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Outcome after total knee arthroplasty with or without patellar resurfacing

M. Shahbaz Siddiqui[1], Vivek Kumar Parsurampuriya[1]*, Neeraj Kumar[2], Sumedh Kumar[3]

[1]Department of Orthopaedics, Hindu Rao Hospital and NDMC Medical College, Delhi, India
[2]Department of Orthopaedics, ESI Hospital, Rohini, Delhi, India
[3]Department of Orthopaedics, Lal Bahadur Shastri Hospital, Khichdipur, Delhi, India

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***Correspondence:**
Dr. Vivek Kumar Parsurampuriya,
E-mail: drvivek2k4@gmail.com

ABSTRACT

Background: Patellar resurfacing in total knee arthroplasty has had its defenders and detractors. There seems to be a great difference in patellar resurfacing between countries and patellar resurfacing is still controversial. Some surgeons resurface the patella routinely, others not at all, and a third group prefers selective resurfacing. Therefore, in this prospective and randomised study, we compared the outcome after total knee arthroplasty with or without patellar resurfacing.
Methods: In this study 50 cases (100 knees) were selected and each case was followed up for 2 years. In each case, one knee was operated by TKA with patellar resurfacing and the other by TKA with patellar non-resurfacing. Patients were followed-up for a period of 2 years and clinical and functional outcome of both knees was measured and compared by the help of knee society score (KSS) and VAS score.
Results: There was statistically significant difference between the patellar resurfacing and non-resurfacing group with regard to knee society score, pain score and visual analogue score (VAS), with the patellar resurfacing having better scores. There was no significant difference in the functional scores between the 2 groups. Range of motion was complication rate was comparable in both the groups. However, there was no case of reoperation nor was there any complication related to the patellar implant.
Conclusions: Patellar resurfacing in TKA leads to less post-operative persisting knee pain, and also leads to better outcome in terms of walking without pain, using stairs without pain and rest pain as compared to TKA without patellar resurfacing.

Keywords: Total knee arthroplasty, Patelloplasty, Patellar resurfacing, Knee score, Knee functional score, KSS, VAS

INTRODUCTION

Total knee arthroplasty remains the gold standard treatment for end stage degenerative joint disease of knee with numerous long terms follow up studies showing excellent survivorship of 90-95% at 15 years.[1]

Since the 1970s, when the first TKA was performed, the early implants made were not designed for patellar resurfacing. The recurrent anterior knee pain that occurred at high rates following treatments with early implants, along with other complications such as dislocation, mal-tracking and subluxation typically were attributed to the patellofemoral joint. This prompted the development and use of tri-compartmental knee replacements that allowed patellar resurfacing.[2] Also, the anterior knee pain that some patients experience after TKA without patellar resurfacing led to the idea of performing patellar resurfacing in every patient.

As a variety of complications like patellar fracture, component wear, loosening and extensor mechanism problems were attributed to patellar resurfacing. It was proposed that resurfacing should be performed on a selective basis according to the degree of arthropathy seen at the time of operation and the experience of surgeon.[3] Commonly accepted indications for patellar resurfacing are rheumatoid arthritis, patellar cysts, hard patellar bone, and loss of congruence between the patella and the trochlear design of the prosthesis.

There seems to be a great difference in patellar resurfacing between countries and patellar resurfacing is still controversial. In North America, more than 90% surgeons resurface the patella, while in Australia it was 60% in 2014. On the other hand, in Sweden and Norway, only about 2% of the TKA had patellar resurfacing done in 2014.[4] Some surgeons resurface the patella routinely, others not at all, and a third group prefers selective resurfacing. Those who prefer resurfacing on a routine basis argue that the patients have less anterior knee pain, better knee function, and more satisfaction with the operative result; in addition, these patients avoid a possible secondary operation for addition of a patellar component. Those who do not resurface the patella take into account pre-operative and post-operative complications (e.g., fracture, infection, wear, or loosening), longer operation time, and higher cost of material-as well as similar operation outcomes. The third group of surgeons who recommend resurfacing only in selected cases-especially in patients with RA, patello-femoral symptoms, and obesity-believe that these factors increase the risk of patellar pain postoperatively[4].

Therefore, the purpose of this study is to compare the outcome after total knee arthroplasty with or without patellar resurfacing.

METHODS

The study was conducted at Sir Ganga Ram hospital in joint replacement unit, old Rajinder nagar, Delhi. The study was done to compare the pain scores pre and postoperatively in total knee arthroplasty with or without patellar resurfacing and to compare the complication rates between total knee arthroplasty with or without patellar resurfacing.

Patients with bilateral grade III/IV osteoarthritis undergoing bilateral TKA under the joint replacement unit were included in the study. The proposed study was undertaken with a sample size of total 50 patients (100 knees). In every patient one side is operated with TKA with patellar resurfacing and other side without patellar resurfacing.

Study was done from January, 2017 to June, 2019. The study population was selected in the first 6 months of study. Once the patient was enrolled in the study, a follow-up period of 2 years was done. After enrolment, group assignments were determined by a computer-generated number sequence and were contained in sequentially numbered opaque envelopes. 50 such envelopes were made with the type of procedure to be done on the right knee. One envelope was opened each time in the operation theatre. The right knee received the treatment generated by the randomization and the contralateral knee received the other treatment.

Inclusion criteria

Inclusion criteria for the study included patients aged between 50 and 75 years, patients with B/L osteoarthritis grade III/IV, patients fit for surgery and patients eligible for spinal anaesthesia.

Exclusion criteria

Exclusion criteria for the study excluded patients with neurological disease, patients with infective/inflammatory arthritis, patients with extensor mechanism dysfunction, patients with medio-lateral or patellofemoral instability and patients with rheumatoid arthritis.

Sample size estimation

Sample size was be determined based on the ability to detect the performance after TKA with or without patellar resurfacing. With reference to previous study done by Waters, the mean functional score of the KSS is 91.4 in group 1 (TKA with patellar resurfacing) and 88.5 in the group 2 (TKA without patellar resurfacing).[3] The total was set as 218 (109 per group) from an effect size of 1.0, a power of 80%, an α of 0.05 where the standard deviation of two groups was assumed 5.93 and 10.23 respectively. The formula for calculated sample size is given below

$$N=\frac{(\sigma 1^2+\sigma 2^2)\,[Z\ 1-\alpha/2+Z\ 1-\beta]^2}{(M1-M2)^2}$$

$$=\frac{(5.93^2+10.23^2)\,[1.96+0.842]^2}{(17\times 17)}$$

$$=\frac{(35.16+104.65)\times 7.85}{289}$$

$$=1097.57/10.05$$

$$=109.22$$

where $Z_{\alpha/2}$ is the critical value of the Normal distribution at α/2 (e.g., for a confidence level of 95%, α is 0.05 and the critical value is 1.96), Z_β is the critical value of the Normal distribution at β (e.g., for a power of 90%, β is 0.1 and its critical value is 1.282) and σ 1 and σ 2 are the Standard deviations of the two groups and M1 and M2 are the means of two groups.

Once the patient fulfilled the inclusion criteria, informed consent was taken and preoperative evaluation done.

Randomization was done at the time of first knee incision. Every patient‘s knee was placed into 2 groups according to the operative procedure approached: Group I: TKA with patellar resurfacing and group II: TKA without patellar resurfacing.

Post-operative patient ‘s knee was immobilized in a compressive bandage using crepe bandage and a knee immobilizer immediately. The patients were started on IV antibiotics and DVT prophylaxis in the form of subcutaneous low molecular weight heparin. For first 7 post-operative days, patients were made to exercise under supervision of trained doctors and nurses.

Parameter for evaluation

The outcome was accessed by using Knee Society Score and Visual Analogue Score.

Data collection tools and techniques

Data was gathered on the basis of clinical evaluation and was categorized according to the operative procedure undertaken in groups I and II, and also based on the status of other joints and associated medical co morbidities. This data was tabulated and analysed to obtain results and conclusion.

Statistical method

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Continuous variables were presented as mean SD/median (IQR) for non-normally distributed data. Categorical variables were expressed as frequencies and percentages.

The comparison of normally distributed continuous variables between the groups was performed using Student ‘s t test, and paired t-test was used to compare the pre- and postoperative scores. Nominal categorical data between the groups were compared using Chi-squared test or Fisher ‘s exact test as appropriate.

Non-normal distribution continuous variables were compared using Mann Whitney U test. For all statistical tests, $p<0.05$ was taken to indicate a significant difference.

Statistical analysis

The analysis was carried out using Statistical package for social sciences 17.00 version. Normally distributed data was presented as Means±SD, or median (Range) if data skewed, and categorical data was presented as frequencies. Comparison of continuous variable was done by using student t- test between two groups. Paired t test was used for comparison of continuous variables from pre to post intervention. Differences between groups were assessed with Chi-square or Fisher ‘s exact test for categorical variables as appropriate. For non-normal data Mann Whitney U test and Wilcoxon signed rank test were used. $P<0.05$ was taken as significant.

RESULTS

Age distribution

There were 50 patients (100 knees) with average age of 63.44 years.

Pain while walking

On the basis of severity of pain while walking both the groups are assessed pre-operative, after 2 weeks, 6 months and 2 years and grouped into mild, moderate and severe pain group. At 2 years follow up, 42 (84%) had no pain while walking in group I as compared to 16 (32%) in group II ($p<0.001$). There was a statistically significant between both the groups at every follow-up, with group I having better scores than group II (Table 1).

Pain while stairs climbing

On the basis of severity of pain while stairs climbing both the groups are assessed pre-operative, after 2 weeks, 6 months and 2 years and grouped into mild, moderate and severe pain group. At 2 years follow up, 38 (76%) of patients of group I had no pain while stairs use and 12 (24%) had mild pain, whereas in group II, 40 (80%) of patients of had mild pain while stairs use and 6 (12%) had no pain. There was statistically significant difference between both the groups at every follow-up, with group I patients having better scores than group II (Table 2).

Pain score (Walking and stairs)

The mean preoperative pain score was 21.8 and 23.2 points in group I and group II respectively. The difference in pain scores was statistically insignificant ($p=0.716$). At 2 weeks follow up, mean pain score was 31.2 points in group I and 22.2 points in group II ($p<0.001$). At 6 months follow up, mean pain score was 41.4 points in group I and 34.4 points in group II ($p<0.001$). At 2 years follow up, mean pain score was 47.8 points in group I and 41.2 points in group II, according to the knee society knee score. The difference in pain score was statistically significant ($p<0.001$) between the two groups (Table 3).

Range of motion

There was no significant difference at final follow up between the two groups ($p=0.558$). The mean value of range of motion continued to increase up-to 2 years of follow up.

Flexion contracture

All of the patients in each group had flexion contracture of less than 10^0 pre-operatively; and 34 (68%) in group I and 30 (60%) in group II had no flexion contracture pre-

operatively. At 2 years follow-up, 4 (8%) patients of group I and 6 (12%) patients in group II had flexion contracture of $<5^0$. No statically significant differences were evident between two groups, pre-operatively and post-operatively.

Complication rate

In our study, two (4%) cases in group I developed superficial infection. There was no statistically significant difference between the complication rates between both the groups.

Knee score

The mean pre-operative knee score was 47.04 in group I and 48.68 in group II. The knee score at 2 years follow-up was 90.28 in group I and 84.16 in group II. The difference between 2 groups was statistically significant (p<0.001) (Table 4).

Knee functional score (KFS)

The mean preoperative and 2 years postoperative KFS were 45.00(SD±12.22) and 88.72 (SD±10.33) for group I and group II both. It showed no significant difference (p=1.000) between the two groups (Table 5).

Knees society score (KSS)

The KSS is the overall sum of the KSS and KFS. The mean preoperative KSS was 92.04 (SD±23.14) in group I and 93.68 (SD±21.56) in group II. The KSS at 2 years follow up was 179 (SD±11.94) in group I and 172.88 (SD±13.98) in group II. The difference between the two groups was statistically significant (p=0.018) (Table 6).

Visual analogue score (VAS)

The mean pre-operative VAS was 7.12 and 7.32 in group I and group II respectively. At 2 weeks follow-up, the mean VAS was 4.28 and 4.64 in group I and group II resp. (p=0.095) which was statistically insignificant. At 6 months follow-up, the mean VAS was 2.36 and 2.76 in group I and II respectively (p=0.05), which was statistically insignificant. At 2 years follow-up, mean VAS score was 0.76 and 1.56 in group I and II respectively (p=0.002) which was statistically significant (Table 7).

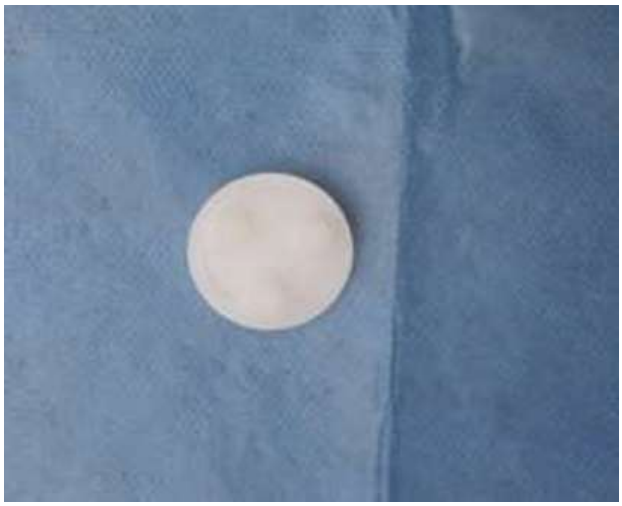

Figure 1: Patellar button.

Table 1: Comparison of severity of pain while walking between group I and II.

Pain while walking		Severity of pain (%)				P value
		None	Mild	Moderate	Severe	
Pre-op	Group I	0 (0)	14 (28)	26 (52)	10 (20)	0.891`
	Group II	0 (0)	14 (28)	26 (52)	10 (20)	
Post-op 2 weeks	Group I	0 (0)	34 (68)	16 (32)	0 (0)	0.001
	Group II	0 (0)	12 (24)	36 (72)	2 (4)	
Post-op 6 months	Group I	14 (28)	34 (68)	2 (4)	0 (0)	0.006
	Group II	0 (0)	38 (76)	12 (24)	0 (0)	
Post-op 2 years	Group I	42 (84)	8 (16)	0 (0)	0 (0)	0.001
	Group II	16 (32)	32 (64)	2 (4)	0 (0)	

Table 2: Severity of pain while stairs use between group I and II.

Pain while stairs use		Severity of pain (%)				P value
		None	Mild	Moderate	Severe	
Pre-op	Group I	0 (0)	18 (36)	20 (40)	12 (24)	0.376
	Group II	2 (4)	20 (40)	20 (40)	8 (16)	
Post-op 2 weeks	Group I	0 (0)	14 (28)	32 (64)	4 (8)	0.02
	Group II	0 (0)	2 (4)	38 (76)	10 (20)	
Post-op 6 months	Group I	10 (20)	36 (72)	4 (8)	0 (0)	0.002
	Group II	2 (4)	26 (52)	22 (44)	0 (0)	
Post-op 2 years	Group I	38 (76)	12 (24)	0 (0)	0 (0)	<0.001
	Group II	6 (12)	40 (80)	4 (8)	0 (0)	

Table 3: Pain score (walking and stairs) between group I and II.

Pain score (Walking and stairs)		Mean	Std. deviation	P value
Pre-op	Group I	21.8	14.133	0.716
	Group II	23.2	12.9	
Post-op 2 weeks	Group I	31.2	7.943	<0.001
	Group II	22.2	8.549	
Post-op 6 months	Group I	41.4	4.682	<0.001
	Group II	34.4	8.578	
Post-op 2 years	Group I	47.8	3.253	<0.001
	Group II	41.2	5.642	

Table 4: Comparison of knee scores between group I and II.

Knee score	Group I, (n=50)		Group II, (n=50)		P value
	Mean	SD	Mean	SD	
Pre-op	47.04	20.50	48.68	19.64	0.774
Post-op 2 weeks	66.60	10.87	53.52	10.84	<0.001
Post-op 6 months	79.96	5.777	72.64	9.83	0.002
Post-op 2 years	90.28	4.316	84.16	6.31	<0.001

Table 5: Comparison of functional score between group I and II.

Functional score	Group I, (n=50)		Group II, (n=50)		P value
	Mean	SD	Mean	SD	
Pre-op	45.00	12.22	45.00	12.22	1.000
Post-op 2 weeks	41.88	7.38	41.88	7.38	1.000
Post-op 6 months	66.64	5.47	66.64	5.47	1.000
Post-op 2 years	88.72	10.33	88.72	10.33	1.000

Table 6: Comparison of KSS between group I and II.

Knee society score	Group I, (n=50)		Group II, (n=50)		P value
	Mean	SD	Mean	SD	
Pre-op	92.04	23.14	93.68	21.56	0.797
Post-op 2 weeks	108.48	16.24	95.4	15.38	0.005
Post-op 6 months	146.6	7.56	139.28	12.82	0.018
Post-op 2 years	179	11.94	172.88	13.98	0.018

Table 7: VAS scores in group I and II.

VAS score	Group I, (n=50)	Group II, (n=50)	P value
Pre-op	7.12	7.32	0.53
Post-op 2 weeks	4.28	4.64	0.095
Post-op 6 months	2.36	2.76	0.05
Post-op 2 years	0.76	1.56	0.002

DISCUSSION

In our study, we compared the patellar resurfacing versus non resurfacing TKA for management of osteoarthritis knee of stage III and IV. The study was conducted on 50 patients (100 knees) of either sex, at Sir Ganga Ram hospital. Patellar resurfacing during total knee arthroplasty has remained controversial. It has been argued that patellar resurfacing is unnecessary and may be associated with serious complications, such as fracture, subluxation, wear, component loosening or failure, and extensor mechanism rupture.[5,6] We, in our 2 years study, did not note any complication related to patellar resurfacing.

Prospective, randomized trials are considered the gold standard with which we properly evaluate clinical methods. We know of many studies with reference to patellar resurfacing, all had deferring conclusions. Barrack et al studied 118 knees in a mean follow-up of 70.5 months and found no significant difference between the resurfaced and non-resurfaced knees with respect to the overall KSS (p=0.36), pain score (p=0.77) or the KFS (p=0.16).[7] According to them, postoperative anterior knee pain does not relate to whether the patella is resurfaced or not and rather depends on the component design and the surgical technique. Schroeder-Boersch et al in a trial of forty patients with a 2 year follow up, demonstrated that resurfacing was associated with improved knee and function scores.[8] Feller et al, in a study of forty patients, reported that although resurfacing was associated with no complications, it was also associated with no benefit.[9] Conversely, Bourne et al, in a study of 100 knees with a two year follow up, found less pain and better function in the non-resurfacing group.[10] Newman et al, in a trial of 125 knees with a minimum duration of follow up of 5 years, noted only one patellar complication in the resurfacing group and maintained that resurfacing should be performed routinely and cannot be based on the appearance of the patella.[11]

The confounding factors that could have hampered the above-mentioned studies such as weight, BMI, age, sex, patient's perception factors and occupation have been eliminated in our study. We have included strictly only cases of bilateral total knee arthroplasties in our study with only grade III and IV osteoarthritis in our studies and excluded inflammatory arthropathies and neurological diseases in our study.

In our study we found a significant difference in pain score, knee scores, KSS and VAS scores between the two groups, with the patellar resurfacing group having better scores. After a follow up of 24 months, we found better pain scores (p<0.001), Knee score (p<0.001), KSS (p=0.02) and VAS scores (p=0.002) in the patellar resurfacing group. However, there was no difference in the KFS (p=1.000) between both the groups. The mean pre-operative knee and function score in the patellar resurfacing group was 47.04 and 45 respectively, whereas the mean pre-operative knee and function score in the patellar non-resurfacing group was 48.68 and 45 respectively. At 2 years follow up, the mean knee and function score in the patellar resurfacing group was 90.28 and 88.72 respectively and knee and function score in the patellar non-resurfacing group was 84.16 and 88.72 respectively.

Park et al found significant difference in respect of functional scores in between both the groups.[12] They concluded that patients with TKA with patellar resurfacing had statistically significant better Knee function scores than the non-resurfacing group (p=0.044) and the knee scores in both the groups were statistically insignificant (p=0.29).

All the patients participating in the study were satisfied with the results of both the knees. At 24 months follow-up, when asked to compare both the knees, 26 (52%) of them felt no difference in pain in both knees, whereas 20 (40%) of them preferred the patellar resurfacing knee and 4 (8%) of them preferred the non-resurfacing knee. In the study conducted by Barrack et al 5 (21%) of the patients preferred the resurfacing knee, 7 (29%) the non-resurfacing side and 12 (50%) had no preference.[7] We have found a preference for the resurfaced knee in our patients.

We also found the pre-operative knee score to have an effect on post-op knee scores, with patients with low pre-operative knee scores having a slightly low knee score post-operatively.

We also compared the range of motion between both the groups and found statistically no significant difference. Waters et al also reported no statistical difference in between both groups (p=0.46).[3] There was no case of aseptic loosening of implants, deep infections, migration/subsidence, particulate synovitis, instability, extensive osteolysis and subluxation or dislocation of mobile bearing, till the latest follow up. In a study conducted by Barrack et al, 7 (12%) of the non-resurfacing group subsequently required patellar resurfacing, all these being done after at least 2 years follow-up.[7]

Some limitations of our study should be acknowledged. First limitation is that the present study was of relatively short duration with a mean follow-up of 24 months and that accelerated failure may occur in either group with longer follow-up. Secondly, the results inferred from our study may be specific to the type of prosthesis used, and different results may be reported for different patellar designs. Thirdly, it is frequently difficult for a patient who has undergone bilateral total knee arthroplasty to distinguish the function of one knee from that of the other.

In this study, we saw improvement in clinical and functional outcomes for patients operated with TKA with patellar resurfacing versus non-resurfacing. Therefore, in this population, we recommend patellar resurfacing with the use of patellar implant in every case of total knee replacement. The extra cost of the patellar button far outweighs the post-operative clinical outcome and pain scores in the study population.

Table 8: Comparison between ours and previous studies.

Study	Type of study	Mean follow up (months)	Operation type (number of knees)	Pre-op KSS score		Post-op KSS score		
				Pre-op pain score	Pre-op function score	Post-op pain score	Post-op function score	Total
Barrack et al[7]	Prospective randomized study	30	R (58) NR (60)	45.8, 47.4	- -	91.2, 89.3	83.3, 81.3	174.5, 170.9
Burnett et al[13]	Prospective randomized clinical trial (bilateral)	110	R (28) NR (28)	48, 50	38, 40	83, 83	63, 65	146, 148
Park et al[12]	Retrospective	149 (R) 140.9 (NR)	R (36) NR (25)	50.5±16.2 53.7±15.9	39.8±17.5 46.3±15.3	93.5, 95	77.5, 60	-
Wood et al[14]	Prospective randomized trial	48	R (92) NR (128)	57.4±14.0 55.7±16.6	51.3±13.5 51.6±16.4	87.0±10 86.5±11	70.0± 32.5 65.0± 28.5	-
Our study	prospective randomized study	24	R (50) NR (50)	47.04, 48.68	45, 45	90.28, 84.16	88.72, 88.72	179, 172.8

CONCLUSION

In our study of 100 knees (50 patients), with a mean follow-up of 24 months, we have found that knees operated with patellar resurfacing had better pain scores, KSS and VAS scores. Patellar resurfacing knees performed better postoperatively in respect to pain while walking, pain while using stairs and pain at rest as compared to patellar non-resurfacing group.

The KFS, were found to be similar in both the groups studied, as the patients in both the groups were the same. We also found no difference in postoperative range of motion, complication rate, stability and flexion contracture in between both the groups.

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