

Short term outcome comparative study of total knee arthroplasty, rotating platform (mobile bearing) versus fixed bearing (congruent) knee designs

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Abstract: *Background:* Various long term studies have been done independently on both Rotating platform and fixed bearing prosthesis, but only few studies, are available comparing the two prosthesis, hence this study has been done to compare Rotating platform (mobile bearing) versus Fixed bearing in patients undergoing total knee arthroplasties, with regard to clinical and radiographic outcomes. *Method:* This randomized prospective study aims to compare the effectiveness and efficiency of a standard Rotating platform(mobile bearing) versus Fixed bearing prosthesis in primary TKA, and to evaluate clinical and radiological outcome, in consecutive primary osteoarthritis patients getting admitted for primary TKR at our hospital. We included 32 patients (16 in each group) who were randomly selected, operated and both the groups were followed in prospective manner for 1 year and data collected was assessed by statistical methods. *Results:* The mean knee society knee scores in fixed bearing and mobile bearing total knee replacement, at the end of 1 year were 91.75 and 92.12 respectively and the mean knee society function scores in fixed bearing and mobile bearing total knee replacement, at the end of 1 year were 79.06 and 79.37 respectively in our study P VALUE (ns<0.05). *Discussion:* We conclude that there was no significant statistical difference in clinical, functional and radiological out come in both fixed bearing and mobile bearing prosthetic designs. Our study has shown that using a fixed-bearing or a mobile-bearing design, when all the other variables are controlled, did not seem to influence the outcome in short-term follow up.

Keywords: Total knee arthroplasty; rotating plate; fixed bearing; clinical outcome.

Introduction

The primary concern of any total knee arthroplasty is to provide the near normal functional outcome for the patient. The success of any total knee arthroplasty is influenced by a complex interaction between the geometry of the components and the soft tissue envelope that surrounds this articulation [1]. The long term results of total knee arthroplasty with symmetric fixed bearing designs have shown high degree of clinical success especially in older and less active individuals [2] there is concern, however, with regard to problems related to patellofemoral articulation, polyethylene wear, and osteolysis [3]. Mobile bearing arthroplasties were introduced with the aim of reducing polyethylene wear and related osteolysis, which were seen with some fixed bearing designs [4]. Congruency between the femoral component and the superior surface of the rotating polyethylene in a mobile bearing

design was intended to reduce polyethylene wear, while rotation between the inferior polyethylene surface and the metal tray was intended to reduce stress on the metal tray and the tibial bone interface [5]. The risk of bearing subluxation and dislocation associated with the mobile bearing (Rotating platform) knee replacement is a cause for concern and may necessitate early revision [6].

A study was done by S. Bhan et al in the year 2005 for 4.5 years in which they compared fixed bearing and mobile bearing TKA and found no advantage of mobile bearing over fixed bearing with regard to clinical results [6]. In the year 2007, Y. H. Kim, et al conducted a study on long term results of simultaneous fixed bearing and mobile bearing TKA performed in the same patients and they found no evidence of superiority of one design over the other [7]. J. M. Stefan et

al, conducted a study in 2007 which concluded less anterior knee pain with a mobile bearing prosthesis with a fixed bearing prosthesis [8]. E. Most, G. Li, et al conducted a study in 2003 on kinematics of fixed and mobile bearing TKA and concluded that, the kinematics for fixed and mobile bearing TKA were similar despite component design variations [1]. Kim Y H, et al did a Comparison study of mobile bearing and fixed bearing TKA in 2001 in 116 pt's concluded that no difference in clinical outcome in two groups at a mean follow up of 7.4 years [9]. In the year 2004, Woolson ST, et al compared the results of 45 NEXGEN Fixed bearing and 57 LCS Rotating platform implants at a mean follow up of 41 months and found no difference clinically and radiologically [10].

Aglietti P, Baldini A, Buzzi R, et al compared the results of 107 TKR pt's with Fixed bearing prosthesis and 103 TKR pt's with Mobile bearing prosthesis at a mean follow up of 36 months, in a randomized prospective trial in the year 2005 and they concluded that there was no difference in the short-term recovery and early results after TKA [11]. In the year 2009 Attique Vasdev, Satish Kumar, Gaggan Chadha, Shyama Prasad Mandal compared the mid-term clinical outcomes in Indian patients after total knee arthroplasty (TKA) using a fixed- or mobile-bearing prosthesis in 120 consecutive patients and the mean follow-up duration was 3.5 (range, 1–4.6) years. The mid-term outcome of the 2 groups was comparable [12]. Various long term studies have been done independently on both Rotating platform and fixed bearing prosthesis, but only few studies, are available comparing the two prosthesis, hence this study has been done to compare Rotating platform (mobile bearing) versus Fixed bearing in patients undergoing total knee arthroplasties, with regard to clinical and radiographic outcomes [6].

Material and Methods

Study was conducted at Kamineni Hospitals which is a tertiary level referral centre in Hyderabad, Andhra Pradesh, India. 32 patients who were admitted for undergoing total knee arthroplasty (16 patients in Fixed bearing group and 16 patients in Mobile bearing group) were prospectively followed for the study from 1st August 2008 to 31st December 2009. Average follow up period was 6 months to 12 months

(Short-term follow up study). There were 20 females and 12 male patients with mean age of 63.65 years.

Patients were operated by the same surgeon using same instrumentation (Exactech–FIXED BEARING (Cruciate Retaining {CR})/ MOBILE BEARING Posterior stabilised{PS} by Optetrek Company). Patients received a similar course of postoperative rehabilitation after each surgery. The knee society scoring system was used for assessment of preoperative and postoperative clinical and radiological outcome at each follow up. This randomized prospective study aims to compare the effectiveness and efficiency of a standard Rotating platform(mobile bearing) versus Fixed bearing prosthesis in primary TKA, and to evaluate clinical and radiological outcome, in consecutive primary osteoarthritis patients getting admitted for primary TKR at Kamineni hospitals, Hyderabad between 1st August 2008 to 31st December 2009 were randomized into two groups.

Clinical evaluation was carried out preoperatively and post operatively using knee society knee score according to the knee society recommendation [13] and radiographic evaluation was done on the preoperative and postoperative radiographs, which includes an anteroposterior radiograph made with the patient standing, lateral radiographs made with the patient supine, and a skyline patellar radiograph. The overall alignment of the limb, the position of each of the implants, and the location of radiolucent lines at the bone cement interface was analyzed according to the guidelines of the knee society [14]. The knee society score and radiographs were assessed at 6 weeks, 3months, 6 months and 1 year post operatively in both groups. Patients aged between 50-70 years undergoing cemented primary total knee arthroplasty and suffering from primary osteoarthritis of knee joint were included in the study.

All the values were documented and compared statistically using MEDCALC soft ware. Continuous variables were expressed as mean \pm one standard deviation. The Mann whitney U test was used for non parametric

data (Individual Scores). Nominal variables tested by using chi-squared test. The results were considered significant if $p < 0.05$.

Results

Present study was designed for prospective randomized analysis of the patients undergoing total knee arthroplasty with a fixed bearing knee or a mobile bearing knee. 32 patients undergoing total knee arthroplasty (16 Fixed bearing knee and 16 Mobile bearing knee) were prospectively followed for the study from 1st August 2008 to 31st December 2009. Average follow up period was up to 12 months (Short-term follow up study). In the FB group there were 10 females and 6 male patients with mean age of 63.68 years. In the MB group there were 10 females and 6 male patients with mean age of 63.75 years.

All the patients were suffering from primary osteoarthritis of both the knees with Minimum age of the patient in the study was 50 yrs and maximum 73 years, mean age was 63.65 years. Patient age did not show any relation to the functional outcome of the surgery.

Group	FFD	%
FB (n=16)	8	50%
MB(n=16)	10	68.75%

Fixed flexion deformity was present in 8 patients of fixed bearing TKR group and 10 patients of Mobile bearing TKR group (Table no 6).

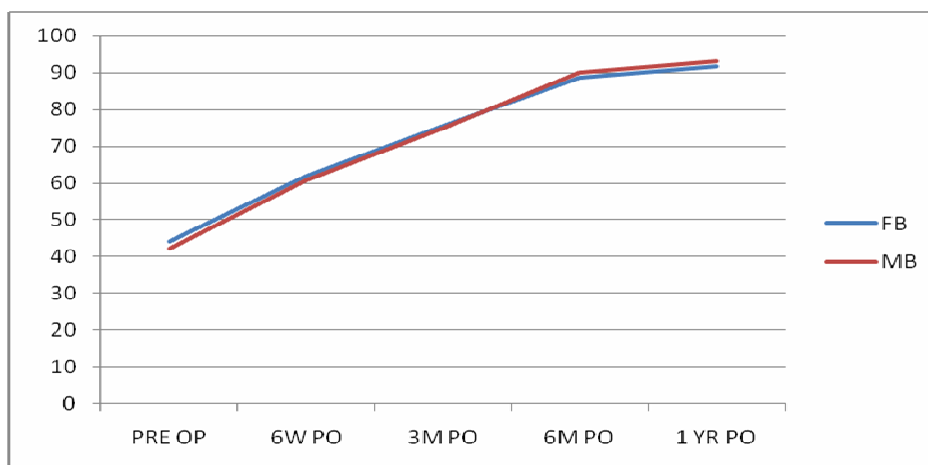
Group	Varus Deformity	Valgus Deformity
FB(n=16)	15	1
MB(n=16)s	14	2
Total	29	3

15 Pt's were having varus deformity in Fixed bearing group, 14 pt's in Mobile bearing group) and 3 Pt's were having valgus deformities (Table no 6).

Group	OS	FS
FB(n=16)	44.18	36.87
MB(n=16)	42.31	37.81
P value	ns(p>0.05)	ns(p>0.05)

The mean Preoperative OS score for FB group was 44.18 ranging from 38 to 50. The mean Preoperative OS score for MB group was 42.31 ranging from 38 to 49. The mean Preoperative FS score for FB group was 36.87 ranging from 15 to 55. The mean Preoperative FS score for MB group was 37.81 ranging from 15 to 55. There was no significant statistical difference between the two groups, p value > 0.05 .

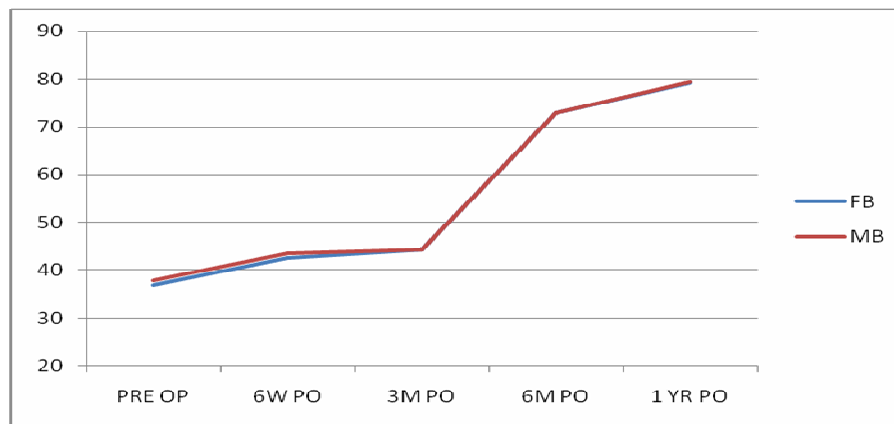
Graph-1: Trend of objective scores of fixed and mobile bearing groups



There is consistent increase in the mean objective scores of fixed bearing total knee arthroplasty group over 1 year. Preoperative objective score of the fixed bearing group was 44.18. At the end 1 year the objective score of the fixed bearing group was 91.75. There is consistent increase in the mean objective scores of mobile bearing total knee arthroplasty group over 1 year. Preoperative

objective score of the mobile bearing group was 42.31. At the end 1 year the objective score of the mobile bearing group was 93.12. There was no significant statistical difference between the objective scores of fixed bearing and mobile bearing groups, p value >0.05.

Graph-2: Trend of mean functional scores of FB and MB groups



There is consistent increase in the mean functional scores of fixed bearing total knee arthroplasty group over 1 year. Preoperative functional score of the fixed bearing group was 44.18. At the end 1 year the functional score of the fixed bearing group was 91.75. There is consistent increase in the mean functional scores of mobile bearing total knee arthroplasty group over 1 year. Preoperative functional score of the mobile bearing group was 42.31. At the end 1 year the functional score of the mobile bearing group was 93.12. There was no significant statistical difference between the functional scores of fixed bearing and mobile bearing groups, p value >0.05.

group was also about 105°. When mean scores were compared there was no significant statistical difference in the range of motion (ROM) scores either in the pre operative period or during all the follow up periods.

Group	PRE OP	6W	3M	6M	1YR
FB(n=16)	85°	95°	95°	95°	105°
MB(n=16)	85°	95°	100°	100°	105°

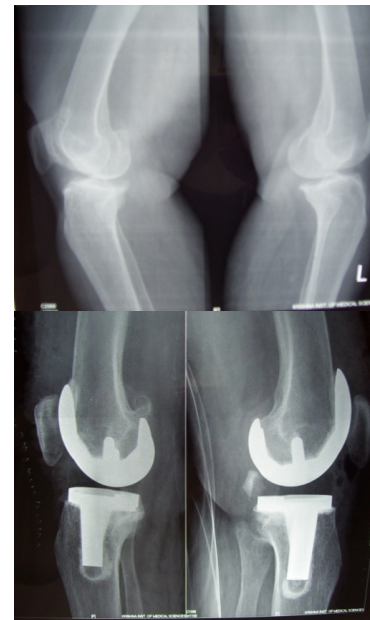
There is consistent improvement in the range of motion (ROM) in both the groups, at the end of 1 year the range of motion in the fixed bearing group was about 105°. At the end of 1 year the range of motion (ROM) in the mobile bearing

Parameters	Duration	FB	MB
Varus	Pre operative	7.625°	7.5°
	Post operative	0.5°	0.5°
Valgus	Preoperative	11°	10°
	Post operative	5°	5°
Femoral Component Alignment	Antero posterior (α angle)	95°	95.25°
	Sagittal (γ angle)	4°	3.5°
Tibial Component Alignment	Antero posterior (β angle)	91.12°	91°
	Sagittal (σ angle)	83.56°	83.5°
Radiolucent Line	Femoral	1	1
	Tibial	1	1
Patellar tilt		-	-
Patellar subluxation		-	-
Patellar Height	Preoperative	-	-
	LAST F.U	-	-

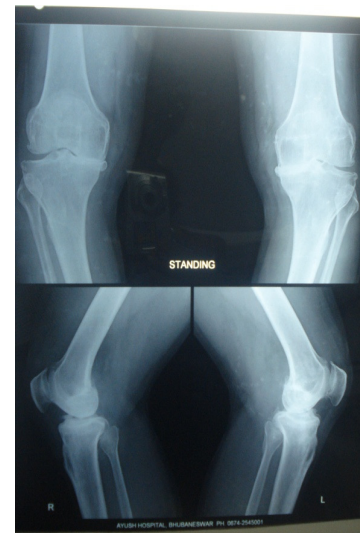
The mean pre operative varus deformity in the FB group 7.625 degrees, the mean pre operative varus deformity in the MB group 7.5 degrees. The mean postoperative varus deformity in the FB group 0.5 degrees, the mean postoperative varus deformity in the MB group 0.5 degrees. The mean pre operative valgus deformity in the FB group 11 degrees, the mean pre operative valgus deformity in the MB group 10 degrees. The mean postoperative valgus deformity in the FB group 5 degrees, the mean postoperative valgus deformity in the MB group 5 degrees.

Femoral component alignment anteroposterior (α angle) in the fixed bearing group was 95 degrees and 95.25 degrees in mobile bearing group. Femoral component alignment saggital (γ angle) in the fixed bearing group was 4 degrees and 3.5 degrees in mobile bearing group. Tibial component alignment anteroposterior (β angle) in the fixed bearing group was 91.12 degrees and 91 degrees in mobile bearing group. Tibial component alignment saggital (σ angle) in the fixed bearing group was 83.56 degrees and 83.5 degrees in mobile bearing group. There were no significant implant loosening as suggested by a radiolucent line $>2\text{mm}$, were noted in both the study groups. The components of patellar tilt, subluxation and height were not assessed as we have not done patellar replacement in any of the patients.

Pre & Post OP Radiographs of Fixed Bearing Knee



Pre & Post OP Radiographs of Mobile Bearing Knee



Discussion

Present study was designed for prospective randomized analysis of the clinical, functional & radiological outcome of the patients undergoing total knee arthroplasty with a fixed bearing knee or a mobile bearing knee. 32 patients undergoing total knee arthroplasty {16 Fixed bearing knee (FB Group) and 16 Mobile bearing knee (MB Group)} were prospectively followed for the study from August 2008 to December 2009. Average follow up period was 12 months (Short-term follow up study).

In the Fixed bearing group there were 10 females and 6 male patients with mean age of 63.68 years. In the Mobile bearing group there were 10

females and 6 male patients with mean age of 63.75 years.

All the patients were suffering from primary osteoarthritis of both the knees with Minimum age of the patients in the study was 50 yrs and maximum 73 years, mean age was 63.65 years. Patient’s age did not show any relation to the functional outcome of the surgery. Strict preoperative protocol was observed for all the patients. Patients were randomized and were allocated the prosthesis according to the randomization table. The functional and radiological outcomes of the patients in both were measured at 6 weeks, 3 months, 6 months and 1 year post operative period and were compared.

Table-6: Comparison of various studies in discussion

Studies	Duration	Average age (in yrs)		Mean knee Society Knee Score		Mean knee Society Function Score		Result
		FB	MB	FB	MB	FB	MB	
Paolo Aglietti et al [15]	4 years	69.5	71	93	93	79	80	Both are equal
P-Value (ns<0.05)		ns		ns		ns		
Attiq Vasdev et al [12]	3.5 years	63 (57-76)	63 (55-76)	91.7	91.2	-	-	Both are equal
P-Value (ns<0.05)		ns		ns		ns		
Present Study	1 year	63.68 (52-74)	63.75 (50-73)	91.75	93.125	79.06	79.37	Both are equal
P-Value (ns<0.05)		ns		ns		ns		

The average duration of our study period was 1 year, which was a short term study. In our study the average age of patients undergoing fixed bearing and mobile bearing total knee replacement was 63.68 and 63.75 years respectively. The mean age was comparable to the other mean ages of patients in the above studies. The mean knee society knee scores in fixed bearing and mobile bearing total knee replacement, at the end of 1 year were 91.75 and 92.12 respectively and the mean knee society function scores in fixed bearing and mobile bearing total knee replacement, at the end of 1 year were 79.06 and 79.37 respectively in our study. The mean knee society knee scores (both

objective and functional) were comparable to the mean knee society knee scores in other studies. In our study the mean knee range of motion (ROM) in fixed bearing and mobile bearing total knee replacement, at the end of 1 year were 105° and 105° respectively. The mean knee range of motion (ROM) at the end of 1 year in our study was comparable to the mean knee range of motion (ROM) at the end of 1 year in other studies.

Complications: There were no major postoperative complications in both the groups except in one patient of Fixed bearing group who developed Right sided Hemiplegia

due to Middle Cerebral Artery thrombus and did recover completely after the episode. No implant loosening or wound healing problems were noted during the study.

Limitations of the study: The post operative follow up is of only 1 year duration and thus the long term outcome of the two prosthetic designs can't be assessed in the present study.

Conclusion

The clinical, functional and radiological outcome of both fixed bearing total knee arthroplasty and mobile bearing total knee arthroplasty were compared. Both the groups were followed in prospective manner for 1 year and data collected was assessed by statistical methods. The knee society knee score and the functional scores

improved consistently in the post operative period in both fixed bearing total knee arthroplasty and mobile bearing total knee arthroplasty.

The knee range of movements (ROM) also improved consistently in the post operative period in both fixed bearing total knee arthroplasty and mobile bearing total knee arthroplasty. In our study there was no significant statistical difference in clinical, functional and radiological out come in both fixed bearing and mobile bearing prosthetic designs. Our study has shown that using a fixed-bearing or a mobile-bearing design, when all the other variables are controlled, did not seem to influence the outcome in short-term follow up.

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