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Research Article

Side preference between CR *vs.* CS designs in patients undergoing bilateral TKA-an institutional experience in 2 years prospective follow up study

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Statistic

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Abstract

Aim: Patient satisfaction after total knee patient satisfaction after Total Knee Arthroplasty (TKA) is a matter of concern. There are multitude of patient, surgery and implant factors associated to it. Implant design is one of the important factors.

Materials and Methods: Here, we try to assess the correlation between the implant design (Cruciate Retaining (CR) or Posterior Stabilizing (PS)/Cruciate Sacrificing (CS)) and the patient's preference of satisfaction in patients undergoing bilateral total knee arthroplasty for equally affected arthritic knees.

Results: 34 patients (68 knees) were followed up for a period of 2 years and knee society knee scoring, preference data were recorded and statistically assessed. Correlation between implant design were also looked into. At 6 weeks, 3 months, 6 months, 1 year and 2 years follow up, there is significant association of side preference to the side which was operated first irrespective of the implant design. There was no association between the implant design (CR, PS) to the side preference. Patient showed a strong association of pain scoring to side preference.

Conclusion: Patient satisfaction after TKA is multifactorial. Implant design may play a role in it. Our study showed the side first operated had much more satisfaction rate than the second operated ones. Mostly, the worse knee was operated first. We would like to follow up this finding with more number of samples.

Keywords: Knee; Arthroplasty; Cruciate; Retaiting; Sacrificing; Satisfaction

INTRODUCTION

Total Knee Arthroplasty (TKA) is one of the most successful surgeries of the decade. The evaluation of the success of the surgery has seen evolution of many implant designs. Most routinely done designs are CR (Cruciate Retaining) and CS (Cruciate Sacrificing) designs. In CR designs, PCL is left *insitu* and in CS designs both ACL and PCL are removed [1]. There have been many studies comparing the functional advantages and disadvantages of both of them. Many of them concluded with better functional outcomes with CS designs than the CR designs whereas many have outlined that there were no significant differences between both the designs in functional outcome [2]. Although the discussion of the designs of TKA and retention of PCL has been the subject of argument for decades, the superiority of CR designs over the PS designs has never been established. In many of the studies done earlier for comparing CR VS PS designs, hemilateral TKA was done first and few months later or more ipsilateral TKA was done, where pre-operative functional status, post-operative pain management, type of anaesthesia and analgesia for rehabilitation were different [3].

A prospective randomized study of CR Vs CS designs in simultaneous same sitting bilateral TKA which would minimize the patient factors and pain management protocol and rehabilitation would be of higher value to determine whether the CR designs or the PS designs is superior. No clear benefits or drawbacks are apparent for either type of implant designs to the extent that either of them is clearly superior [4]. PS designs have been suggested to offer easier correction of deformity without concern for obtaining appropriate tension on the PCL, a more conforming polyethylene surface that results in polyethylene wear and a more reliable roll back of femur on tibia in flexion. Proponents of PS designs note the more widespread clinical usefulness in that in can be used in knees without PCL, as well as the potential benefit of avoiding late posterior instability from PCL rupture which has been reported in osteoarthritic patients and in those with inflammatory arthritis [5].

Proponents of CR have suggested advantages including preservation of an important central stabilizing structure, transfer of stress to a functional ligament rather than a mechanical structure with subsequent reduction in wear and fixation stress, more consistent preservation of the joint line, improvement in stair climbing ability and greater conservation of bone [6]. In addition, problems that appeared to be unique with PS designs like patellar clunk and posterior breakage and wear are absent in CR designs. Finally, the concept of simply resurfacing the joint and maintaining as much as normal structure as possible is the philosophically appealing one. Multiple studies have noted no difference between the two in ultimate range of motion and knee outcome ratings [7].

In this study, we look into those patients who underwent bilateral TKA-either single sitting or sequential staged one week apart with either of the designs with same type of anaesthesia, post-operative pain management and physiotherapy protocol [8].

Study was done regarding thepatient preference based on pain and functional outcome.

METHODS

AIMS AND OBJECTIVES

To assess the significance of the type of implant used and the side first done in post-operative preferences in patients who underwent bilateral total knee arthroplasty either staged or single sitting. To evaluate pain and functional outcome of these patients till a period of 2 years of post-operative follow up [9].

INCLUSION CRITERIA

Patients with bilateral OA/RA knee with similar Kellgren Lawrence class and pre-operative Knee Society Knee Score (KSKS); (Pain score-40-60, Function score-30-60) who underwent bilateral TKA-either staged one week apart or simultaneous in our institution from 2011 May to 2012 September. Those who gave the valid informed consent signed [10].

EXCLUSION CRITERIA

Revision TKA patients and patients who underwent bilateral TKA staged more than one week apart were also excluded. Patient who had any bony deficits in femur or tibia who required any augmentation procedures, who had associated problems of the spine with neurological deficits or any complications which required compromise in the hospital post TKR physiotherapy protocol and those with coronal plane deformities more than 20 degrees [11]. Those patients with any arthritic symptoms in ipsilateral hip or ankle joints which we felt could alter the post-operative observation of the study were excluded.

34 patients who underwent bilateral TKA-either staged one week apart or simultaneous in our institution was followed up till a period of two years [12,13]. Follow up pain and functional assessment and their side preference was documented at 6 weeks, 3 months, 6 months, 1 year and 2 years. The entire data is analyzed to assess the factors which contributed to the preference. It's statistical significance was tested [14,15]. All the patients were informed of the study, it's nature and the purpose. Institute Review Board clearance has been obtained for the study. We used implants from different companies for the patients, but all the patients received either CR or PS designs of the same company [16].

In bilateral TKA, all patients underwent TKA with an extramedullary instrumentation for tibial cut and intramedullary instrumentation for femoral cut on one side and the other side with navigation assisted system which was randomized. Ligament balancing in flexion and extension were achieved depending on any medial or lateral side opening [17]. Release of the medial side was done by removal of tibial and femoral osteophytes, releasing the tibial attachment of MCL, releasing of posteromedial capsule and release of attachment of semi membranosus tendon at posteromedial corner. Post operative management was followed uniformly for all patients.

All the patients received post operative analgesia either by an epidural catheter or a femoral block and isometric quadriceps excercises, ankle pumps and toe movements were started as soon as the patient could do it actively. Range of movement excercises were begun and full weight bearing with walker was initiated the next day. DVT prophylaxis was initiated for all the patients.

STATISTICAL ANALYSIS

Considering the previous studies and the results, it is statistically acceptable to conduct the study with a sample size of 34 patients and 68 knees. Statistical Analysis will be performed by standard tests-*chi square* test; Fischer exact test to assess the association between the variables. Data will be expressed in proportions.

RESULTS

34 patients (68 knees) who underwent bilateral total knee replacement in our Institution, during a time period of 1 year, were followed up for a period of 2 years. At each and every visit, preference of knee were noted as well as Knee Society Knee Scoring. The score and the side preference were compared and statistically analysed.

Table 1. The side done first and the patient's preference at regular follow up intervals.

	6 wk preference			
Side 1st done	**Left**	**Right**	**p-value**	
Left	8 (61.5%)	5 (38.5%)		
Right	0 (0%)	13 (100%)	<0.001	
	3 m preference			
Side 1st done	**No preference**	**Left**	**Right**	**p-value**
Left	1 (7.7%)	8 (61.5%)	4 (30.8%)	
Right	0 (0%)	0 (0%)	13 (100%)	<0.001
	6 m preference			
Side 1st done	**No preference**	**Left**	**Right**	**p-value**
Left	1 (7.7%)	8 (61.5%)	4 (30.8%)	
Right	0 (0%)	0 (0%)	13 (100%)	0.001
	1 yr preference			
Side 1st done	**No preference**	**Left**	**Right**	**p-value**
Left	2 (15.4%)	8 (61.5%)	3 (23.1%)	
Right	0 (0%)	0 (0%)	13 (100%)	<0.001
	2 yr preference			
Side 1st done	**No preference**	**Left**	**Right**	**p-value**
Left	3 (23.1%)	7 (53.9%)	3 (23.1%)	
Right	0 (0%)	0 (0%)	13 (100%)	<0.001

From the chart, on follow up at 6 wks, it is clear that the patients in whom staged bilateral TKA was done preferred the side which was done first; irrespective of the design of the implant. But 5 patients out of 13 patients (38.5%) in whom left side was done first preferred right side. The correlation appears to be statistically significant. At 3 months follow up, 4 patients in whom left side was done first preferred right side. One patient had no preference and all the right side first patients preferred right side itself. The correlation appears to be statistically significant. At 6 months follow up, the statistics showed the same trend as at 3 months follow up. At 1 year follow up, 2 patients in whom left side was done first turned to have no preference to the side and 3 of them preferred right side. All the patients in whom right side was done preferred right side itself.

Table 2. The relation between side preference to implant design at 6 wks post op follow up.

Left side	**6 wk**		**p-value**
	Left	**Right**	
CR	3 (42.9%)	4 (57.1%)	
PS	5 (83.3%)	1 (16.7%)	0.266

At 6 wks 13 patients who underwent Lt side first 7 had CR and 6 had PS design 8 preferred Lt side and 5 preferred Rt side showing no association between the side preference and implant design.

Table 3. Side preference to implant design at 3 months follow up.

Left side	3 m			p-value
	No pref	Left	Right	
CR	1 (14.3%)	3 (42.9%)	3 (42.9%)	
PS	0 (0%)	5 (83.3%)	1 (16.7%)	0.296

At 3 months one patient who preferred Rt side with CR design at 6 wks has changed to no preference but the remaining patients have shown the same findings indicating that there is no association between side preference and implant design.

Table 4. Side preference to implant design at 6 months follow up.

Left side	6 m			p-value
	No pref	Left	Right	
CR	1 (14.3%)	3 (42.9%)	3 (42.9%)	
PS	0 (0%)	5 (83.3%)	1 (16.7%)	0.296

This table also shows no association between the implant design and side preference as earlier.

Table 5. Side preference to implant design at 1 year follow up.

Left side	1 yr			p-value
	No pref	Left	Right	
CR	2 (28.6%)	3 (42.9%)	2 (28.6%)	
PS	0 (0%)	5 (83.3%)	1 (16.7%)	0.25

In this table one more patient have changed to No preference from Rt side preference with CR design, but still there is no statistical association between the side preference and implant design.

Table 6. The pain score for Lt side done at 6 wks, 3 months, 6 months and 1 year.

Pain score-Lt	Mean	n	Std. deviation	p-value
Pre op	52.26	34	17.681	-
6 wks post op	79.68	34	13.316	<0.001
3 m post op	86.91	34	10.172	<0.001
6 m post op	91.65	34	6.085	0.002
1 yr post op	94.44	34	5.489	<0.001

This table tells us that there has been statistical improvement in the pain score after the procedure.

Table 7. The pain score for Rt side done at 6 wks, 3 months, 6 months and 1 year.

pain score-Rt	Mean	n	Std. deviation	p-value
Pre op	54.79	34	16.968	
6 wks post op	81.21	34	12.133	<0.001
3 m post op	87.38	34	9.257	0.002
6 m post op	91.74	34	5.119	0.003
1 yr post op	94.65	34	5.039	<0.001

This table tells us that there has been statistical improvement in the pain score after the procedure.

Table 8. The function score for Lt side done at 6 wks, 3 months, 6 months and 1 year.

Function score-Lt	Mean	n	Std. deviation	p-value
Pre op	40.88	34	16.259	
6 wks post op	48.97	34	22.455	0.001
3 m post op	71.47	34	15.449	<0.001
6 m post op	84.56	34	12.635	<0.001
1 yr post op	92.35	34	11.026	<0.001

This table tells us that there has been statistical improvement in the function score after the procedure.

Table 9. The function score for Rt side done at 6 wks, 3 months, 6 months and 1 year.

Function score-Rt	Mean	n	SD	p-value
Pre op	40.88	34	16.259	
6 wks post op	51.18	34	21.883	0.006
3m post op	70.74	34	15.576	<0.001
6m post op	84.56	34	12.635	<0.001
1 yr post op	92.35	34	11.026	<0.001

This table tells us that there has been statistical improvement in the function score after the procedure except for scoring at 6 wks.

Table 10. The KSKS for Lt side done at 6 wks, 3 months, 6 months and 1 year.

KSKS-Lt	Mean	N	Std. deviation	p-value
Pre op	10.12	34	3.073	
6 wks post op	21.94	34	3.733	<0.001
3 m post op	28.41	34	2.904	<0.001
6 m post op	34.88	34	2.705	<0.001
1 yr post op	37.71	34	2.097	<0.001

This table tells us that there has been statistical improvement in the KSKS after the procedure.

Table 11. The KSKS for Rt side done at 6 wks, 3 months, 6 months and 1 year.

KSKS-Rt	Mean	N	Std. deviation	p-value
Pre op	10.12	34	3.073	
6 wks post op	21.94	34	3.733	<0.001
3 m post op	28.41	34	2.904	<0.001
6 m post op	34.88	34	2.705	<0.001
1 yr post op	37.71	34	2.097	<0.001

This table tells us that there has been statistical improvement in the KSKS after the procedure.

Table 12. Relation between side preference to pain score, function score and KSKS at 6 wks post op.

	6 wks post op	Mean	n	Sd	p-value
Left preferred	Pain score-Lt	83.92	12	7.17	
	Pain score-Rt	82.33	12	7.33	0.174
	Function score-Lt	56.67	12	22.7	
	Function score-Rt	53.33	12	23.48	0.339
	KSKS - Lt	22.67	12	4.12	1

	KSKS-Rt	22.67	12	4.12	
Right preferred	Pain score-Lt	77.36	22	15.36	
	Pain score-Rt	80.59	22	14.21	0.001
	Function score-Lt	44.77	22	21.68	
	Function score-Rt	50	22	21.44	0.264
	KSKS-Lt	21.55	22	3.54	
	KSKS-Rt	21.55	22	3.54	1

Here there is no statistical association between these scorings and the side preference, except for Rt side preference at 6wks to the pain score.

Table 13. The association between side preference to pain score, function score and KSKS.

	3 m Post op	Mean	n	SD	p-value
Left preferred	Pain score-Lt	90.82	11	5.21	0.001
	Pain score-Rt	87.45	11	5.57	
	Function score-Lt	72.73[a]	11	17.37	1
	Function score-Rt	72.73[a]	11	17.37	
	KSKS-Lt	28.18[a]	11	2.75	1
	KSKS-Rt	28.18[a]	11	2.75	
Right preferred	Pain score-Lt	84.33	21	11.75	<0.001
	Pain score-Rt	86.76	21	11.02	
	Function score-Lt	69.52	21	14.74	0.424
	Function score-Rt	68.33	21	14.78	
	KSKS-Lt	28.19[a]	21	2.96	1
	KSKS-Rt	28.19[a]	21	2.96	

This table shows us that there is no association between the side preference to the scoring done except for Rt side preference at 6 wks to pain score on the Rt side.

Table 14. The association between side preference to pain score, function score and KSKS.

	6 m Post op	Mean	n	SD	p-value
Left preferred	Pain score-Lt	92.91	11	3.36	
	Pain score- Rt	90.64	11	3.2	0.006
	Function score-Lt	84.09	11	13.19	
	Function score- Rt	84.09	11	13.19	1
	KSKS-Lt	34.55	11	3.11	
	KSKS-Rt	34.55	11	3.11	1
Right preferred	Pain score-Lt	90.48	21	7.03	
	Pain score- Rt	91.81	21	5.81	0.017
	Function score-Lt	83.81	21	12.74	
	Function score-Rt	83.81	21	12.74	1
	KSKS-Lt	34.95	21	2.58	
	KSKS-Rt	34.95	21	2.58	1

This table shows us that there is no association between the side preference to the scoring done at 6 months follow up.

Table 15: Showing the association between side preference to pain score, function score and KSKS.

	1 yr Post op	Mean	n	SD	p-value
Left preferred	Pain score-Lt	94.45	11	2.54	
	Pain score-Rt	92.91	11	3.05	0.015
	Function score-Lt	90.91	11	11.36	1

	Function score-Rt	90.91	11	11.36	
	KSKS-Lt	37.82	11	2.27	
	KSKS-Rt	37.82	11	2.27	1
Right preferred	Pain score-Lt	93.8	20	6.75	
	Pain score-Rt	95	20	5.88	0.064
	Function score-Lt	92	20	11.52	
	Function score-Rt	92	20	11.52	1
	KSKS-Lt	37.6	20	2.21	
	KSKS-Rt	37.6	20	2.21	1

This table shows us that there is no association between the side preference to the scoring done at 1 year follow up.

DISCUSSION

TKR is one of the the most commonly performed orthopaedic procedures. The patient satisfaction after TKR has not been analyzed thoroughly and systematically. There are different scores and methods to assess the patient satisfaction after TKR. Different studies quote different methods to assess the satisfaction rate after TKR. Surgeons satisfaction lies at radiological parameters, implant survivorship, and ROM. But patient's perception of satisfaction depends on various other factors also. Lau et al. suggested that following two perspectives, internal determinants and external components, should be considered in the valuation of patient satisfaction [18]. The former refers to patient-dependent factors, such as age and expectations, whereas the latter indicates patient-independent factors, such as hospital environment and surgical technique.

The most commonly reported predictors of satisfaction are higher post-operative function, greater improvement in function from pre-operative to post-operative levels, and decreased pain. Fulfillment of expectations was also reported as a key predictor of satisfaction after TKR. So, pre-operative pain and functional status and expectations of the patient are very important factors in determining post-operative satisfaction. The severity of involvement, the type of prosthesis used, age, gender, co-morbidities, BMI, functional status, functional demands, rehabilitation process, patient's personality, are all important factors to be considered while assessing the satisfaction rate.

The most frequently reported predictors of dissatisfaction included persistent pain after surgery, anxiety, depression or poorer mental health. Persistent pain after TKR has been a subject of dilemma for many decades and continues to be a problem for some patients and surgeons as well. Low social support, poverty, mental and psychological factors too add to the dissatisfaction rate [19].

Also, it is described that worse affected knees are supposed to have better KSKS scoring post-operative. In this study, keeping apart all other factors, we focused on the type of implant used and the satisfaction rate. Patients with similar pre-operative pain and function score were pooled and studied. The type of prosthesis (CR or CS) and the company was randomly decided. Which side to be operated was based on patient's decision. In some patients, more symptomatic sides showed lesser radiological abnormality. Hence co-relation with deformity/severity of involvement and satisfaction rates were not looked into.

The impact of implant design on the outcome of TKA has been studied by many researchers, and some of which have demonstrated a relationship between the type of implant and postoperative satisfaction. There are studies that prove that the type and make of the implant doesn't correlate with patient satisfaction [20-22].

CONCLUSION

In this study, we could conclude that at 6 weeks, 3 months, 6 months, 1 year and 2 years follow up, there is significant association of side preference to the side which was operated first irrespective of the implant design, with a p value of <0.001.

61.5% of patients preferred left side when the left knee was operated first. 100% of patients preferred right side when the right knee was operated first. There was no association between the implant design (CR, PS) to the side preference. The p value was >0.05 at 6 weeks, 3 months, 6 months and 1 year.

Patient showed a strong association of pain scoring to side preference except for scoring at 6 weeks follow up, where patients preferred the left side but there was no difference in pain score between the left and right sides.

There is no significant association between side preference to implant design in cases where we have done bilateral same sitting using either designs in knees in the same patient. In our observation, we found that patients preferred the side with CR designs, but as the sample size is too small, no association was found statistically significant. We would like to follow up this finding with more number of samples.

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