



Original Research Article

A prospective observational study on comparing the outcome of patellar resurfacing and patellar nonresurfacing total knee arthroplasty in south Indian population

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ABSTRACT

Introduction: Total Knee Arthroplasty (TKA) has been a very successful surgery in relieving pain and restoring function in osteoarthritis. Conflicting evidence in literature exists regarding the merits of patellar resurfacing during TKA over non-resurfacing. Our aim is to evaluate and compare the difference between patellar resurfaced group and non-resurfaced group in primary TKA.

Materials and Methods: This prospective observational study was initiated in May 2016 conducted till April 2018 (2 years) in Yashoda Superspeciality Hospital, Hyderabad. At least 14 mm of patella was ensured to be retained after patellar cut. A total of 40 patients were allocated to receive (n=20) or not to receive patellar resurfacing (n=20) during primary TKA. The data was analyzed statistically using the Student t test. Overall patient satisfaction was recorded using the SF-36 score.

Results: Of the 40 patients, 67.5% females and 32.5 % males underwent TKA. Among those who underwent resurfacement, 40% were males. 75% among the non-resurfaced group were females. Right knee was operated on 37.5% of cases. Mean operative time being 103.9 and 122.5 minutes in nonresurfaced and resurfaced cases respectively. Mean patellar thickness was 22.1mm in nonresurfaced and 23.6mm in resurfaced group. The difference in VAS score, modified HSS score, KSS scores between the two groups were statistically insignificant with p-values of 0.230, 0.0214, 0.2513 respectively at the end of two year, but there was significant reduction of anterior knee pain in the resurfaced with p-value < 0.001.

Conclusion: The functional outcome was not affected by whether the patella was resurfaced or non-resurfaced. There was no significant difference between the two groups with respect to the prevalence of knee-related readmission, or of subsequent patella-related surgery or patients overall satisfaction. We recommend selective patellar resurfacing at the time of primary total knee replacement.

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1. Introduction

Osteoarthritis is a common disabling disease that affects millions of people worldwide. The incidence of osteoarthritis is increasing with aging population which is predicted to increase in the coming decades.¹ Total knee arthroplasty (TKA) is undoubtedly one of the surgical success stories of modern times. It is being done in large

numbers owing to better understanding of the joint and the evolution of the implants.² Altered biomechanics of patella can be a cause of poor functional results after a primary total knee arthroplasty sometimes requiring revision. For a long time, the patella was wrongfully marginalized and merely considered as an afterthought during total knee arthroplasty (TKA). Understanding the patello-femoral anatomy, biomechanics of the patello-femoral joint, the multitude of problems associated with both resurfacing and non-resurfacing and the importance of these factors helps

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in decision making for the surgeons to perform a successful TKA. The first recorded patellar resurfacing combined with a nonconstrained condylar-type replacement arthroplasty was performed by Groeneveld and colleagues in 1970. First tricompartmental total-condylar replacement was implanted in October 1974 by Ranawat et al.³ Presently almost all available knee replacement systems had provisions for patellar resurfacing. Even today, patella resurfacing is often thrown in for good measure without proper understanding of the functional interplay among arthroplasty components. The patella should be recognized as an integral part of any TKA. The clinician must be aware that judicious surgical management of the patella will not only affect patient satisfaction but occupies a pivotal role in the success or failure of TKA.⁴ Conflicting evidence in literature exists regarding the merits of patellar resurfacing during TKA over non-resurfacing. To resurface (or) not to resurface the patella in tri-compartmental osteoarthritis is still a contentious issue among orthopedic surgeons performing TKA. Some surgeons always resurface the patella, some never use a patellar implant, and some only do it in selected cases depending on patient factors, implant design factors, surgical techniques and material properties.⁵ The aim of our study is to compare the functional outcome between patella resurfaced and non-resurfaced group in primary TKA and to compare the overall patient satisfaction in both the groups.

2. Objectives of Our Study

1. To assess functional outcome using American knee society scoring (KSS) and hospital for special surgery score (HSS) and analysing variables statistically.
2. To record overall patient satisfaction using SF36 Score.

3. Materials and Methods

This is a prospective observational study conducted in department of orthopedics, Yashoda superspeciality hospital, Somajiguda, Hyderabad between may 2016 to april 2018. In our study 40 cases of primary osteoarthritis were studied and sample size calculation was done using Cochran formula based on study conducted in 2016 by Pal CP et al.⁶ Out of all the TKA's operated in our hospital in May 2016, 20 patients underwent patellar resurfacement TKA and all of them are allocated to resurfacement group. Out of all the patients operated with non-resurfacement TKA 20 patients were randomly selected by chit method and allocated to non resurfacing group. The decision to resurface or not to resurface patella was justified in the best interest of patients by the operating surgeon intraoperatively. All the patients from both the groups were followed postoperatively for a period of 24 months. The study was approved by IEC (Reg.no- ECR/49/Inst/AP/2013/RR-16) dated 21/03/2018.

3.1. Sample size calculation

As per the Cochran formula- Based on study by Pal CP et al.⁶

n_0 -sample size

z-value (from z table as per confidence level).

P-proportion of population with OA in the given age group of population.⁶ (At age > 65 – 40% of patients i.e 0.4)

$q = 1-p$ ($1-0.4 = 0.6$)

e-degree of accuracy or precision (-/+ 0.05).

For 95% confidence level “z = 1.96”

Calculation $n_0 = \frac{z^2 Pq}{e^2}$

$$n_0 = \frac{(1.96)^2 \times 0.4 \times 0.6}{(0.05)^2}$$

But we could not conduct our study on 393 persons because, Not every OA patient undergo TKA, every patient undergoing TKA doesn't need patellar resurfacing, there should be gross arthritic changes in patello-femoral joint for doing resurfacing. Intraoperative patellar sizing to estimate a minimum thickness of 14mm to be retained after resection, is a must to perform resurfacing. Study duration is limited to 24 months only, number of patellar resurfacing TKA is less in South India as compared to studies conducted abroad. So keeping sample size of previous studies in consideration and above mentioned facts we decided to do our study on 40 persons.

3.2. Inclusion criteria

1. Patients of either sex with tricompartmental degenerative osteoarthritis of knee.
2. Patients who are medically fit to undergo a total knee arthroplasty.
3. Patient willing for periodic assessment.

3.3. Exclusion criteria

1. Patients of Age < 50 years.
2. Patients with Comorbid conditions like: Peripheral vascular disease, Malignancies, Uncontrolled diabetes, Severe COPD, Severe cardiac disease, nephropathies, Inflammatory arthritis, Neuropathic joints, neuromuscular disorders, severe osteoporosis, patellar fracture or instability or previous patellectomy, Patients with any extensor mechanism surgery.

3.4. Study procedure

A prospective observational study of 40 patients, underwent primary total knee arthroplasty for degenerative tricompartmental osteoarthritis were studied. Patient's demographic details and Body Mass Index were recorded. All patients were evaluated clinically with a thorough history and clinical examination and routine blood investigations preoperatively. Specific investigations like

plain radiography of involved knee joint (anteroposterior, lateral and skyline views), urine culture and sensitivity, bilateral lower limb venous, arterial doppler and 2D echocardiography were done. Informed written consent was taken from all the patients prior to surgery. Of the 40 patients 20 patients were assigned to patellar resurfacing group and 20 to non-resurfacing group respectively. To resurface or not to resurface patella, the decision was justified in the best interest of patients by the Orthopedic surgeon intraoperatively. Preoperatively pain was evaluated and documented using Visual Analogue Score (VAS) and functional scores were evaluated and documented using the Modified Hospital for Special Surgery (HSS) and the Knee Society Score (KSS). Post operatively the patient was followed up for a mean duration of two years. The pain and functional scoring were evaluated at the time of one month, six months, one year, and two years post operatively. The overall patient satisfaction was documented using the SF -36 questionnaire preoperatively and at 2 years postoperatively. Variables pertaining to the patella-femoral articulation like, anterior knee pain and transfer scores were evaluated and compared. We used medial parapatellar approach in all the cases and Intra-operative thickness of native patella was documented. After measuring the intra-operative patellar thickness a minimum of 14 mm of patella is ensured to retained after performing the patellar cut. The decision of resurfacing or non-resurfacing was made selectively in our study based on the intraoperative native patellar thickness, patellar degenerative changes, patellar tracking. The patellar tracking was confirmed both using the trail components and also after cementing the component. The operative time required for the surgery is noted in both the non-resurfacing and resurfacing groups. Post operatively plain radiographs were taken to check the alignment, component position and tracking of patella. The collected data was documented in master chart and analysed statistically using the Student t test.

4. Observations and Results

Out of the 40 patients, 20 patients underwent patellar resurfacing and in the other 20 patients the patella was not resurfaced. Out of which 13 (32.5%) were males and 27 (67.5%) were females. The data which was analysed using the student t test. Of 13 male patients in our study 5 patients (25%) underwent patella nonresurfaced TKA and 8 (40%) underwent patellar resurfaced TKA. Similarly out of 27 females in our study 15 (75%) underwent patella nonresurfaced TKA and 12 (60%) underwent patellar resurfaced TKA. It is found in our study that degenerative osteoarthritis is relatively more common in the Indian women population compared with men. Majority of the patients were homemakers 23 patients (62.5%) or retired officials 17 patients (37.5%). It could be noted that degenerative osteoarthritis had a preponderance to the left

knee (62.5%) more than right knee (37.5%). Resurfacing of patella is relatively more in left knee (55%). The operative time is more for resurfacing TKA, difference between the resurfaced and non resurfaced is statistically significant with a p value of <0.0001. The measured intraoperative patellar thickness using a caliper is more for resurfaced patella and their difference is statistically significant with a p value <0.0001. The mean age difference between the two groups is not statistically significant. The body mass index compared between the two groups show non significant difference.

Anterior knee pain scores were statistically different between the two groups. Non Resurfaced group experienced more AKP at the at 24 months postoperatively with a mean of 3.2 and SD of 0.52 when compared to resurfaced group with a mean of 1.4 and SD of 0.50 (p value <0.0001). The difference in VAS scores are not statistically significant between the two groups at preoperative, 6, 12, 24 months post operatively. The difference in VAS score is significant at 1 month post-operative, with more pain in resurfaced group.

The differences in HSS and KSS scores are not statistically significant between the two groups at 1, 6, 12, 24 months.

The overall satisfaction in patients undergoing total knee arthroplasty (TKA) was evaluated using the SF-36 questionnaire. Differences between SF-36 scores of all patients undergoing total knee arthroplasty (TKA) (irrespective of resurfacing or non resurfacing), pre-operative and post operative was statistically significant. (p<0.0001). Comparing the resurfaced and non-resurfaced groups, there was no statistical significance in SF 36 scores difference between two groups at 2 years postop followup.

Transfer scores in the patients undergoing total knee arthroplasty (TKA). Where 5 is normal and 2 is with support as described in HSS Score. Pre-op transfer score for all patients undergoing total knee arthroplasty (TKA) was 2. Post-op changes in transfer score is shown in Table 5. Change in transfer score pre operative and post operative is statistically significant with p-value <0.0001. The change in transfer score across the groups at the end of two years is not statistically significant (p value = 0.5388).

Patellar Maltracking was seen in 1 patient post-op in non-resurfaced group.

5. Discussion

Literature reviews strongly characterize the diversity of opinions expressed in the debate about patella resurfacing into three basic strategies —always to resurface, never to resurface, or to resurface the patella selectively. Proponents of patellar resurfacing claim reduced incidence of postoperative anterior knee pain, avoidance of secondary resurfacing, higher patient satisfaction, better overall function, low complication rate, relatively inexpensive and

Table 1: Age / BMI / Operative time / Patellar thickness

	Patella						T	df	p Value
	Nonresurfaced			Resurfaced					
	N	Mean	SD	N	Mean	SD			
Age	20	60.55	8.09	20	63.05	7.15	1.0355	38	0.3070
Body Mass index	20	27.80	2.33	20	28.40	2.85	0.770	38	0.4459
Operative Time	20	103.9	2.47	20	122.5	2.19	25.213	38	<0.0001
Patella Thickness (mm)	20	22.10	1.25	20	23.6	0.75	4.602	38	<0.0001

Table 2: HSS Scores pre op, at 1, 6, 12, 24 months

HSS	Patella						T	df	p Value
	Nonresurfaced			Resurfaced					
	N	Mean	SD	N	Mean	SD			
PRE-OP	20	41.6	4.35	20	43.3	2.62	1.497	38	0.1426
1 Month	20	69.4	3.22	20	67.5	3.25	1.865	38	0.0711
6 Months	20	72.1	3.46	20	69.2	3.50	2.635	38	0.0121
1 Year	20	77.2	4.11	20	73.4	4.03	2.952	38	0.0054
2 Years	20	77.8	3.86	20	75.0	3.51	2.40	38	0.0214

Table 3: KSS scores pre op, at 1, 6, 12, 24 months

KSS	Patella						T	df	p Value
	Nonresurfaced			Resurfaced					
	N	Mean	SD	N	Mean	SD			
Pre-OP	20	95.3	7.76	20	97.5	6.54	0.9695	38	0.3384
1 Month	20	145.7	7.81	20	145.5	7.02	0.0852	38	0.9326
6 Months	20	154.1	7.59	20	152.4	5.39	0.8167	38	0.4192
1 Year	20	157.8	5.63	20	155.6	7.65	1.3486	38	0.1855
2 Years	20	159.3	5.31	20	157.4	5.00	1.1650	38	0.2513

Table 4: SF36 score pre and post op and at 2 yrs follwup

SF 36 Score	N	Mean	SD	t - Value	df	p Value
Preoperative	40	39.96	4.08	34.64	38	<0.0001
Postoperative	40	67.73	3.02			

SF 36 SCORE	Patella						T	df	p Value
	Nonresurfaced			Resurfaced					
	N	Mean	SD	Mean	SD				
2 Yrs POST –OP	20	67.08	2.54	20	68.385	3.37	1.38	38	0.1747

Table 5: Transfer scores pre and post op, resurfaced and nonresurfaced

Transfer scores	With Support (2)	Normal (5)	Mean	SD	t-Value	p-Value
Preoperative	40	—	2	—	4.095	<0.0001
Post operative Total	28	12	2.9	1.39		
Non resurfaced	15	5	2.75	1.33	0.6203	0.5388
Resurfaced	13	7	3.05	1.47		

Table 6: Patellar maltracking

Patella Tracking	Patella				Total	
	Nonresurfaced		Resurfaced		COUNT	%
	COUNT	%	COUNT	%		
Mal-Tracking	1	5.0	0	0.0	1	2.5
Proper Tracking	19	95.0	20	100	39	97.5
Total	20	100	20	100	40	100

not time-consuming. The articulation between cartilage and metal is considered nonphysiologic, and prolonged exposure to high compressive forces is believed to cause cartilage erosion.⁷ The proportion of the overall revision rates attributable to the resurfaced patella have decreased over the past 25 years, from almost 50% in the 1980s to approximately 12% today. The prevalence of patellofemoral complications has also decreased significantly and currently is approximately 4%.⁸ Proponents of nonresurfacing claim conservation of patellar bone, reduced likelihood of patellar osteonecrosis, more physiologic patellofemoral kinematics, ability to with-stand high patellofemoral forces, especially in younger and more active patients.⁹ Particular emphasis is placed on the avoidance of intraoperative and postoperative complications associated with patellar resurfacing, which include patellar fracture, implant wear, loosening, and dissociation.¹⁰ In our study we did not find any complications in both the groups, however we had one case of patellar maltracking in nonresurfaced group intraoperatively which was tracking well on closure with sutures. Selective resurfacing attempts to identify those who are thought to have an improved clinical outcome with patellar resurfacing while avoiding potential complications associated with unnecessary resurfacing.¹¹ Favorable patient selection criteria for patella retention include younger patients (<65 years) with reasonably well-preserved retropatellar cartilage, absence of crystalline/inflammatory disease, central patellar tracking, and use of a patella-friendly femoral component. Kim et al reported a 97.5% survival rate in unresurfaced TKAs at 10 years when these selection criteria were applied. When resurfacing the patella, the surgeon is required to adhere to strict surgical principles to reproduce patellar thickness, preserve patellar blood supply, and achieve appropriate positioning of all implant components, with balanced soft tissue to allow for central patellar tracking.¹² When not resurfacing the patella, the choice of prosthetic design with a patella-friendly femoral component becomes critical to success. We have adopted selective resurfacing in our study if the intraoperative patellar thickness was adequate and favorable after adhering to strict surgical principles to reproduce patellar thickness. The high incidence of AKP in early arthroplasty designs without a patellar component led initially to recommendations for universal patellar resurfacing.¹³ Problems such as patellar maltracking and subluxation, component wear and loosening, patellar fracture, extensor mechanism failure, and AKP have been reported in 4% to 35% of cases. Therefore, selective resurfacing of the patella has been popularized by some clinicians, mainly based on patient's weight, presence of preoperative AKP, and degree of patellar degeneration. The incidence of AKP following TKA shows wide variations, with reported figures of 0 % to 47% in patients with

patellar resurfacing and 0% to 43% in those patients in whom the patella is retained. A significant number of clinical studies have shown that patients undergoing patellar resurfacing are less likely to be affected by AKP and overall are more satisfied. However, it is still controversial whether patients with a nonresurfaced patella really suffer more pain than those who have been resurfaced.¹⁴ It was observed in our study the knee functional scores in both the groups were better at around one year follow up and in the longer follow up the scores in both the groups started to show a similar decline suggesting in the longer follow up it does not make any significant difference in function in either groups. It is simplistic to attribute all AKP to the patella, because various conditions may be responsible for the development of discomfort projected in and around the patellofemoral articulation and patellar maltracking have all been implicated as potential causes of AKP and should be excluded before treatment is initiated.¹⁵ In our study the anterior knee pain at two years seems to be less in the resurfaced group. Predictors for postoperative AKP have been suggested but few, such as obesity and flexion contracture, have been reliably identified. Soudry and coworkers were unable to define a correlation between the degree of cartilage damage and the level of pain or quality of result in patients whose knees had been left unresurfaced.¹⁶ In our study the BMI was similar in resurfaced and non-resurfaced group. It is noted that obesity is definitely prevalent in patients undergoing TKA but there is no difference in AKP in surfaced and non-resurfaced group keeping BMI as a factor. Waters and Bentley assessed 514 knees randomized for patellar resurfacing and found no difference between knees with AKP and those without in regard to age, weight, gender, lateral release, cruciate retention or sacrifice, and whether the knees were affected by osteoarthritis or RA. Despite resurfacing or nonresurfacing of the patella, the prevalence of AKP remains high. Combined with the fact that such pain often fails to respond to secondary resurfacing, it has been suggested that underlying patient, implant, or surgical factors, other than patellar resurfacing, may have a significant impact on the presence of AKP following TKA.¹⁷ Implant design has been shown to have a major effect on patellar kinematics and it is therefore conceivable that such an effect may influence the development of postoperative AKP. Most femoral components are designed to articulate with a designated patellar prosthesis. The number of revisions for pain is higher if the patella is left unresurfaced and involves the insertion of patellar components in up to 10% of cases.¹⁸ In our study though the overall satisfaction scores improved with TKA, but the satisfaction was similar in both the groups. We in our study did not perform any secondary resurfacing procedures.

The frequency of implanting a patellar component varies greatly among countries. Two RCTs found no significant

Table 7: Trend based on chronological order among different investigators

Study Year	TKA Implant Type	Patellar Implant	No of cases NR/RS	Follow-up (Yrs)	Pain %		KSS		Investigators Comments
					NR	RS	NR	RS	
Partio & Wirz (1995)	PFC CR	Modified Dome	50/50	2.5	22	2	169	170	RS Better
Feller et al (1996)	PCA	Offset Dome	20/20	3	-	-	89	86	NR Better
Schroeder Boersch et al (1998)	Duracon	Onlay	20/20	4.8	20	10	150	163	RS Better
Barrack et al (2001)	MG II CR	Modified Dome	60/58	5	17	19	169	162	No Difference
Fengler (2001)	PFC	Dome (Italy)	68/68	1	0	0	147	138	NR Better
Wood et al (2002)	MG II CR	Not Specified	128/92	4	31	16	152	157	RS Better
Waters and Bentley (2003)	PFC CR/PS	Dome	231/243	3	25.1	5.3	162	167	RS Better
Burnett et al (2004)	AMK CR	Dome	48/42	8	25	37	146	145	No Difference
Galdone et al (2005)	NexGen PS	Anatomic	28/28	2	21	0	178	178	RS Better
Myles et al (2006)	LCS RP	Modified Dome	25/25	8	-	-	162	147	No Difference
Campbell et al (2006)	MG II CR	Modified Dome	54/46	10	43	47	136	138	No Difference
Burnett et al (2007)	MG ii CR	Dome (InLay)	32/32	10	17.3	16.5	148	146	No Difference
Smith et al (2008)	Profix	Modified Dome	86/73	4	21	30	163	152	No Difference
Burnett et al (2009)	MG II CR	Modified Dome	60/58	10	16	21	165	146	No Difference
Our Study	Genesis 2 CR		20/20	2	-	-	159	157	No Difference
Totals					21.5	17	157	155	

difference regarding the performance of functional tasks between resurfaced and nonresurfaced patients, whereas two other RCTs showed a trend toward increased pain with stair ascent and descent if the patella was left unresurfaced, although values did not reach statistical significance.¹⁹ We did not find any significant difference in the stair climbing or decent in our patients. A meta-analysis of these studies revealed a total of 239 patients followed up for 2 to 10 years (average, 5.1 years). In all studies, satisfaction was assessed by asking patients which knee they prefer. The resurfaced side was favored by 31% of patients, the nonresurfaced side was favored by 18%, and 51% expressed no preference for either knee.²⁰ In our study we did not find any differences statistically in pain, mobility, alignment, stair climbing, transfers or overall patient satisfaction.

6. Conclusion

We conclude from our study that there is no clear benefit of resurfacing the patella during total knee arthroplasty, as

resurfacing had no significant effect on patient's functional status. There was no significant difference between the two groups with respect to the prevalence of knee-related readmission or of subsequent patella-related surgery, overall satisfaction or quality of life. The anterior knee pain was found to be statistically lesser in the resurfaced group in our study. Selective resurfacing has been suggested as a possible compromise but evidence regarding the validity of selection criteria remains elusive, and the decision when to resurface is often based on intuitive intraoperative reasoning alone. Surgical technique and implant design have been unequivocally identified as major factors in influencing clinical outcome.

7. Source of Funding

None.

8. Conflict of Interest

The authors declare that there is no conflict of interest.

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