior resident, Department of Orthopaedics, KEM Hospital Mumbai.

Dr Sangam Jain Senior resident, Department of Orthopaedics, KEM Hospital Mumbai.

ABSTRACT

Intro- For TKA, there are two types of bearing designs: fixed-bearing and mobile-bearing. Round femoral components articulate with a relatively flat tibial articular surface in a fixed-bearing knee design. Because the insert does not hinder the natural movements of the femoral component, the mobile-bearing (MB) TKA design is thought to allow more flexibility of motion than the fixed-bearing (FB) variety. **Aim and objective:** To compare fixed bearing and mobile bearing total knee arthroplasty. **Material and methods:** This study is a prospective type of study done at Seth GS medical college Mumbai, Department of Orthopaedics during August 2019 to June 2021 on patients undergoing total knee arthroplasty. Patients who were to undergo total knee arthroplasty were invited to take part in the study. This study, done on them was explained in detail to them. An informed consent was obtained. Patients fulfilling the inclusion criteria were listed. **Result:** Range of motion achieved after mobile arthroplasty was 123.62 ± 2.94 and in fixed arthroplasty it was 121.96 ± 2.74 . Pain after last follow up in mobile arthroplasty was 48.83 ± 0.62 and for fixed arthroplasty was 47.39 ± 0.86 . Flexion gap after last follow up in mobile arthroplasty was 24.13 ± 0.45 and in fixed was 24.02 ± 0.45 . Stability was almost similar in both mobile and fixed arthroplasty. **Conclusions:** there is no significant difference between fixed arthroplasty and mobile arthroplasty as far as Range of motion, Pain, Flexion gap, Stability was almost similar in both mobile and fixed arthroplasty.

KEYWORDS

Fixed arthroplasty, mobile arthroplasty, knee, TKA

INTRODUCTION

TKA is a promising therapy option for symptomatic osteoarthritis of the knee that has resisted conservative treatments. The literature has yet to find a potentially effective alternative option for cartilage regeneration in people with endstage degenerative alterations weakening the articular cartilage in many compartments of the knee. As a result, TKA has showed repeatable, longterm effectiveness in such patients in terms of pain reduction and improved overall quality of life. (1) The first primitive hinge joints made of ivory were implanted by German surgeon Themistocles Gluck in 1860, marking the beginning of total knee arthroplasty.

Following the invention of the Walldius hinge joint in 1951, which was first made of acrylic and then, in 1958, of cobalt and chrome, development really took off. This hinge joint, unfortunately, failed prematurely. (2) End-stage, degenerative osteoarthritis of the knee is the most common underlying diagnosis and indication for TKA, with roughly 94 to 97 percent of knee replacements performed for primary or post-traumatic osteoarthritis. These patients must have degenerative changes in their knees, as well as discomfort and limited function, that have resisted conservative and non-operative treatment. Rheumatoid arthritis, peri-articular fractures, and cancer are some of the other underlying illnesses that can be treated with a knee replacement. Patients with cancer, on the other hand, may frequently require megaprotheses. (3)

An active infection in the joint, as well as a distant infection or bacteremia, are the only absolute contraindications to TKA. Significant vascular disease, which can lead to poor wound healing and an increased risk of infection, is a relative contraindication. In the literature, there is currently debate and discussion about risk stratification and the increased problems linked with obesity. In comparison to non-obese patients, patients with a BMI more than 30 have a higher risk of infection and medical problems. Those with a BMI of more than 40 are at an even higher risk.

A statistically significant increase in superficial infection, deep infection, operating time, deep vein thrombosis (DVT), duration of stay, renal insufficiency, reoperation, and wound dehiscence was reported in patients with a BMI > 40. (3)

For TKA, there are two types of bearing designs: fixed-bearing and mobile-bearing. Round femoral components articulate with a relatively flat tibial articular surface in a fixed-bearing knee design. (4) Because the insert does not hinder the natural movements of the femoral component, the mobile-bearing (MB) TKA design is thought to allow more flexibility of motion than the fixed-bearing (FB) variety. This allows for tibial internal rotation to be replicated during flexion, while also reducing contact loads and linear wear on the polyethylene and improving patellofemoral tracking. (5)

Mobile-bearing prostheses strive to combine the advantages of both high-conformity and low-conformity designs, reducing osteolysis and polyethylene wear. They can spin (rotating platform) or slide (meniscal-bearing) on the tibial tray. Both systems offer rotational motions, but meniscal bearing designs additionally allow translational movements in the sagittal and coronal planes, depending on the prosthesis's precise characteristics. Despite their theoretical benefits, there is debate over the perceived downsides of meniscal-bearing prosthesis, such as the importance of "backside" wear and bearing instability. (6)

AIM OF THE STUDY

To compare fixed bearing and mobile bearing total knee arthroplasty.

MATERIAL AND METHODS

This study is a prospective type of study done at Seth GS medical college Mumbai, Department of Orthopaedics during August 2019 to June 2021 on patients undergoing total knee arthroplasty.

INCLUSION CRITERIA

Diagnosed with osteoarthritis
Candidate for primary total knee arthroplasty for this reason
Expected to undergo only one arthroplasty procedure within the next 12 months
50–80 years old
Preoperative alignment (varus or valgus) <20 degree

EXCLUSION CRITERIA

Missing or having an insufficient posterior cruciate ligament
Mediolateral instability

Infective arthritis

Severe deformity and revision

Currently enrolled in a clinical investigation with either a drug or an investigational device or has been enrolled in such an investigation during the last 6 months

Suffer from heart or lung disease

METHODOLOGY

Patients who were to undergo total knee arthroplasty were invited to take part in the study. This study, done on them was explained in detail to them. An informed consent was obtained. Patients fulfilling the inclusion criteria were listed.

RESULTS

Table 1. Demographic parameters of both treatment groups.

	Mobile		Fixed		P value
	Min-Max	Mean±SD (n=50)	Min-Max	Mean±SD (n=50)	
Age (years)	48-76	63.77±5.98	47-79	64.88±7.83	0.884
BMI (kg/m ²)	20.7-47.3	34.27±6.11	25.9-40.7	33.16±3.47	0.272
	n	%	n	%	P value
Gender					
Male	7	14	6	12	0.777
Female	43	86	44	88	
Side					
Right	26	52	27	54	
Left	24	48	23	46	

In patients undergoing mobile knee arthroplasty mean age was 64.91±6.16 years, mean BMI was 33.25±5.59 kg/m², 12.8% were males and 87.2% were females, almost equal number of left and right side cases were seen. In patients undergoing fixed knee arthroplasty mean age was 64.70±8.13 years, mean BMI was 32.19±3.32 kg/m², 10.1% were males and 89.1% were females, more right side cases were seen.

Table 2. Comparison of clinical scores in the mobile- and fixed-bearing groups.

	Preoperative			Last follow-up		
	Mobile	Fixed	P value	Mobile	Fixed	P value
Range of motion	85.11±11.39	89.78±10.36	0.735	122.73±2.92	121.98±2.72	0.217
Pain	1.89±1.18	2.66±1.39	0.546	48.87±0.66	47.39±0.86	0.01
Flexion gap	16.89±2.29	17.87±2.11	0.550	24.15±0.47	24.04±0.47	0.402
Stability	21.11±1.13	21.87±1.11	0.147	24.48±0.56	24.07±0.73	0.214
Flexion contracture	0.98±1.92	8.59±2.01	0.648	2.11±1.18	1.59±0.77	0.525
Extension gap	1.72±0.89	2.08±1.24	0.964	0.43±0.41	0.54±0.46	0.702
Knee score	16.4±13.8	19.2±14.7	0.392	93.5±6.2	89.7±6.9	0.007
Functional score	45.2±19.2	38.2±20.7	0.135	89±13	83.3±17.1	0.129

Range of motion achieved after mobile arthroplasty was 123.62±2.94 and in fixed arthroplasty it was 121.96±2.74. Pain after last follow up in mobile arthroplasty was 48.83±0.62 and for fixed arthroplasty was 47.39±0.86. Flexion gap after last follow up in mobile arthroplasty was 24.13±0.45 and in fixed was 24.02±0.45. Stability was almost similar in both mobile and fixed arthroplasty. Flexion contracture was -2.11±1.17 in mobile arthroplasty cases and -1.59±0.78 in fixed arthroplasty cases. Knee score and functional score was relatively higher in cases who underwent mobile arthroplasty.

Table 3. Comparison of clinical scores in the mobile- and fixed-bearing groups.

	Preoperative		P value	Final follow-up		P value
	MB	FB		MB	FB	
General health	48.29±3.48	50.73±4.33	0.384	72.52±5.18	70.98±5.86	0.695

Physical function	43.30±5.11	38.75±6.03	0.278	78.74±5.19	71.66±6.86	0.190
Role physical	47.34±6.84	41.31±7.93	0.318	90.45±5.83	88.07±6.19	0.479
Bodily pain	13.62±3.28	10.12±2.88	0.126	88.36±3.84	87.36±5.22	0.903
Role emotion	38.97±7.95	32.58±7.62	0.235	92.76±4.04	84.55±6.45	0.049
Energy/vitality	46.49±3.48	45.52±4.63	0.744	74.42±3.83	69.95±4.97	0.158
Mental health	64.62±3.63	64.57±3.81	0.984	82.93±3.27	80.54±3.21	0.260
Social function	44.81±5.57	41.03±5.90	0.362	90.53±3.83	83.71±6.17	0.204

General health, physical function, physical role, mental health, social function all were better in mobile arthroplasty cases. Bodily pain was less in fixed cases.

Table 5. Radiologic results

	Mobile-bearing	Fixed-bearing	P value
Femoral valgus	95.33±0.84	91.92±5.78	0.578
Tibial angle	88.32±0.59	87.44±0.82	0.086
Femoral flexion	2.59±0.60	2.87±0.64	0.812
Tibial slope	89.2±0.9	88.1±1.6	0.076
Preop alignment	4.8° varus	5.8° varus	0.113
Final follow-up	4.4° valgus	3.3° valgus	0.600
Patellar tilt	5.7° lateral	6.8° lateral	0.370
Femur-radiolucent line	0.40±0.35	0.72±0.78	0.826
Tibia-radiolucent line anteroposterior view	0.15±0.20	0.37±0.47	0.616
Tibia-radiolucent line lateral view	0.11±0.16	0.13±0.20	0.974

Tibial angle and tibial slope were more in mobile cases. Femoral flexion and patellar tilt was less in mobile group. 8279906709

DISCUSSION

Age

In a study by **Antonio Silvestre Munoz** et al (2008)(7) age for mobile cases ranged between 54-85 years and for fixed group it was between 44-82 years. Mean age in fixed group was 64.4±15.9 years and in mobile group was 67.6±7.0 years in a study by **Liao-bin Chen** et al (2013)(8). In a study by **Prakit Tienboon** et al (2012)(9) average age was 68.43 years in fixed group and 69.91 years in mobile group. In a study by **Michael Tjørnild** et al (2014)(10) age ranged between 54-75 years in both types.

BMI

In a study by **Prakit Tienboon** et al (2012)(9) average BMI in fixed group was 25.18 kg/m² and in mobile group it was 27.49 kg/m². In a study by **Michael Tjørnild** et al (2014)(10) average BMI in fixed group was 30 kg/m² and in mobile group it was 27 kg/m².

Gender

In a study by **Antonio Silvestre Munoz** et al (2008)(7) females were more in both fixed and mobile arthroplasty cases. Similar female preponderance was seen in a study by **Liao-bin Chen** et al (2013)(8) and **Michael Tjørnild** et al (2014)(10). **Robert Namba** et al (2014)(11) studied 319,616 knee arthroplasty patients out of which 60% were females.

Side

In a study by **Antonio Silvestre Munoz** et al (2008)(7) right side predominated in both fixed and mobile arthroplasty cases. In a study by **Michael Tjørnild** et al (2014)(10) more left side cases were observed in fixed group and more right side cases in mobile group.

Range of motion

In a study by **Dr. James C George** et al (2007)(12) the mean preoperative range of movement in the PFC group was 111.53°±20.4° (ranging from 70-140°). This showed an improvement to a mean flexion of 113.26°±13.9° (ranging from 90-140°) post operatively. The mean preoperative range of movement in the LCS group was 94.68°±29.3° (ranging from 20-130°). This showed an improvement to a mean flexion of 98.2°±14.8° (ranging from 50-140°) post operatively. In a study by **Michael Tjørnild** et al (2014)(10) range of motion in both mobile and fixed group was seen to be between 88-144

degrees. In a study by **Sharma A.**(13) et al the weight-bearing range-of-motion for the fixed (average 112.2°) bearing TKA was statistically (13)greater ($p= 0.02$) than mobile bearing TKA (average 97.2°). On average, the fixed bearing subjects experienced -0.8mm (medial) and -3.2mm (lateral) of antero-posterior motion and 3.1° of axial rotation. The mobile bearing subjects experienced 2.7mm (medial) and -1.8mm (lateral) of antero-posterior motion and 5.9° of axial rotation.

Flexion contracture

In a study by **Prakit Tienboon** et al (2012)(9) flexion contracture occurred in no cases in neither fixed nor mobile

Knee score

In a study by **Dr. James C George** et al (2007)(12) the mean Oxford Knee Society Score was calculated to be 17.46±1.6 in the fixed group and 17.91±2.1 in the mobile group. This difference in the score between the two groups was not found to be statistically significant ($p=0.895$). In a study by **Prakit Tienboon** et al (2012)(9) average knee score in fixed group was 22.9 and in mobile group was 22.88.

Functional score

In a study by **Prakit Tienboon** et al (2012)(9) average functional score in fixed group was 39.53 and in mobile group was 37.92. In a study by **P. Z. Feczko** et al (2017)(14) post operative function ranged between 30–100 in cases who underwent fixed type and 5-100 in mobile type

Femoral valgus

Femoral valgus was almost similar in both fixed and mobile arthroplasty cases in a study by **Antonio Silvestre Munoz** et al (2008)(7)

CONCLUSIONS:

In this study on the basis of findings we can conclude that there is no significant difference between fixed arthroplasty and mobile arthroplasty as far as Range of motion, Pain, Flexion gap. Stability was almost similar in both mobile and fixed arthroplasty.

REFERENCES

1. Varacallo M. Total Knee Replacement (TKR) Techniques Total Knee Replacement (TKR) Techniques. 2019;(April).
2. Williams DH, Garbuz DS, Masri BA. Total knee arthroplasty: Techniques and results. *B C Med J*. 2010;52(9):447–54.
3. Total Knee Replacement (TKR) Techniques - StatPearls - NCBI Bookshelf [Internet]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK538208/>
4. Hao D, Wang J. Fixed-bearing vs mobile-bearing prostheses for total knee arthroplasty after approximately 10 years of follow-up : a. 2021;1–9.
5. Cheng M, Chen D, Guo Y, Zhu C, Zhang X. Comparison of fixed- and mobile-bearing total knee arthroplasty with a mean five-year follow-up: A meta-analysis. *Exp Ther Med*. 2013;6(1):45–51.
6. Cox J, Tetsworth K. Comparisons between mobile-bearing and fixed-bearing total knee replacement. *Curr Orthop Pract*. 2009;20(1):35–9.
7. Muñoz AS, Herrero FA, Lozano RL, Linares FA. Comparison of mobile- and fixed-bearing cemented total knee arthroplasty. *Acta Orthop Belg*. 2008;74(6):801–8.
8. Chen L bin, Tan Y, Al-Aidaros M, Wang H, Wang X, Cai S han. Comparison of functional performance after total knee arthroplasty using rotating platform and fixed-bearing prostheses with or without patellar resurfacing. *Orthop Surg*. 2013;5(2):112–7.
9. Tienboon P, Jaruwangsanti N, Laohasinnurak P. A prospective study comparing mobile-bearing versus fixed-bearing type in total knee arthroplasty using the free-hand-cutting technique. *J Med Assoc Thai*. 2012;95 Suppl 1:77–86.
10. Tjornild M, Søballe K, Møller Hansen P, Holm C, Stilling M. Mobile-vs. Fixed-bearing total knee replacement: A randomized radiostereometric and bone mineral density study. *Acta Orthop*. 2015;86(2):208–14.
11. Graves S, Sedrakyan A, Baste V, Gioe TJ, Namba R, Cruz OM, et al. International comparative evaluation of knee replacement with fixed or mobile-bearing posterior-stabilized prostheses. *J Bone Jt Surg - Am Vol*. 2014;96:59–64.
12. James CG. Comparison of Fixed-Bearing and Mobile Bearing Total Knee Arthroplasty. 2007; Available from: http://repository-tnmgrmu.ac.in/3033/1/220201107_jamescgeorge.pdf
13. paper NO. (865):37996.
14. Feczko PZ, Jutten LM, Van Steyn MJ, Deckers P, Emans PJ, Arts JJ. Comparison of fixed and mobile-bearing total knee arthroplasty in terms of patellofemoral pain and function: A prospective, randomised, controlled trial. *BMC Musculoskelet Disord*. 2017; 18(1):1–9.