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Khayas Omer Kunheen
Department of Rthopaedics
Government Medical College
Thiruvananthapuram, Kerala, India

Dr. Shanavas EK
Department of Rthopaedics
Government Medical College
Thiruvananthapuram, Kerala, India

Vikraman CS
Department of Rthopaedics
Government Medical College
Thiruvananthapuram, Kerala, India

Correspondence
Dr. Shanavas EK
Associate Professor, Medical College, Alappuzha, Kerala, India

Mobile bearing vs fixed bearing total knee arthroplasty-shortterm outcome and postoperative recovery analysis

Khayas Omer Kunheen, Dr. Shanavas EK and Vikraman CS

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Abstract
Background: Controversy exists regarding the clinical and functional outcome of mobile bearing compared to fixed bearing total knee prostheses. Even though lot of studies have compared the long term results, few have studied the early postoperative recovery, short term functional outcome and clinical outcome in terms of range of motion
Objective: The purpose of this prospective clinical study was to compare the postoperative recovery, short term functional outcome and short term clinical outcome in terms of range of motion of 2 groups of patients undergoing total knee arthroplasty.
Method: 25 patients who received a fixed bearing prosthesis (posterior stabilised PS) was compared with 25 patients who received a mobile bearing prosthesis (rotating platform RP). They were followed up at regular intervals using Knee society clinical and functional scoring system
Results: At an average follow-up of 12 months, there was significant postoperative improvement in both groups; but there was no significant difference between the groups with regard to the mean postoperative range of motion (92.56 in PS and 99.16 in RP respectively; p=0.239), the mean KSS clinical score (84.76 in PS and 83.4 in RP respectively; p=0.542), or the mean KSS functional score (70.6 in PS and 75.2 in RP respectively; p=0.263). Using a fixed-bearing or a mobile-bearing design did not seem to grossly influence the short-term recovery and early results after knee arthroplasty.

Keywords: Mobile bearing, fixed bearing total knee, arthroplasty-shortterm outcome, postoperative recovery analysis

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. They allow a more natural tibial rotation during flexion than fixed bearing implants. Their designs provide articulation at both the upper and lower surfaces of the bearing, improving congruency and thus leading to a reduction of polyethylene contact stresses. Simulator studies have shown that this significantly lowers the wear rate compared to standard fixed-bearing knee replacements. It has also been suggested that mobile bearings minimise stress at the tibial bone-prosthesis interface [1]. 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, but often different types and designs of prostheses were compared. The studies also differ in methodology, patient selection, operative technique and outcome measures.
We compared the clinical and functional outcome of total knee arthroplasty surgery using fixed bearing (posterior stabilized) and mobile bearing (rotating platform) implant model performed at Govt. Medical College, Thiruvananthapuram between 2013-2014.
This article tries to briefly assess the early postoperative recovery and related factors in the patients undergoing total knee arthroplasty surgery and reviews the literature on patient outcomes after total knee arthroplasties for osteoarthritis and possible determinants of pain, function and HRQL

Materials and Methods
Prospective study was done between the period of 1st January 2013-31st October 2014. 25 patients who consented and underwent Total Knee Arthroplasty with posterior stabilised fixed

bearing TKA implant were compared with 25 patients who received rotating platform mobile bearing implant clinically and functionally using Knee Society score. The follow up period was at 6 weeks, 6 months and 1 year. The study was conducted at the Department of Orthopaedics in Government Medical College, Thiruvananthapuram. This is a hospital based cross-sectional study.

All patients with gross mediolateral instability, revision knee arthroplasties, intraoperative and postoperative fractures (Periprosthetic fracture), constraint knee and any comorbidity that prevents the patient from following postoperative protocol including ipsilateral hip pathologies were excluded.

The operations were performed by or under direct supervision of two orthopaedic surgeons. All operating surgeons were experienced in the use of the Total knee Replacement system and its instrumentation. All the Rotating Platform implants were of Buechel And Pappas Ltd. while Posterior stabilised implants of Smith and Nephew Ltd. (21 cases),Stryker Ltd. (3 cases) and Zimmer Ltd. (1) were included in the study. The operation was carried out through a midline incision using a medial parapatellar approach. Intramedullary referencing was used for the femur and extramedullary referencing for the tibia. All femoral and tibial components were cemented. The posterior cruciate ligament (PCL) was sacrificed in all cases. The patella was not resurfaced. A tourniquet was applied routinely. 1st post op day, patient was taught static quadriceps exercises. 2nd post op day, the dressing was debulked and wound inspected. Patient was made to walk full weight bearing within the limits of pain with the knee immobiliser and advised to continue static quadriceps exercises. 4th post op day, knee flexion was started and patient was taught dynamic quadriceps exercises. IV antibiotics were given for the first 48 hours post op and the switched over to oral antibiotics for the next five days. DVT prophylaxis was given for the first five days post operatively. 12th post op day, sutures were removed and patient was advised to continue regular physiotherapy. The patient was assessed 6 weeks post operatively for any signs of post-operative infection. Once post-operative infection was ruled out clinically the patient was assessed clinically and functionally using the Knee Society Score further at an interval of 6 months and 1 year post-operative

Results

Fifty one patients were recruited for this study. One patient was excluded from the study due to infection and implant removal was done. Later on the case ended up in knee arthrodesis. Thus the final study population was 50 patients, 25 from each group

The study was found to be age matched since there was no significant difference between the groups ($p>.05$). The majority of the patients were from the age group of 61-70 years for RP while it was 51-60 in PS group which accounts for 40% of patients in RP and 44% in PS in our study. The youngest patient was 33 years of age and the oldest patient was 79. Secondary osteoarthritis was the primary diagnosis for most knees in each group (92% RP and 88% PS); the PS group had slightly more knees with rheumatoid arthritis than the RP group (3 vs 2 knees).There was an overall predominance of female patients in both groups, 84% in RP and 80% in PS. There was a predominance of left side in both the groups 60% in RP, 52% in PS. Majority of patients were overweight in both the groups. 56% in RP, 59% in PS. Noone was morbidly obese. Whether the BMI was normal or not did not statistically influence the clinical or functional outcome of the population as a whole. (Table 1, 2).The distribution of comorbidities were comparable. Apart from the one case of infection excluded from the study and few cases of transient paraesthesia in leg region, there were no grave complications seen throughout.

At an average follow-up of 12months (table 3, figure 1), there was significant improvement in both groups; but there was no significant difference between the groups with regard to the mean postoperative range of motion (92.56 in PS and 99.16 in RP respectively; p=0.239), the preoperative ROM had significant influence on the improvement in KCS knee clinical score. Both the groups showed a decrease in their total range of flexion score from the preoperative status at 6 weeks follow up. But consistent improvement was noted in 6 month and 1 year follow up (figure 1)

At an average follow-up of 12months (table 3), there was significant improvement in both groups; but there was no significant difference between the groups with regard to the mean KSS clinical score (84.76 in PS and 83.4 in RP respectively; p=0.542), or the mean KSS functional score (70.6 in PS and 75.2 in RP respectively; p=0.263).

Discussion

Despite the many theoretical advantages of a mobile bearing total knee prosthesis, this prospective short term study demonstrated no significant differences in the early functional or clinical outcomes between the PS and RP prostheses used in this study. These results are supported by several other studies that also do not demonstrate any significant differences in outcomes between fixed bearing and mobile-bearing devices [3, 4, 5]

The decrease in flexion at 6 weeks follow up in the present study in both groups (figure1) is well accounted by the comparatively higher pain score for the patients during these periods of follow up. This is consistent with the evidence in literature [7, 8, 9] both the groups showed a decrease in their total range of flexion score from the preoperative status at 6 weeks follow up. But consistent improvement was noted in 6 month and 1 year follow up

The flexion attained one year postop in both groups were lower compared to the flexion attained in various short term studies in literature [7, 12, 13, 14, 11] but comparable with certain other studies. In one prospective study that compared fixed-bearing with rotating-platform prostheses, the rotating-platform group was noted to have a greater range of motion than the fixed-bearing group at six weeks and at one year [11]. However, that difference disappeared by the time of the two-year follow-up.

A primary treatment goal to attain functional independence includes joint range of motion. Limited range of joint motion after surgery is multifactorial. Because few studies statistically control for other factors such as comorbidities and contra-lateral joint involvement, the extent to which knee range of motion attained immediately postarthroplasty and its longterm functional outcomes remains ambiguous. Evidence states that Knee mobility after total knee arthroplasty is not dependent upon gender, age, other joint involvement, preoperative deformity, or the use of a continuous passive motion machine (CPM) [12] Postoperative range of motion is reported to be dependent on the preoperative range of motion, body mass index, prosthetic design, postoperative pain, and activity [7, 8, 9, 12] Evidence suggests that patients with the most restricted range preoperatively had the greatest relative improvements, typically occurring within 1 to 3 years after surgery as evidenced in our study. Also maximum range was

achieved by those who had better preoperative ROM [7]
In a study by Hanusch *et al*. [13] one hundred& twenty patients were randomised to receive either a fixed-bearing or rotating-platform total knee replacement. 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.
In a multicentre, prospective trial, Price *et al*. [14] found better KSS and Oxford knee scores at 1 year postoperatively for a mobile-bearing prosthesis; however, these differences were no longer present at 3 years. Kohn *et al*. reported short-term results of the Interax TKA comparing 116 knees of the fixed-bearing version and 48 of the mobile version at an average FU of 1.5 years without showing any significant difference between the 2 groups Ranawat *et al*. also found no significant differences in their outcomes after a mean follow up of 2.5 years. In their study, all patients underwent bilateral arthroplasties [16].

Conclusion & Summary

Despite the many theoretical advantages of a mobilebearing total knee prosthesis, this prospective short term study demonstrated no significant differences in majority of the early clinical and functional outcomes (as assessed by the Knee society scoring system) between the PS and RP prostheses used in this study as supported by several other studies. The constrains of our hospital setting and the patient factors resulted in suboptimal rehabilitation sessions for the patients which explains the poor ROM and poor short term recovery pattern compared to international standards. Long term studies are warranted for better analysis of implant survival and clinical and functional outcome

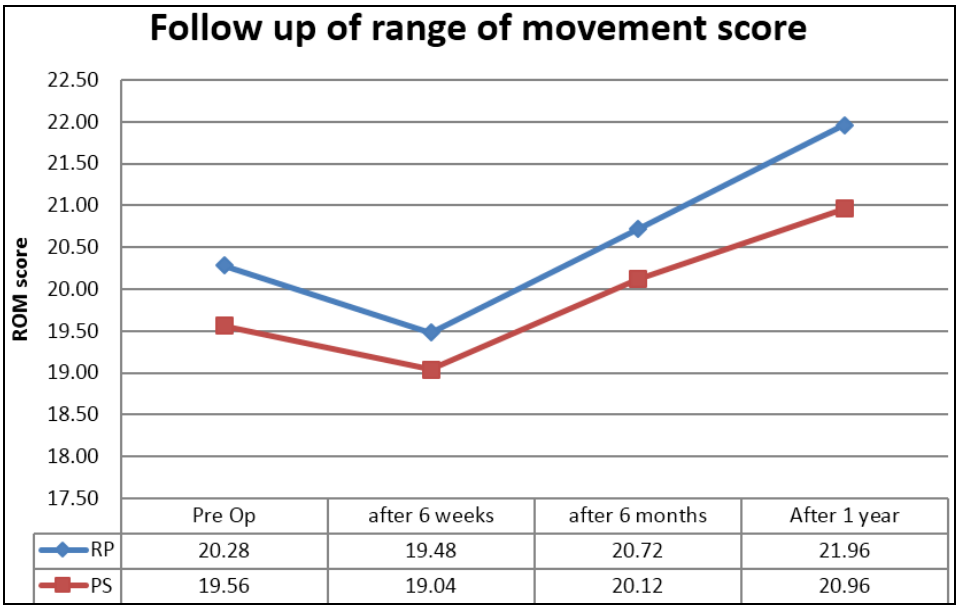

Fig 1

Table 1: Relation of patient factors and improvement in clinical score

		N	Change in Knee clinical score postop		T	P
			Mean	SD		
BMI	Normal	19	52.89	13.63	1.2	0.236
	Overweight	31	47.65	15.79		
Preop ROM score	<21	23	56.48	12.15	3.232	0.002
	≥21	27	43.81	15.07		

Table 2: Relation of patient factors and improvement in functional score

		N	Change in Knee postop Functional score		T	P
			Mean	SD		
BMI	Normal	19	58.16	18.57	0.457	0.65
	Overweight	31	55.65	19.05		
Preop ROM score	<21	23	58.7	18.29	0.727	0.471
	≥21	27	54.81	19.24		

Table 3: Mean score comparison

Knee Clinical score	RP(N=25)	PS(N=25)	Unpaired t test	
	Mean ± sd	Mean ± sd	T	P
Pre-Operative score	37.68±12.51	31.2±13.01	1.795	0.079
1 year Post-Operative score	83.4±7.46	84.76±8.2	-0.613	0.542

Knee functional score	RP (N=25)	PS (N=25)	Unpaired t test	
	Mean ± sd	Mean ± sd	T	P
Pre-Operative score	16.74±15.93	15.2±15.1	0.344	0.733
1 year Post-Operative score	75.2±13.65	70.6±15.02	1.133	0.263

PS knee Case 1
33 year old female with rheumatoid arthritis right –varus knee with FFD

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<tr><th colspan="1">Immediate Post OP</th><th colspan="2">1 year post OP</th></tr>
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RP knee Case 3
61 year old female with OA left knee

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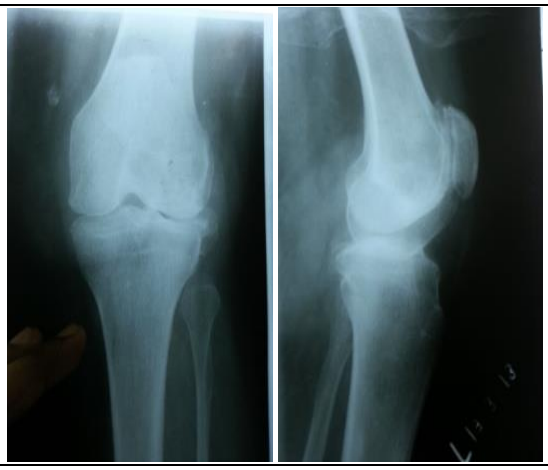
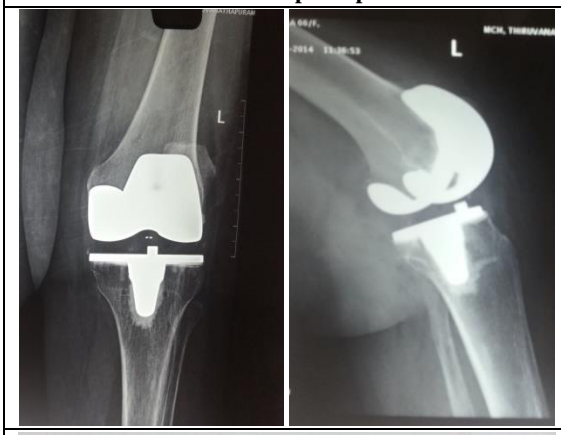
<tr><td>  </td><td colspan="2">  </td></tr>
<tr><td>6 month post op</td><td colspan="2">1 year post Op</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
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