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Research Article

Selective Patellar Resurfacing in Total Knee Arthroplasty: A 10-Year Retrospective Cohort Study of Outcomes and Risk Factors

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Abstract

The necessity of patellar resurfacing in Total Knee Arthroplasty (TKA) remains controversial. This study compared outcomes between resurfaced and non-resurfaced patients to identify subgroups that benefit most from the procedure.

A retrospective analysis of 625 patients undergoing PCL-sacrificing TKA (2012-2023) was conducted. Patients were categorized into non-resurfaced (n=469, 75%) and resurfaced (n=156, 25%) cohorts. Resurfacing was selectively performed for patients with rheumatoid arthritis (RA), severe patellofemoral degeneration, obesity, or prior patellar fractures. Outcomes included functional scores (KSS, WOMAC), pain (VAS), and patient satisfaction (measured via a standardized survey).The resurfaced group was significantly older and had higher rates of secondary osteoarthritis, RA, osteoporosis, and prior contralateral knee surgery. Postoperatively, the resurfaced group demonstrated a significant reduction in crepitation. However, there were no significant differences in pain scores (VAS, WOMAC) or patient satisfaction levels between the two groups.

Conclusion: Patellar resurfacing in TKA improves patellofemoral mechanics in high-risk subgroups (those with RA, secondary OA, osteoporosis, or prior surgery). While it did not confer superior pain relief or satisfaction compared to non-resurfacing, selective resurfacing based on these specific risk factors is supported to optimize biomechanical outcomes. A tailored approach, guided by patient-specific factors and intraoperative findings, is recommended.

ABBREVIATIONS

FKSS: Functional Knee Society Score; KSS: Knee Society Score; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; VAS: Visual Analog Scale (Pain: 0–10); Preop: Preoperative;| Postop: Postoperative; Sig.*: Independent Samples T-test (between-group differences); Sig.# : ANOVA (within-group changes over time)

INTRODUCTION

Total knee arthroplasty is a highly successful procedure with growing adoption, yet some controversies persist—including the question of patellar replacement [1,2]. While patellar resurfacing has received less dedicated research attention than TKA as a whole, it plays a critical role in improving functionality and quality of life in specific patient populations [3,4]. The decision of whether to perform patellar resurfacing during Total Knee Arthroplasty (TKA) remains a subject of debate among orthopedic surgeons [5,6]. While some advocate for routine resurfacing to reduce postoperative anterior knee pain and improve functional outcomes [7,8], others prefer selective or non-resurfacing approaches, citing potential complications such as patellar fractures, implant loosening, or overstuffing of the patellofemoral joint [9,10]. However, existing studies lack consensus on which patient subgroups (e.g., Rheumatoid Arthritis [RA], osteoporosis, or severe patellofemoral damage) benefit most from resurfacing, highlighting the need for evidence tailored to individualized decision-making [10,11].

To address this gap, this study aimed to identify specific patient subgroups that derive the greatest benefit from patellar resurfacing by comparing demographic, clinical,

and surgical outcomes between resurfaced and non-resurfaced cohorts in a large, single-center population. We hypothesized that patients with specific risk factors—including rheumatoid arthritis, secondary osteoarthritis, osteoporosis, or a history of prior contralateral knee surgery—would demonstrate superior patellofemoral mechanics and functional outcomes following patellar resurfacing compared to those without resurfacing. To test this hypothesis, we compared the clinical and demographic characteristics of patients who underwent patellar resurfacing during TKA with those who did not over a 10-year period. By analyzing these variables, this study seeks to provide actionable insights for surgical planning and refine evidence-based indications for this procedure [8,12].

METHODS

This retrospective study analyzed data from 625 patients who underwent posterior cruciate ligament (PCL)-sacrificing Total Knee Arthroplasty (TKA) between 2012 and 2023 at the Department of General Orthopedics 3, Orthopedic Institute Hospital "Banjica," with a follow-up period of 10 years [13-15]. The patients were divided into two groups: 469 patients (75%) who did not undergo patellar resurfacing with a polyethylene patellar button during TKA and 156 patients (25%) who did [16,17]. The 75%/25% split reflected patient-specific factors, including the presence of Rheumatoid Arthritis (RA), severe patellofemoral degeneration, obesity, or prior patellar fractures, as detailed below.

Clinical and demographic variables were collected for each patient, including gender, age, cause of osteoarthritis (primary or secondary) [18,19], and previous surgeries on the contralateral knee or other joints [20]. All implants were cemented, and patellar components (when used) were dome-shaped. Functional outcomes were assessed using the Kujala Score, Functional Knee Society Score (FKSS), Knee Society Score (KSS), and WOMAC, while pain was measured via Visual Analog Scale (VAS).

The study assessed these variables using chi-square tests for categorical data and t-tests for continuous data, with statistical significance set at $p < 0.05$ [21,22]. Patients were also evaluated for comorbidities such as hypertension (HTA) [23], diabetes mellitus (DM) [24], rheumatoid arthritis (RA) [25,26], and osteoporosis [27], among others, to identify any potential association between these conditions and the likelihood of undergoing patellar resurfacing.

In our practice, the decision to perform patellar resurfacing was influenced by specific clinical criteria. For patients with rheumatoid arthritis (RA), patellar resurfacing was routinely performed due to the potential impact of residual cartilage on the synovium, which could contribute to chronic synovitis and pannus formation [28-30]. In patients with degenerative joint disease, patellar resurfacing was indicated in cases of significant patellofemoral arthritis, characterized by complete cartilage loss, eburnated bone, and severe anterior knee pain [31-33]. Additionally, patellar resurfacing was performed in obese patients [34,35] and those with a history of patellar fractures [36,37]. These criteria guided our surgical approach and were consistently applied throughout the study period [38].

A complete statistical analysis was performed using the IBM SPSS software, version 26.0. The Kolmogorov-Smirnov test was used to assess the normality of the distribution for numerical data. Numerical data are presented as mean values with standard deviation. The significance of differences in continuous variables was tested using parametric tests: The Independent Samples t-test and Paired Samples t-test for comparisons between two groups, and ANOVA for comparisons involving three or more measurements, with Bonferroni correction and Tukey's HSD post-hoc test applied as needed. Categorical data are presented as absolute and relative frequencies, and the significance of differences between subgroups was assessed using the Chi-square test. This analysis ensured rigorous statistical evaluation of the data, accounting for both continuous and categorical variables while maintaining appropriate corrections for multiple comparisons.

RESULTS

Patient Demographics: Of the total 625 patients, 469 (75%) did not undergo patellar replacement surgery, and 156 (25%) did. The gender distribution was slightly skewed, with 96 (20.5%) men and 373 (79.5%) women in the non-replacement group, and 26 (16.7%) men and 130 (83.3%) women in the replacement group. Gender did not show a statistically significant difference ($p = 0.357$). The mean age of patients who did not undergo patellar replacement was 66.30 ± 7.33 years, while the mean age for those who underwent the procedure was 67.89 ± 9.84 years ($p = 0.033$).

Cause of Osteoarthritis: A significant difference was observed between the groups in terms of the cause of osteoarthritis. Of the patients who did not undergo patellar replacement, 91.7% had primary OA, and 8.3% had secondary OA. In contrast, 75% of those who underwent patellar replacement had primary OA, while 25% had

secondary OA ($p < 0.001$). This suggests that secondary OA is a more common cause for undergoing patellar replacement surgery.

Second Knee Surgery: A higher percentage of patients who underwent patellar replacement had previously undergone surgery on the contralateral knee. Specifically, 32.1% of patients who had patellar replacement had surgery on the second knee, compared to 22.2% of patients who did not undergo patellar replacement ($p = 0.018$). This finding indicates a higher likelihood of bilateral knee involvement in patients requiring patellar replacement.

Comorbidities: Among the most common comorbidities, hypertension (HTA) was observed in 55.4% of patients who did not undergo patellar replacement compared to 44.9% in the replacement group ($p = 0.028$). Additionally, rheumatoid arthritis (RA) was significantly more prevalent in the group undergoing patellar replacement (14.1%) compared to the non-replacement group (5.1%) ($p < 0.001$). The presence of osteoporosis was also more common in the replacement group (6.4% vs. 1.7%, $p = 0.006$).

Clinical Outcomes: When analyzing pain levels before and after surgery using the Visual Analog Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), no significant differences were observed between the two groups (Table 1). However, a significant reduction in pain was demonstrated within each of the analyzed groups. Patients who underwent patellar resurfacing showed significantly less postoperative crepitation compared to the non-resurfaced group ($p < 0.05$), suggesting improved patellofemoral joint mechanics. Regarding satisfaction levels, no significant differences were found between the two surgical approaches.

Table 1. Differences in pain intensity and satisfaction with surgery

Parameter	No Patellar Resurfacing	Patellar Resurfacing	p-value*
Preoperative VAS pain	10.00 ± 0.00	10.00 ± 0.00	/
Postoperative VAS pain	1.60 ± 0.61	1.66 ± 0.62	0.313
p-value #	<0.001	<0.001	
Satisfaction score	9.67 ± 0.47	9.66 ± 0.50	0.798

*Independent Samples Test; #Paired Samples Test

	Without Patellar Replacement	With Patellar Replacement	Sig. (p-value)
Number of patients	469 (75.0%)	156 (25.0%)	
Gender: Male / Female	96 (20.5%) / 373 (79.5%)	26 (16.7%) / 130 (83.3%)	0.357*
Age (years)	66.30 ± 7.33	67.89 ± 9.84	0.033#
Cause: Primary / Secondary Osteoarthritis	430 (91.7%) / 39 (8.3%)	117 (75.0%) / 39 (25.0%)	<0.001*
Surgery on other knee: No / Yes	365 (77.8%) / 104 (22.2%)	106 (67.9%) / 50 (32.1%)	0.018*
Surgery on other joint: No / Yes	425 (90.6%) / 44 (9.4%)	142 (91.0%) / 14 (9.0%)	1.000*

*- Chi-square test; #- Independent Samples Test

Comorbidities

	Without Patellar Replacement	With Patellar Replacement	Sig. (p-value)
No comorbidities	67 (14.3%)	9 (5.8%)	0.007
Hypertension	260 (55.4%)	70 (44.9%)	0.028
Diabetes Mellitus	72 (15.4%)	23 (14.7%)	0.956
Cerebrovascular Disease	14 (3.0%)	2 (1.3%)	0.382
Chronic Obstructive Pulmonary Disease	22 (4.7%)	12 (7.7%)	0.219
Anemia	9 (1.9%)	3 (1.9%)	1.000
Angina Pectoris	5 (1.1%)	1 (0.6%)	1.000
Arrhythmias	38 (8.1%)	7 (4.5%)	0.182
Asthma	11 (2.3%)	8 (5.1%)	0.138
Rheumatoid Arthritis	24 (5.1%)	22 (14.1%)	<0.001
Breast Cancer	35 (7.5%)	26 (16.7%)	0.001
Hypothyroidism	36 (7.7%)	12 (7.7%)	1.000
Gastritis	10 (2.1%)	4 (2.6%)	0.997
Myocardial Infarction	11 (2.3%)	2 (1.3%)	0.630
Benign Prostatic Hyperplasia	3 (0.6%)	1 (0.6%)	1.000
Nodular Goiter	/	2 (1.3%)	0.101
Osteoporosis	8 (1.7%)	10 (6.4%)	0.006
Lupus	1 (0.2%)	/	1.000
Thrombosis	2 (0.4%)	/	1.000
Thrombocytopenia	1 (0.2%)	/	1.000
Sjögren's Syndrome	1 (0.2%)	/	1.000
Non-Hodgkin's Lymphoma	1 (0.2%)	/	1.000
Heart Defects	5 (1.1%)	2 (1.3%)	1.000
Arthralgia	22 (4.7%)	8 (5.1%)	0.996
Back Pain	15 (3.2%)	3 (1.9%)	0.583
Kidney Cancer	1 (0.2%)	/	1.000
Cerebrovascular disease	5 (1.1%)	3 (1.9%)	0.679
Depression	8 (1.7%)	1 (0.6%)	0.563
Bronchitis	2 (0.4%)	/	1.000
Epilepsy	2 (0.4%)	1 (0.6%)	1.000
Hyperthyroidism	1 (0.2%)	1 (0.6%)	0.999
Tuberculosis	/	1 (0.6%)	0.563
Parkinson's Disease	1 (0.2%)	1 (0.6%)	0.999
Glaucoma	1 (0.2%)	2 (1.3%)	0.315
Hashimoto's Thyroiditis	1 (0.2%)	/	1.000
Dementia	1 (0.2%)	/	1.000
Lung Cancer	1 (0.2%)	/	1.000
Colon Cancer	1 (0.2%)	/	1.000
Hiatal Hernia	1 (0.2%)	/	1.000
Gout	2 (0.4%)	/	1.000
Leukopenia	1 (0.2%)	/	1.000

*- Chi-square test; Cumulative percentages

Notes:
- **Sig.** = Significance (p-value)
- # = Independent Samples Test (likely t-test for age comparison)

/ = No cases reported

DISCUSSION

Patellar resurfacing during Total Knee Arthroplasty

Clinical Outcomes Comparison: Without Patellar Replacement vs. With Patellar Replacement

Parameter	Without Patellar Replacement	With Patellar Replacement	Sig. (p-value)
Kujala Score	87.57 ± 2.84	85.47 ± 3.03	<0.001*
FKSS (Preop)	27.74 ± 7.58	24.17 ± 9.14	<0.001*
FKSS (1 Year Postop)	76.98 ± 3.96	73.81 ± 5.57	<0.001*
FKSS (10 Years Postop)	71.98 ± 3.96	68.81 ± 5.57	<0.001*
Sig.# (Time Effect)	<0.001	<0.001	
KSS (Preop)	23.99 ± 7.21	20.98 ± 8.44	<0.001*
KSS (1 Year Postop)	94.73 ± 2.67	93.31 ± 3.29	<0.001*
KSS (10 Years Postop)	92.60 ± 2.69	91.12 ± 3.31	<0.001*
Sig.# (Time Effect)	<0.001	<0.001	
WOMAC (Preop)	25.96 ± 7.17	23.08 ± 7.91	<0.001*
WOMAC (1 Year Postop)	88.22 ± 3.04	86.32 ± 3.10	<0.001*
WOMAC (10 Years Postop)	86.42 ± 3.09	84.86 ± 3.16	<0.001*
Sig.# (Time Effect)	<0.001	<0.001	
VAS Pain (Preop)	10.00 ± 0.00	10.00 ± 0.00	1.000
VAS Pain (Postop)	1.60 ± 0.61	1.66 ± 0.62	0.313
Satisfaction Score	9.67 ± 0.47	9.66 ± 0.50	0.798

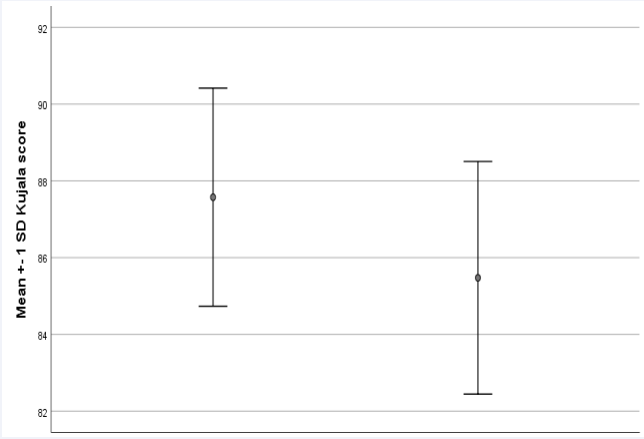

Figure 1

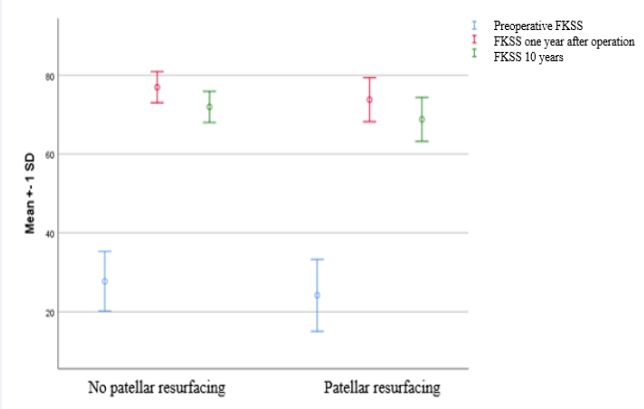

Figure 2

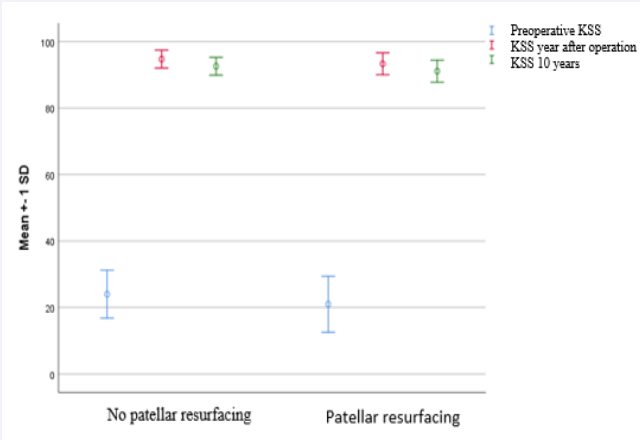

Figure 3

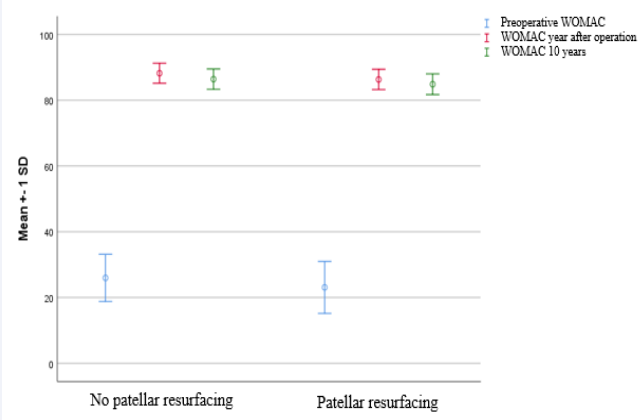

Figure 4

(TKA) remains one of the most debated topics in orthopedic surgery [3-39]. The decision to resurface or not to resurface the patella is influenced by a variety of factors, including patient demographics, underlying pathology, surgeon preference, and the potential for postoperative complications [6-41]. This discussion will explore the general principles of patellar resurfacing in TKA, followed by an analysis of the results presented in this study, which compare outcomes between patients who underwent TKA with and without patellar resurfacing. The findings will be contextualized within the broader literature to provide a comprehensive understanding of the implications of patellar resurfacing [42].

The patellofemoral joint is a critical component of knee biomechanics, contributing to knee extension, stability, and overall function [3-43]. During TKA, the management of the patella - whether to resurface it or leave it unsurfaced - has significant implications for postoperative outcomes, including anterior knee pain, patellar tracking, and the need for revision surgery [44,45].

The indication for patellar resurfacing is typically considered in patients with significant patellofemoral arthritis, patellar maltracking, or those with a history of anterior knee pain [46]. Resurfacing involves removing the articular cartilage of the patella and replacing it with a prosthetic component, which aims to improve patellar tracking and reduce pain [46,47]. However, the procedure is not without risks, including patellar fracture, implant loosening, and increased surgical complexity [48].

The controversy surrounding patellar resurfacing in TKA stems from conflicting evidence regarding its benefits and risks [49], with some studies demonstrating reduced anterior knee pain and revision rates when resurfacing is performed, while others suggest the potential complications may outweigh these advantages, particularly in cases with minimal patellofemoral involvement [50]. This divergence in outcomes has led to persistent debate within the orthopedic community, further complicated by the influence of patient-specific factors such as age, activity level, and comorbidities on surgical decision-making [17]. The results of this study provide valuable insights into the characteristics and outcomes of patients who underwent TKA with and without patellar resurfacing. The analysis of 469 patients without patellar resurfacing (75.0%) and 156 patients with patellar resurfacing (25.0%) reveals several important findings.

The study population was predominantly female, with women comprising 79.5% of the non-resurfaced group and 83.3% of the resurfaced group. This is consistent with the general trend in TKA populations. The mean age of patients in the resurfaced group was slightly higher (67.89 ± 9.84 years) compared to the non-resurfaced group (66.30 ± 7.33 years), with a statistically significant difference ($p = 0.033$). This suggests that older patients may be more likely to receive patellar resurfacing, possibly due to concerns about patellar wear or instability in older individuals with longer-standing arthritis.

The primary indication for surgery in both groups was osteoarthritis, with 91.7% of the non-resurfaced group and 75.0% of the resurfaced group undergoing TKA for primary osteoarthritis. However, the resurfaced group had a significantly higher proportion of patients with secondary osteoarthritis (25.0% vs. 8.3%, $p < 0.001$). This finding may indicate that surgeons are more likely to resurface the patella in cases of secondary osteoarthritis, where the patellofemoral joint may be more severely affected. Additionally, the resurfaced group had a higher rate of prior surgery on the contralateral knee (32.1% vs. 22.2%, $p = 0.018$), suggesting that patients with a history of knee surgery may be more likely to undergo patellar resurfacing, possibly due to prior complications or persistent symptoms related to the patellofemoral joint.

The comorbidity profiles of the two groups revealed several significant differences. Patients in the resurfaced group had a lower prevalence of hypertension (HTA) (44.9% vs. 55.4%, $p = 0.028$) and a higher prevalence of rheumatoid arthritis (RA) (14.1% vs. 5.1%, $p < 0.001$). The higher prevalence of RA in the resurfaced group is particularly noteworthy, as rheumatoid arthritis is known to affect the patellofemoral joint more severely than osteoarthritis. This may explain why surgeons are more likely to resurface the patella in these patients, as the inflammatory nature of RA can lead to greater cartilage degradation and patellar instability. A higher prevalence of osteoporosis was also observed in the resurfaced group (6.4% vs. 1.7%, $p = 0.006$). Osteoporosis can affect the integrity of the patellar bone, making it more susceptible to fractures or complications if left unresurfaced. This may explain why surgeons are more likely to resurface the patella in patients with osteoporosis, as resurfacing may provide additional stability and reduce the risk of patellar fractures.

The decision to resurface the patella during TKA remains a topic of debate in the orthopedic community [17]. Proponents of patellar resurfacing argue that it reduces the risk of anterior knee pain, improves patellar tracking, and decreases the need for revision surgery [3]. Opponents, however, point to the potential complications associated with resurfacing, such as patellar fractures, implant loosening, and increased surgical time [3-45].

The results of this study suggest that the outcomes of TKA with and without patellar resurfacing are similar in many respects. For example, there were no significant differences between the two groups in terms of other comorbidities such as diabetes mellitus (DM) or chronic obstructive pulmonary disease (COPD). This indicates that the presence of these comorbidities does not appear to influence the decision to resurface the patella, nor do they significantly affect the outcomes of TKA in either group.

However, the higher prevalence of RA and osteoporosis in the resurfaced group suggests that these conditions may play a role in the decision-making process [6-18]. Patients with RA or osteoporosis may benefit more from patellar resurfacing due to the increased risk of patellofemoral complications in these populations [17,18]. Additionally, the higher rate of prior contralateral knee surgery in the resurfaced group may indicate that these patients have a higher likelihood of experiencing patellofemoral issues, prompting surgeons to resurface the patella to prevent recurrent problems.

Limitations of the Study

While this study offers valuable insights into the characteristics and outcomes of patients undergoing total knee arthroplasty (TKA) with and without patellar resurfacing, it is important to acknowledge its limitations. Firstly, the retrospective design of the study restricts the ability to establish definitive causal relationships between patellar resurfacing and clinical outcomes. Secondly, the sample size of the resurfaced group (n = 156) is notably smaller compared to the non-resurfaced group (n = 469), potentially impacting the statistical power and generalizability of the findings. Additionally, a significant limitation of our study is that all procedures were conducted within a single hospital and a single department. This may introduce bias and limit the external validity of the results, as the outcomes may not be representative of practices or patient populations in other settings. Future multicenter studies with larger, more balanced cohorts and extended follow-up periods are needed to further validate these findings.

CONCLUSION

In summary, the prevailing evidence supports a deliberate and selective strategy for patellar resurfacing in total knee arthroplasty (TKA). Based on our clinical outcomes, we strongly advocate for resurfacing in identified high-risk patient cohorts. This includes patients with inflammatory arthropathies such as rheumatoid arthritis, those with secondary osteoarthritis, individuals diagnosed with osteoporosis, and patients with a history of prior knee surgery. In these groups, patellar resurfacing demonstrably improves patellofemoral joint kinematics and significantly reduces the incidence of postoperative complications, particularly anterior knee pain and audible crepitation.

It is important to note that for the general population, reported outcomes for pain relief and overall patient satisfaction remain equivalent between resurfaced and non-resurfaced cohorts. This fundamental equivalence is why a universal policy is not justified. Instead, the intraoperative assessment is critical; resurfacing should be performed when there is visible evidence of significant patellofemoral degeneration, ranging from full-thickness cartilage wear to eburnated bone.

Therefore, the surgical decision-making must be highly individualized. We recommend that surgeons integrate three key elements: the patient's specific clinical profile and comorbidities, the observed intraoperative condition of the patellofemoral articulation, and the patient's anticipated functional demands and activity level. Future research with larger, prospective trials will help to further refine these indications. Until then, a selective approach, guided by patient-specific factors and surgical findings, represents the optimal standard of care for patellofemoral management in TKA.

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Competing interests

The authors declare that they have no competing interests in this section.

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Authors' contributions

A.B. and G.B. wrote the main manuscript text and G.M and N. M prepared tables, M.D and M.D prepared all data base. R.M does all statics. All authors reviewed the manuscript.

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