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FUNCTION OUTCOME OF PATELLOPALSTY VERSUS PATELLA RESURFACING AFTER TOTAL KNEE REPLACEMENT: A RANDOMIZED NON INFERIOR ACADEMIC TRIAL

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ABSTRACT

Introduction: Knee osteoarthritis (KOA) is a major cause of disability in older adults, and total knee arthroplasty (TKA) remains the most effective treatment for advanced disease. However, anterior knee pain (AKP) following TKA continues to be a significant concern, often attributed to patellofemoral pathology. While resurfacing may reduce early AKP, it carries risks of complications, whereas patelloplasty preserves bone and biomechanics but may predispose to persistent pain. Evidence comparing these techniques remains inconclusive. *Objective-* To compare the functional outcomes of patelloplasty and patellar resurfacing in patients undergoing TKA for advanced KOA. **Materials And Methods:** This prospective, hospital-based observational study was conducted in the Department of Orthopaedics, Dr. S.N. Medical College, Jodhpur, after ethical approval. A total of 72 patients were included, with 36 undergoing patelloplasty and 36 undergoing patellar resurfacing. Baseline demographic and clinical data were collected. Outcomes were assessed using the Knee Society Score (KSS), Knee Society Functional Score (KFS), Visual Analogue Scale (VAS) for pain, and range of motion (ROM). Follow-ups were conducted at 3, 6, 9, and 12 months postoperatively. Statistical analysis was performed using Student's t-test and chi-square test, with significance set at $p<0.05$. **Results:** Both groups were comparable in terms of age and sex. The mean hospital stay was significantly shorter in the resurfacing group (8.97±2.95 vs. 11.64±2.84 days; $p<0.001$). Resurfacing patients had higher KSS at 3 and 6 months, but by 1 year, patelloplasty patients showed significantly better scores (79.56±2.44 vs. 76.44±2.40; $p<0.001$). Functional scores (KFS) were superior in the patelloplasty group from 6 months onward, with the largest difference at 1 year (93.47±2.62 vs. 87.25±3.33; $p<0.001$). ROM was significantly greater in the patelloplasty group from 3 months onward ($p<0.001$). VAS scores showed lower pain in patelloplasty patients at 3 and 6 months, though pain was similar at later follow-ups. **Conclusion:** Patellar resurfacing was associated with shorter hospital stay and early functional improvement, whereas patelloplasty provided superior long-term functional outcomes, greater ROM, and better mid-term pain control. Patelloplasty thus emerges as a viable and potentially preferable alternative for patients undergoing TKA when long-term outcomes are prioritized.

KEYWORDS :

INTRODUCTION

Knee osteoarthritis (KOA) is a leading cause of disability in older adults, with about 11% of individuals over the age of 64 experiencing symptomatic disease.[1] For advanced stages, total knee arthroplasty (TKA) is the most effective treatment, offering pain relief and functional restoration, with long-term survival rates of 90–95% at 15 years.[2]

Although TKA is highly successful, some patients continue to report unsatisfactory outcomes due to anterior knee pain (AKP), which occurs in 4–49% of cases.[3,4] AKP, characterized by pain around or behind the patella, is multifactorial, with contributing factors including prosthesis design, surgical technique, and patient characteristics.[5] The patellofemoral joint is considered central to this problem, and patellar management during TKA remains controversial.

Two main approaches are used: patellar resurfacing and non-resurfacing (patelloplasty). Patellar resurfacing (PR), introduced by Insall-Burstein in 1975, involves replacing the articular surface with a prosthetic component to restore thickness and congruence.[6] Advocates suggest it lowers AKP and reoperation rates[7], but complications such as fracture, loosening, polyethylene wear, and extensor mechanism failure have been reported.[8,9] Errors in restoring patellar thickness may further contribute to failure.[10]

Patelloplasty, on the other hand, preserves the native patella, typically including osteophyte removal and circumpatellar denervation with electrocautery.[11] This technique maintains biomechanics, preserves bone, and avoids prosthesis-related complications, making it more suitable for younger or more active patients. Favorable conditions for non-resurfacing include preserved cartilage, congruent tracking, and insufficient bone stock for resurfacing.[12,13]

The evidence comparing these two approaches is conflicting. Nizard et al[14], in a meta-analysis of 12 randomized controlled trials, found resurfacing reduced reoperations for AKP but showed no difference in Knee Society or Hospital for Special Surgery scores. Similarly, Parvizi et al[15] reported more AKP and secondary resurfacing in non-resurfaced patients (8.7%) but no differences in functional outcomes. Fu et al[16] further suggested patelloplasty may be preferred in the absence of inflammatory synovitis and with preserved bone and cartilage, while resurfacing should be avoided in small or eroded patellae, obesity, and highly active young patients.

Overall, resurfacing may reduce postoperative AKP but introduces risks of implant-related complications, while patelloplasty avoids these risks but may predispose to residual pain and later revision. Despite many studies, there is no consensus on the superior method, and most focus on

reoperation or pain rather than functional outcomes such as Knee Society Functional Scores, range of motion, and pain levels.

The present randomized trial aims to compare the functional outcomes of patelloplasty and patellar resurfacing in patients undergoing TKA for advanced KOA. By evaluating objective parameters of function, mobility, and pain, this study seeks to determine whether patelloplasty can provide results comparable to resurfacing while reducing the risk of prosthesis-related complications.

MATERIALS AND METHODS

This prospective, hospital-based observational study was conducted in the Department of Orthopaedics, Dr. S.N. Medical College and Attached Hospital, Jodhpur, after obtaining approval from the Institutional Ethical Committee. The study aimed to compare the functional outcomes of patelloplasty and patellar resurfacing following total knee replacement (TKR). The total study duration was 18 months, which included 12 months for data collection and 6 months for data analysis.

A sample size of 32 patients in each group was calculated at 95% confidence and 80% power based on the expected difference in mean Knee Society Scores (KSS) reported in previous studies. Considering a 10% loss to follow-up, the final sample size was increased to 36 patients per group, giving a total of 72 patients, of whom 36 underwent patellar resurfacing and 36 underwent patelloplasty. Patients aged between 18 and 80 years with knee osteoarthritis, rheumatoid arthritis, tubercular arthritis, idiopathic arthritis, or post-traumatic arthritis and scheduled for TKR were included after providing written informed consent. Patients with a history of previous patella surgery, patella fracture, high tibial osteotomy, or revision TKR were excluded.

Data collection was carried out using a structured Case Record Form (CRF). Baseline information included demographic profile, diagnosis, symptom duration, comorbidities, and any prior interventions. Preoperative assessment included measurement of Knee Society Score (KSS), Visual Analog Scale (VAS) for pain, knee range of motion (ROM), and radiographic evaluation. Postoperative follow-up assessments were conducted at 3, 6, 9, and 12 months and included KSS, VAS, ROM, and monitoring of complications such as anterior knee pain, patellar maltracking, infection, instability, or reoperation.

All patients underwent TKR under spinal or combined spinal-epidural anesthesia. Standard preoperative prophylaxis with antibiotics was administered, and a tourniquet was applied to minimize intraoperative blood loss. A midline incision with medial parapatellar arthrotomy was performed to expose the joint. In the patellar resurfacing group, the articular surface of the patella was resected with a cutting guide, and a polyethylene patellar component was fixed with polymethyl methacrylate bone cement. Tracking was assessed throughout the range of motion, and a lateral release was performed when necessary. In the patelloplasty group, the native patella was preserved, osteophytes and damaged cartilage were excised, and the articular surface was smoothened. Circumpatellar denervation with electrocautery was also performed, and tracking was evaluated intraoperatively. In both groups, femoral and tibial cuts were performed with alignment guides, trial components were used to confirm balance and stability, and final implants were cemented in place. After confirming patellar tracking and range of motion, the joint was irrigated and closed over a suction drain, followed by early mobilization with physiotherapy starting on the first postoperative day as per institutional protocol.

The Knee Society Score (KSS) and Knee Society Function Score were the primary outcome measures. The KSS assessed pain, stability, range of motion, and alignment of the operated knee, while the Function Score assessed walking distance and stair climbing ability, with deductions for the use of walking aids. Each was scored out of 100, providing a comprehensive measure of both anatomical and functional outcomes. In addition, the Visual Analog Scale (VAS) was used to assess subjective pain perception, scored from 0 (no pain) to 10 (worst imaginable pain), and the range of motion was measured using a goniometer from full extension to maximum flexion. All these parameters were recorded preoperatively and at each follow-up visit, enabling an objective comparison of functional outcomes between the two groups.

Statistical Analysis

The collected data was entered into a Microsoft Excel sheet by the investigator on the same day to minimize any potential data entry bias. Continuous or quantitative data were summarized using mean and standard deviation. The difference between two means was assessed using Student's t-test. Discrete or qualitative data were presented as proportions, and the significance of differences in proportions was evaluated using the chi-square test. A 95% confidence level was maintained for all statistical analyses.

RESULTS

[Table 1] Most patients in both groups were aged 60–69 years. Females were slightly more common in both groups. Hospital stay was longer in patelloplasty patients, with most staying 8–14 days, while a higher proportion of resurfacing patients were discharged within 3–7 days. Age and sex distribution were similar between the two groups ($p>0.05$). A significant difference was seen in hospital stay ($p<0.001$), with resurfacing patients having shorter stays.

Table 1- Distribution Of Patients According To Age Group, Sex, And Hospital Stay

Variable		Patello Plasty (n=36)	Patella Resurfacing (n=36)	Test of significance
Age group (Years)	40-49	4(11.1)	1(2.8)	X2 =2.694, Df=1, p value=0.600
	50-59	10(27.8)	11(30.6)	
	60-69	18(50)	17(47.2)	
	70-80	4(11.1)	7(19.4)	
Sex	Female	22(61.1)	20(55.6)	X2 =0.229, Df=1, p value=0.633
	Male	14(38.9)	16(44.4)	
Hospital Stay (Days)	3-7 days	2(5.6)	15(41.7)	X2 =14.846, Df=2, p value<0.001
	8-14 days	28(77.8)	20(55.6)	
	≥15 days	6(16.7)	1(2.8)	

[Table 2] The mean age was 60.28±7.96 years in the patelloplasty group and 62.94±6.92 years in the resurfacing group. The mean hospital stay was 11.64±2.84 days for patelloplasty versus 8.97±2.95 days for resurfacing. Hospital stay was significantly shorter in resurfacing patients compared to patelloplasty patients ($p<0.001$).

Table 2- Comparison Of Mean Age And Mean Duration Of Hospital Stay Between The Two Groups

Variable	Patello Plasty (n=36)	Patella Resurfacing (n=36)	Test of significance
Age (Years)	60.28±7.96	62.94±6.92	t=1.517, p=0.134
Hospital Stay (Days)	11.64±2.84	8.97±2.95	t=3.96, p<0.001

[Table 3] Preoperative KSS was similar between groups ($p=0.649$). At 3 and 6 months, resurfacing patients had higher scores ($p<0.05$), but by 9 months there was no significant difference ($p=0.210$). At 1 year, patelloplasty patients had

significantly higher KSS (79.56±2.44 vs. 76.44±2.40; p<0.001). Functional scores were comparable preoperatively and at 3 months, but patelloplasty patients showed significantly better outcomes at 6, 9, and 12 months, most notably at 1 year (93.47±2.62 vs. 87.25±3.33; p<0.001).

Table 3- Comparison Of Mean KSS And KSS Function Between Both Study Groups At Different Time Intervals

Variable		Patello Plasty	Patella Resurfacing	Test of significance	p value
KSS	Pre-operative	44.64±3.21	44.97±2.98	0.457	0.649
	3 months	65.83±2.26	67.86±2.11	3.931	<0.001
	6 months	73.03±1.7	74.44±2.93	2.509	0.014
	9 months	76.78±1.96	76.08±2.64	1.266	0.21
	1 year	79.56±2.44	76.44±2.4	5.455	<0.001
KSS function	Pre-operative	45±6.55	47.08±6.59	1.346	0.183
	3 months	76.25±5.4	77.92±4.2	1.462	0.148
	6 months	85.28±3.77	82.64±3.87	2.931	0.005
	9 months	90.28±3.95	86.94±3.5	3.789	<0.001
	1 year	93.47±2.62	87.25±3.33	8.801	<0.001

[Table 4] In this study, there was no statistically significant difference in the preoperative range of motion (ROM) between both study groups (p=0.274). However, from the 3-months, patients who underwent patelloplasty consistently demonstrated significantly greater ROM as compared to those who underwent patellar resurfacing (p<0.001).

Table 4- Comparison Of Mean ROM Between Both Study Groups At Different Time Intervals

ROM	Patello Plasty	Patella Resurfacing	Test of significance	p value
Pre-operative	93.72±3.11	92.86±3.51	1.102	0.274
3 months	130.67±1.88	122.72±2.02	17.251	<0.001
6 months	130.97±1.63	123.5±1.87	18.048	<0.001
9 months	130.97±1.63	123.97±1.72	17.751	<0.001
1 year	131.08±1.56	124.47±1.54	18.12	<0.001

[Table 5] In the present study, the preoperative Visual Analogue Scale (VAS) pain scores were comparable between the two groups (p=0.660), indicating that both groups started at a similar baseline level of pain. At the 3-month follow-up, patients in the patelloplasty group had significantly lower pain scores compared to those in the resurfacing group (2.58±0.5 vs. 2.92±0.73; p=0.027). This difference continued at 6 months, where the patelloplasty group again reported significantly lower VAS scores (2.36±0.49 vs. 2.00; p<0.001). By the 9-month and 1-year follow-up visits, however, the pain scores were found to be equal in both groups, suggesting similar long-term pain outcomes.

Table 5- Comparison Of Mean VAS Score Between Both Study Groups At Different Time Intervals

VAS	Patello Plasty	Patella Resurfacing	Test of significance	p value
Pre-operative	4.94±0.83	5.03±0.77	0.442	0.660
3 months	2.58±0.5	2.92±0.73	2.256	0.027
6 months	2.36±0.49	2	4.448	<0.001
9 months	2	2	-	-
1 year	2	2	-	-

DISCUSSION

In the present study, both groups were comparable in baseline demographics such as age and sex distribution. This confirm that both groups were demographically comparable, thereby ensuring that subsequent differences in clinical outcomes were attributable to the intervention rather than confounding baseline variables.

Duration Of Hospital Stay

A statistically significant difference was observed in the duration of hospital stay. A greater proportion of patients in the Patellar Resurfacing group were discharged within 3–7 days (41.7% vs. 5.6%), while most patients in the Patelloplasty group required 8–14 days of hospitalization (77.8% vs. 55.6%). The mean hospital stay was also shorter in the resurfacing group (8.97±2.95 days) compared to the patelloplasty group (11.64±2.84 days; p<0.05). This difference may be related to reduced postoperative anterior knee pain and smoother articulation in resurfaced patellae, facilitating earlier mobilization and discharge. In contrast, patelloplasty, which involves reshaping and denervation of the native patella, might contribute to greater immediate postoperative inflammation and slower adaptation during mobilization.

Knee Society Score (KSS) and Knee Society Functional Score (KFS)

Preoperatively, both groups had statistically comparable KSS (p=0.649), indicating similar baseline function. At 3 and 6 months postoperatively, patients in the Patellar Resurfacing group demonstrated significantly higher KSS values, suggesting better early recovery. However, by 9 months, this difference disappeared (p=0.210), and at 1 year, the Patelloplasty group showed significantly higher scores (79.56±2.44 vs. 76.44±2.40; p<0.001). These results suggest that resurfacing may offer short-term advantages, but patelloplasty leads to superior long-term knee function. Our findings are partly consistent with Haider MI et al[17], who observed improvement in KSS after TKR irrespective of resurfacing, though they did not report intergroup differences. Similarly, Jung Ho Noh et al[18] and De Padua VB et al[19] also found no significant difference in KSS outcomes between groups. The difference of our results, showing long-term superiority of patelloplasty, adds new evidence to this debate and highlights the importance of extended follow-up in outcome assessment.

Both groups were comparable in Knee Society Functional Score (KFS) (p>0.05). From 6 months onward, however, the Patelloplasty group consistently demonstrated significantly higher functional scores, with the greatest difference observed at 1 year (93.47±2.62 vs. 87.25±3.33; p<0.001). These results indicate that patelloplasty provides more sustained functional improvement in daily activities such as walking and stair climbing.

Balaji S et al[20] also reported progressive improvement in both KSS and KFS after patelloplasty, findings that closely align with our results. Conversely, Usman MA et al[21], in their meta-analysis, noted superior functional scores in resurfacing patients in some populations, while Park et al[22] also favored resurfacing for functional recovery. These conflicting findings in the literature suggest that factors such as patient characteristics, surgical technique, and prosthetic design may influence outcomes. Our results, however, strongly support the long-term functional benefits of patelloplasty.

Range of Motion (ROM)

In this study, preoperative ROM was similar between the groups (p=0.274). From the 3-month follow-up onward, however, the Patelloplasty group consistently achieved significantly greater ROM, and this advantage persisted through 1 year (p<0.001). This finding indicates that patelloplasty provides superior restoration of knee flexibility and mobility.

Our results align with those of Migliorini et al[23], who reported better ROM in non-resurfacing TKA patients. On the other hand, Shahbaz Siddiqui et al[24] and De Padua VB et al[19] found no significant differences in ROM, though their results trended

similarly. Subramanian M et al[25] also demonstrated that preoperative knee flexion strongly influences postoperative ROM, supporting the importance of baseline mobility as a predictor of outcomes.

Visual Analogue Scale (VAS) for Pain

Preoperatively, pain levels were similar in both groups (p=0.660). At 3 and 6 months, the Patelloplasty group reported significantly lower pain scores, suggesting better short- to mid-term pain control. However, by 9 months and 1 year, pain levels were comparable. This indicates that the initial analgesic advantage of patelloplasty does not persist long-term, though it may facilitate better rehabilitation during the early postoperative period.

Pain outcomes reported in the literature remain variable. Siddiqui et al[24] found significantly better VAS scores with resurfacing at 24 months, while Deekshith et al[26] reported lower pain scores in patients who underwent denervation compared to non-denervation. Usman MA et al[21], however, found no significant difference in VAS scores between resurfacing and non-resurfacing. Long-term studies by Li et al[27], Smith et al[28], and Barrack et al[29] also demonstrated no consistent superiority of resurfacing, supporting our conclusion that long-term pain outcomes are similar regardless of patellar management technique.

This prospective study used standardized outcome tools (KSS, VAS, ROM) with multiple follow-up intervals up to one year, ensuring a structured and balanced comparison between patelloplasty and patellar resurfacing. The relatively small, single-center sample and one-year follow-up limit generalizability and long-term assessment. Future multicentric randomized trials with longer follow-up, inclusion of PROMs, and cost-effectiveness analysis are recommended to strengthen evidence and guide clinical decision-making.

CONCLUSION

In this study, both groups were comparable in baseline demographic variables such as age and sex. The duration of hospital stay was significantly shorter in the patellar resurfacing group, indicating faster early recovery.

Functional outcomes assessed by the Knee Society Score (KSS) showed that resurfacing provided better results at 3 and 6 months, but this advantage diminished over time. By 1 year, the patelloplasty group had significantly higher KSS, reflecting superior long-term recovery. Similarly, the Knee Society Functional Score was comparable initially, but from 6 months onward, patelloplasty demonstrated consistently better results, most notably at 1 year.

Range of motion (ROM) was significantly greater in the patelloplasty group from the 3-month follow-up onwards and remained superior throughout. Pain assessment using the Visual Analogue Scale (VAS) showed that patelloplasty patients experienced less pain at 3 and 6 months, though by 9 months and 1 year pain scores were similar in both groups.

Overall, while patellar resurfacing offered shorter hospital stay and early functional improvement, patelloplasty provided better long-term functional outcomes, greater ROM, and lower intermediate pain levels, making it a preferable alternative in selected patients undergoing TKR.

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