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Research Article

Befit Patelloplasty in TKA: A Targeted Approach to Improve Pain and Function

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a Dr. Mohamed Elfekky is a consultant orthopedic surgeon and Director of Tarabichi Joint Care, a leading center for advanced knee and joint preservation. He brings international training and expertise in knee surgery, orthopedic biomechanics, and surgical innovation. Dr. Elfekky holds an MD and MSc in orthopedic surgery, an MRCS, and a diploma in computer-assisted surgery, and has consistently been at the forefront of integrating technology into clinical practice. He is particularly recognized for his work on intraoperative cryoablation of genicular nerves during total knee replacement. This novel technique—performed after prosthesis implantation—has demonstrated effectiveness in reducing postoperative pain while avoiding nerve injury or soft tissue complications. His clinical research in cryoneurolysis contributes to the growing shift toward opioid-sparing strategies in orthopedic care. In addition to holding multiple international patents in ligament-sparing and personalized joint replacement techniques, Dr. Elfekky is an invited speaker at regional and global congresses. He is known for sharing expertise in robotic surgery, cryoanalgesia, and modern approaches to knee preservation.

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Conflicts of Interest Statement for Dr. Mohamed Elfekky

b Dr. Mohamed Shibani is a Libyan orthopedic surgeon who graduated from Tripoli Medical University in 2010. He obtained the Libyan Board certification in Orthopedics in 2019 and currently serves as a specialist orthopedic surgeon at Tripoli University Hospital.

Conflicts of Interest Statement for Dr. Mohamed S. Ben'Musbah

c Dr. Said Abuhalguma is an orthopaedic doctor with specialized interest in arthroplasty and trauma surgery. He has managed complex musculoskeletal injuries across emergency and elective settings, with a particular focus on joint replacement and post-operative rehabilitation. Passionate about improving outcomes through evidence-based care, Dr. Abuhalguma actively engages in quality improvement initiatives and research exploring the community impact of orthopaedic services. He is currently pursuing specialty doctor roles in the UK, contributing to audits, mentoring junior colleagues, and advancing patient-centered approaches in arthroplasty and trauma systems.

Conflicts of Interest Statement for Dr. Said Abuhalguma

d Dr. Hiba Zaidan Alshareef is a Libyan physician who graduated from the Faculty of Medicine at Tripoli University. She is currently serving as a resident surgeon at Tripoli University Hospital in the public sector, while also practicing in the private sector.

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e Dr. Mohadese Rajaeirad is a biomechanical engineering PhD candidate specialized in patient specific implant designs and finite element analysis. She has published several publications in the field of orthopedic and dental biomechanics.

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Conflicts of Interest Statement for Dr. Moataza Mahmoud Abdel Wahab

g Prof. Mansour Muftah Elgassi Elwerfalli, born on January 28, 1956, is a distinguished Consultant Orthopaedic Surgeon and Professor of Orthopaedic Surgery based in Hadba Khadra, Tripoli, Libya. He graduated with an MBBS (2nd Honour Degree) from Tripoli Faculty of Medicine in 1982, earned his FRCS from the Royal College of Surgeons of Glasgow in 1989, completed an MSc in Orthopaedics at the University of London in 1993, and pursued a Knee Fellowship in Droitwich, United Kingdom in 1997. Since 1997, he has served as Consultant Orthopaedic Surgeon and Head of Unit C (Arthroplasty) at Tripoli Medical Center, while also being a Professor at the Tripoli Faculty of Medicine since 2007. In addition, he has held roles as Head Tutor of the Libyan Orthopaedic Board Exam with the Libyan Board of Medical Specialties since 2009, and as Rapporteur of the Arab Scientific Board of Orthopaedics since 2018. Prof. Elwerfalli is an active member of the Libyan Orthopaedic Association, the Libyan Arthroplasty Society, serves as a peer reviewer for SICOT, and is part of the Arab Board of Health Specialisations – Orthopaedic Council.

Conflicts of Interest Statement for Dr. Mansour Elgassi

h Dr. Samih Tarabichi is an Orthopedic Surgeon.

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Background

Patelloplasty offers a bone-preserving alternative to patellar resurfacing and retention during total knee arthroplasty (TKA) by reshaping the native patella to improve tracking and potentially reduce anterior knee pain (AKP). This study assesses the association between patelloplasty and early postoperative outcomes, including AKP incidence, functional recovery, and complication rates.

Methods

In this retrospective, single-center study, 408 patients (727 knees) underwent TKA with patelloplasty between December 2017 and December 2023. Outcomes assessed at 3 and 6 months included AKP incidence, range of motion (ROM), unaided walking, stair climbing, and the need for manipulation under anesthesia (MUA). Descriptive and inferential statistics were applied, with effect sizes estimated using Cramér's V.

Results

AKP incidence declined from 8.8% at 3 months to 2.7% at 6 months. By 6 months, 86.0% of knees achieved full ROM(⩾110° flexion), 77.9% of patients walked unaided, and 72.1% climbed stairs. Among patients impaired at 3 months, 71.3% regained unaided walking and 95.4% regained stair-climbing ability. MUA was required in only 3.2% of cases.

Conclusion

In this observational cohort, patelloplasty was associated with favorable early clinical outcomes, including reductions in AKP, improvements in mobility, and low complication rates. While these findings are encouraging, prospective controlled studies with longer follow-up and standardized outcome measures are warranted to substantiate the potential role of patelloplasty in contemporary TKA.

1. INTRODUCTION

Total Knee Arthroplasty (TKA) effectively relieves pain and improves function in advanced knee osteoarthritis, yet postoperative anterior knee pain (AKP) remains a challenge, impacting patient satisfaction and outcomes (Petersen et al. 2014). Patellar management in TKA is widely debated, with surgeons adopting one of three approaches: routine resurfacing, no resurfacing, or selective resurfacing based on patient-specific criteria (McConaghy et al. 2021). Regional variations exist, with resurfacing rates exceeding 80% in the U.S (Abdel, Parratte, and Budhiparama 2014; Fraser and Spangehl 2017)., contrasting with Norway and Sweden (2–4%) (Abdel, Parratte, and Budhiparama 2014; Fraser and Spangehl 2017; Migliorati, Signori, and Silvestrini-Biavati 2012) and Australia (43–59%) favoring selective resurfacing (Fraser and Spangehl 2017; Vertullo et al. 2019; Clements et al. 2010). While resurfacing may reduce AKP and revision rates, studies report no consistent benefits over retention (Cerciello et al. 2016).

As an alternative, patelloplasty reshapes the patella to enhance congruency with the femoral component, involving osteophyte removal and cartilage resection (Cerciello et al. 2016; Antinolfi et al. 2018). Early evidence suggests improved functional scores and patient satisfaction without significant differences in AKP compared to resurfacing (Sun et al. 2012; Župan et al. 2014). A 2012 study reported superior functional scores and satisfaction in patelloplasty patients, with no difference in AKP (Sun et al. 2012), while a 2014 study found improved Knee Injury and Osteoarthritis Outcome Scores (KOOS) and Oxford Knee Scores (OKS), but no significant differences in pain or function (Župan et al. 2014). Patelloplasty also preserves bone stock, allowing future resurfacing if needed (McConaghy et al. 2021).

Despite promising results, patelloplasty lacks standardized techniques, making cross-study comparisons difficult. Since 2004, six studies have found no significant differences between patelloplasty and resurfacing in function, pain, satisfaction, revision, or radiographic outcomes (Burnett et al. 2004; Agarwala et al. 2018; Li et al. 2012; Liu et al. 2012; Hwang, Yang, and Han 2012; Smith, Wood, and Li 2008). Patient factors such as BMI, comorbidities, and patellar morphology influence outcomes, with obesity and diabetes linked to poorer results, while the absence of preopera-

tive fixed flexion deformity predicts better range of motion (ROM) (Lee 2017, 2016).

This study contributes to the growing body of literature by reporting early postoperative outcomes following a consistently applied patelloplasty technique in over 700 knees within a real-world clinical setting. Unlike prior investigations that often lacked standardized surgical protocols or relied on imprecise outcome measures, our analysis quantifies specific functional endpoints and examines how both patient- and procedure-related factors influence recovery. By focusing on mobility, anterior knee pain, and complications, this study aims to clarify the early effects of patelloplasty on post-TKA recovery which can support more personalized and evidence-informed decisions in patellar management during TKA.

2. METHODOLOGY

2.1. STUDY DESIGN AND ETHICAL COMPLIANCE

This retrospective, observational cohort study included 408 patients (727 knees) who underwent primary total knee arthroplasty (TKA) with patelloplasty between December 2017 and December 2023 at Tarabichi Joint Care and Tripoli University Hospital, Libya. All clinical data were extracted from electronic medical records collected during routine practice. No patient was contacted or subjected to additional procedures or imaging for research purposes. As such, this study met institutional criteria for exemption from formal IRB approval and was conducted in accordance with the principles of the Declaration of Helsinki. Patient data were fully anonymized prior to analysis, and confidentiality was rigorously maintained throughout.

2.2. ELIGIBILITY CRITERIA AND ANALYTICAL APPROACH

Patients were included if they were aged ⩾50 years, underwent TKA with intraoperative patelloplasty, and completed both 3- and 6-month follow-up evaluations. Exclusion criteria included incomplete medical records or concurrent confounding orthopedic procedures (e.g., osteotomies, staged revisions).

Each operated knee was considered an independent analytical unit, yielding 727 knees for analysis. For bilateral procedures, outcomes were recorded and analyzed per knee. No statistical adjustments were made for intra-subject correlation, which is acknowledged as a limitation.

2.3. DEFINITION OF FUNCTIONAL OUTCOMES

Clinical endpoints were defined as follows:

- Full range of motion (ROM): Flexion ⩾110°
- Unaided walking: Ambulation on level ground without assistive devices
- Stair climbing: Ability to ascend and descend stairs independently
- AKP: Subjective anterior knee pain reported at follow-up
- MUA: Requirement for manipulation under anesthesia due to postoperative stiffness unresponsive to physiotherapy

2.4. SURGICAL TECHNIQUE

All procedures were performed under spinal anesthesia via a medial parapatellar approach. The patella was everted at 90–100° of flexion. Patelloplasty was executed with the aid of a power-driven oscillating saw blade (1.6–2.2 mm thick, 2.2–2.8 mm wide), and included:

- Removal of osteophytes, bony bridges, and marginal spurs
- Surface smoothing with rasps and files to reduce irregularities
- Vertical excision to correct luxation typically observed between 40°–90° of flexion
- Horizontal excision to address widened anterior patellar contours or asymmetry
- Lateral facet trimming in cases of tracking lift-off >5 mm
- Posterior beveling when indicated for patella baja or asymmetric wear
- Application of polyethylene patellar components only in cases of severe bone loss
- Micro-pinning used sparingly in the presence of cysts or peripheral instability

Skyline radiographs at 20° and 40° of knee flexion were used intraoperatively to assess patellar tracking and alignment. Definitions and intraoperative criteria for excision procedures are provided in Figure 1. Postoperative rehabilitation began within 24 hours and included quadriceps activation and passive ROM targeting 90–100° under physiotherapy supervision.

2.5. DATA COLLECTION AND VARIABLES

Baseline demographic and clinical variables included age, sex, body mass index (BMI: normal [18.5–<25 kg/m²], overweight [25–<30 kg/m²], obese [⩾30 kg/m²]), hypertension, diabetes mellitus, osteopenia, and presence of preoperative fixed flexion deformity (10–30°). Osteopenia was assessed via clinical evaluation and radiographic features; dual-energy X-ray absorptiometry (DEXA) was selectively performed based on risk stratification.

Intraoperative data included surgical laterality (unilateral, bilateral simultaneous, bilateral staged), and whether lateral release, vertical excision, or horizontal excision was performed.

2.6. STATISTICAL ANALYSIS

Descriptive statistics (frequencies, means, standard deviations) were computed for all variables. *Chi-square* and *z-tests* with Bonferroni correction were used to compare categorical variables. *Cramér's V* was applied to determine effect sizes, interpreted as small (<0.1), moderate (0.1–0.3), or large (>0.3).

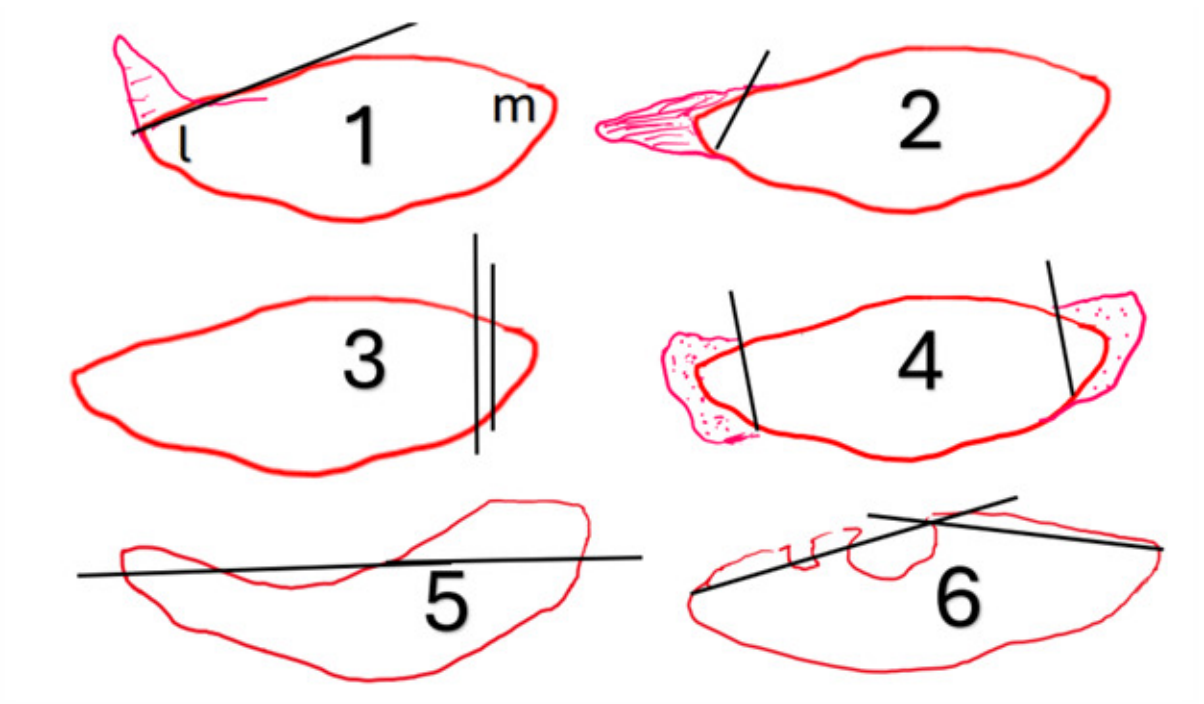

Figure 1. Everted patellae with distinct deformities, including upturned wings (Petersen et al. 2014), laterally extended bridges (McConaghy et al. 2021), excessive bone width (Abdel, Parratte, and Budhiparama 2014), and peri-articular osteophytes (Fraser and Spangehl 2017). Posterior bone loss primarily affecting the middle and lateral thirds in luxing patellae (Migliorati, Signori, and Silvestrini-Biavati 2012) is shown, necessitating peripheral excision while preserving the middle sclerotic surface. Cysts are marked for curettage, pinning, or left untreated as appropriate (Vertullo et al. 2019). Black lines indicate saw blade excision paths. (m: medial , l: lateral)

Multivariable logistic and ordinal regression models were constructed to identify independent predictors of postoperative ROM, functional recovery, and AKP. Predictor variables included patient demographics, comorbidities, deformities, operative approach, intraoperative interventions, and complications (e.g., MUA). Analyses were conducted using SPSS version 26.0, with statistical significance set at $p < 0.05$. Data visualization was performed using Microsoft Excel.

3. RESULTS

3.1. SURGICAL PROCEDURE TYPES AND INTRAOPERATIVE FACTORS

Bilateral staged TKA was the most common approach (74.0%), followed by unilateral (21.8%) and bilateral simultaneous TKA (4.2%) (Table 2). Intraoperative lateral release was performed in 3.2% of cases, with vertical (1.5%) and horizontal (0.5%) excisions being less frequent.

3.2. FUNCTIONAL OUTCOMES

At 6 months, 86.0% achieved full ROM (≥110° flexion), with ROM up to 70°, 100°, and 110° observed in 4.9, 3.9, and 5.1%, respectively. Walking unaided improved from 74.0% at 3 months to 77.9% at 6 months, though 15.1% of patients regressed. Conversely, 71.3% of those unable to walk unaided at 3 months regained mobility. Stair climbing improved from 66.0% to 72.1%, with 95.4% of initially impaired patients recovering, while 27.0% of those previously capable regressed (Table 3).

3.3. POST-OPERATIVE COMPLICATIONS

AKP incidence declined from 8.8% at 3 months to 2.7% at 6 months (Table 3). MUA was required in 3.2% of cases. MUA was required in 13 patients (3.2%) who experienced post-operative stiffness unresponsive to physiotherapy. All MUA procedures were performed within 3 months of surgery.

3.4. ASSOCIATIONS BETWEEN PATIENT CHARACTERISTICS AND OUTCOMES

Female gender had a higher likelihood of walking unaided at 3 months (OR=4.313, 95% CI=[2.663, 6.986]) than male gender, Females also had higher AKP prevalence (OR=4.254, 95% CI=[1.730, 10.462]).

Post-operative anterior pain was of a higher percentage among Obese patients at 3 months (Cramér's V=0.406) and 6 months (Cramér's V=0.231). Patients with pre-operative 10–30° fixed flexion had a higher percentage of those who could climb stairs at 3 months (OR=1.82, 95% CI=[1.16, 2.84]) and lower percentage of post operative anterior pain (Table 5). Diabetics had higher percentage of post-operative pain at 3months (OR=2.73, 95% CI=[1.36, 5.45]) and 6

Table 1. Distribution of TKA with Patelloplasty patients according to patient baseline characteristics.

	No. (n=408)	%
Age (years)•		
Below 60	66	16.2%
60 +	341	83.8%
Min-max	53-96	
Mean± SD	67.4±7.19	
Median	67	
Gender		
Women	231	56.6%
Men	177	43.4%
BMI		
Normal	123	30.1%
Over weight	209	51.2%
Obese	76	18.6%
Comorbidity		
Hypertension	167	40.9%
Diabetes mellitus	127	31.1%
Others	36	8.8%
Osteopenia	61	15.0%
Pre-operative 10-30° Fixed flexion		
No	238	58.3%
Yes	170	41.7%

•age was missing in one patient

Table 2. Distribution of TKA with Patelloplasty patients according to surgical procedure type and Intra operative factors

	No. (n=408)	%
Surgical procedure type		
Bilateral simultaneous	17	4.2%
Bilateral staged	302	74.0%
Unilateral	89	21.8%
Intraoperative factors		
Intraoperative lateral release	13	3.2%
Intra-operative vertical excision	6	1.5%
Intra-operative horizontal excision	2	0.5%
Post-operative MUA (Manipulation under anesthesia)	13	3.2%

months (OR=4.04, 95% CI=[1.16, 14.05]), while osteopenic patients showed improved stair climbing (OR=2.08, 95% CI=[1.057, 4.09]) but higher pain at 6 months (OR=3.4, 95% CI=[0.967, 12]) (Table 5). Effect sizes for categorical variables were interpreted as small (Cramér's V < 0.1), moderate (0.1–0.3), or large (>0.3) (Cohen 2013).

Table 3. Distribution of TKA with Patelloplasty patients according to postoperative outcomes

		No.	%
FUNCTIONAL OUTCOMES			
ROM	Up to 70	20	4.9%
	Up to 100	16	3.9%
	Up to 110	21	5.1%
	full ROM*	351	86.0%
Walk flat unaided	in 3 months	287	74.0%
	in 6 months	300	77.9%
Walk up-down stairs	in 3 months	252	66.0%
	in 6 months	294	72.1%
POST-OPERATIVE COMPLICATIONS			
Post-op ant. Pain	At 3months	36	8.8%
	At 6months	11	2.7%

*Full ROM defined as flexion ⩾110°

3.5. PREDICTORS OF POST-OPERATIVE OUTCOMES

Multivariable regression showed that the absence of pre-operative fixed flexion deformity (OR=2.23, 95% CI=[1.24, 4.03]) and being a man (OR=1.87, 95% CI=[1.01, 3.47]) predicted better ROM (Table 6). Women were more likely to walk unaided at 3 months (OR=4.43, 95% CI=[2.72, 7.23]), while MUA negatively impacted this outcome (OR=0.30, 95% CI=[0.09, 0.98]). Ordinal regression confirmed that being a man and the absence of pre-operative fixed flexion deformities were associated with better ROM outcomes.

4. DISCUSSION

This study evaluated whether patelloplasty in total knee arthroplasty (TKA) is associated with anterior knee pain (AKP), functional recovery, and postoperative complications. Patelloplasty — reshaping the native patella rather than retaining or resurfacing it — aims to enhance patellofemoral congruency while mitigating complications associated with traditional patellar management strategies (Sonkusale and Phadnis 2024; Habib, El Dsh, and Dewidar 2024; De Padua et al. 2024). In this retrospective analysis of 408 patients (727 knees), we observed a reduction in AKP from 8.8% at 3 months to 2.7% at 6 months. Functional recovery also improved, with 86.0% of knees achieving full ROM (⩾110°), and over 70% of patients regaining stair-climbing ability. The complication rate was low, with only 3.2% requiring manipulation under anesthesia (MUA).

Table 4. Association between ROM and patient age, gender, BMI, comorbidities, preoperative fixed flexion and operative factors

		ROM								*Chi square, p value*
		Up to 70		Up to 100		Up to 110		full ROM*		
		No.	%	No.	%	No.	%	No.	%	
	below 60	1	1.5	2	3.0	6	9.1	57	86.4	.224
Age (years)	60 +	19	5.6	14	4.1	15	4.4	293	85.9	
Gender	Women	12	5.2	12	5.2	14	6.1	193	83.5	.316
	Men	8	4.5	4	2.3	7	4.0	158	89.3	
BMI	Normal	4	3.3	6	4.9	8	6.5	105	85.4	
	over weight	15	7.2	7	3.3	9	4.3	178	85.2	.401
	obese	1	1.3	3	3.9	4	5.3	68	89.5	
Hypertension	No	14	5.8	10	4.1	12	5.0	205	85.1	.762
	yes	6	3.6	6	3.6	9	5.4	146	87.4	
Diabetes mellitus	No	19	6.8	10	3.6	15	5.3	237	84.3	.071
	Yes	1	0.8	6	4.7	6	4.7	114	89.8	
Others	No	19	5.1	13	3.5	19	5.1	321	86.3	
	Yes	1	2.8	3	8.3	2	5.6	30	83.3	.499
Osteopenia	No	18	5.2	14	4.0	19	5.5	296	85.3	
	Yes	2	3.3	2	3.3	2	3.3	55	90.2	.779
Pre-operative 10-30° Fixed flexion	No	5	2.1	8	3.4	12	5.0	213	89.5	
	Yes	15	8.8	8	4.7	9	5.3	138	81.2	.015
surgical procedure type	Bilateral simultaneous	0	0.0	1	5.9	1	5.9	15	88.2	
	Bilateral staged	14	4.6	7	2.3	18	6.0	263	87.1	.073
	unilateral	6	6.7	8	9.0	2	2.2	73	82.0	
Intraoperative lateral release	No	19	4.8	16	4.1	21	5.3	339	85.8	
	Yes	1	7.7	0	0.0	0	0.0	12	92.3	.684
Intra operative vertical excision	No	19	4.7	16	4.0	20	5.0	347	86.3	
	Yes	1	16.7	0	0.0	1	16.7	4	66.7	.285
Intra operative horizontal excision	No	20	4.9	16	3.9	21	5.2	349	86.0	
	Yes	0	0.0	0	0.0	0	0.0	2	100.0	.955
Post-op MUA	No	20	5.1	15	3.8	20	5.1	340	86.1	
	Yes	0	0.0	1	7.7	1	7.7	11	84.6	.725

MUA(Manipulation under anesthesia)
Full ROM defined as flexion ≥110°

Table 5. Association between postoperative outcomes and patient age, gender, BMI, comorbidities, preoperative fixed flexion, and operative factors

		walk flat unaided				walk up-down stairs				Post-op ant. Pain			
		3 months		6 months		3 months		6 months		3 months		6 months	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Age (years)	below 60	48	76.2	49	75.4	41	63.1	44	66.7	7	10.6	3	4.5
	60 +	238	73.5	250	78.4	210	66.5	250	73.3	29	8.5	8	2.3
Gender	Women	197	85.3	186	80.5	148	64.1	166	71.9	30	13.0	8	3.5
	Men	90	57.3	114	74.0	104	68.9	128	72.3	6	3.4	3	1.7
BMI	Normal	88	75.9	99	83.2	84	71.2	84	68.3	5	4.1	1	0.8
	overweight	142	71.7	137	71.4	123	64.4	154	73.7	6	2.9	2	1.0
	obese	57	77.0	64	86.5	45	61.6	56	73.7	25	32.9	8	10.5
Hypertension	No	168	73.4	180	78.6	148	65.2	185	76.8	16	6.6	4	1.7
	yes	119	74.8	120	76.9	104	67.1	109	65.3	20	12.0	7	4.2
Diabetes mellitus	No	200	75.2	206	77.7	175	66.8	205	73.0	17	6.0	4	1.4
	Yes	87	71.3	94	78.3	77	64.2	89	70.1	19	15.0	7	5.5
Others	No	261	73.7	275	78.1	229	65.6	271	72.8	27	7.3	9	2.4
	Yes	26	76.5	25	75.8	23	69.7	23	63.9	9	25.0	2	5.6
Osteopenia	No	244	74.2	257	78.1	208	63.8	253	72.9	29	8.4	7	2.0
	Yes	43	72.9	43	76.8	44	78.6	41	67.2	7	11.5	4	6.6
Pre-operative 10-30° Fixed flexion	No	176	77.5	178	79.5	137	60.6	168	70.6	28	11.8	10	4.2
	Yes	111	68.9	122	75.8	115	73.7	126	74.1	8	4.7	1	0.6
surgical procedure type	Bilateral simultaneous	10	66.7	12	80.0	12	75.0	10	58.8	1	5.9	0	0.0
	Bilateral staged	210	73.2	218	76.2	193	67.7	216	71.5	32	10.6	8	2.6
	unilateral	67	77.9	70	83.3	47	58.0	68	76.4	3	3.4	3	3.4
Intraoperative lateral release	No	278	74.1	291	77.8	247	66.6	283	71.6	35	8.9	10	2.5
	Yes	9	69.2	9	81.8	5	45.5	11	84.6	1	7.7	1	7.7
Intra operative vertical excision	No	282	73.8	296	78.1	248	65.8	290	72.1	35	8.7	11	2.7
	Yes	5	83.3	4	66.7	4	80.0	4	66.7	1	16.7	0	0.0
Intra operative horizontal excision	No	285	73.8	299	78.1	250	65.8	293	72.2	36	8.9	11	2.7
	Yes	2	100.0	1	50.0	2	100.0	1	50.0	0	0.0	0	0.0
Post-op MUA	No	280	74.7	289	77.7	243	65.9	285	72.2	35	8.9	11	2.8
	Yes	7	53.8	11	84.6	9	69.2	9	69.2	1	7.7	0	0.0

MUA(Manipulation under anesthesia)

Table 6. Multivariable Regression models for outcomes

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
ROM								
Men	.625	.3162	3.905	1	.048	1.868	1.005	3.471
(No) Pre-operative 10-30° Fixed flexion	.803	.3009	7.119	1	.008	2.232	1.238	4.026
walk flat unaided in 3 months								
Gender	1.489	.249	35.653	1	.000	4.433	2.719	7.227
Post-op MUA	-1.206	.607	3.951	1	.047	.299	.091	.983
Constant	.325	.163	4.000	1	.046	1.384		
stairs 3 months								
osteopenia	.755	.357	4.466	1	.035	2.127	1.056	4.281
Pre-operative 10-30° Fixed flexion	.616	.240	6.613	1	.010	1.852	1.158	2.963
Constant	-1.009	1.214	.691	1	.406	.365		
pain 3 months								
Women	1.158	.497	5.439	1	.020	3.184	1.203	8.426
Other comorbidity	1.618	.506	10.213	1	.001	5.042	1.869	13.599
(No)Pre-operative 10-30° Fixed flexion	.969	.466	4.326	1	.038	2.636	1.058	6.570
Bilateral staged TKA	.573	.288	3.949	1	.047	1.773	1.008	3.118
BMI	.137	.031	19.456	1	.000	1.147	1.079	1.219
Constant	-9.031	1.179	58.704	1	.000	.000		
pain 6 months								
DM	1.356	.692	3.844	1	.050	3.882	1.001	15.059
Osteopenia	1.793	.766	5.478	1	.019	6.007	1.338	26.957
(No)Pre-operative 10-30° Fixed flexion	1.953	1.089	3.216	1	.073	7.050	.834	59.585
BMI	.204	.052	15.312	1	.000	1.227	1.107	1.359
Constant	-12.548	2.293	29.952	1	.000	.000		

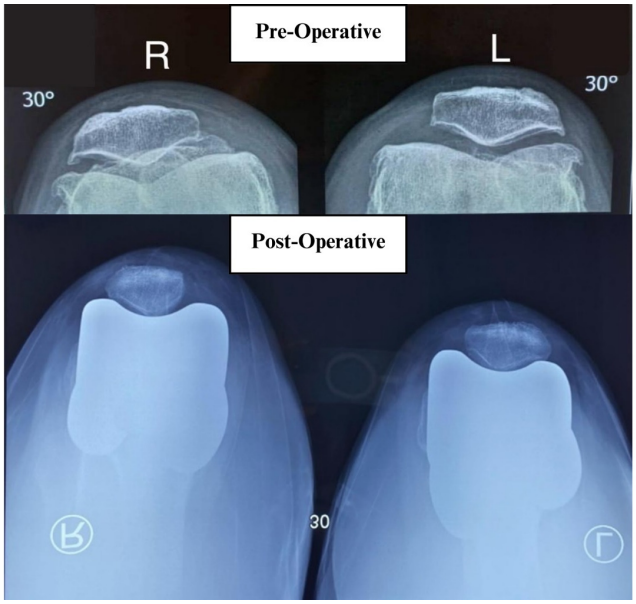

Figure 2. Pre-operative (top row) and post-operative (bottom row) skyline radiographs at 30° knee flexion, illustrating patellar alignment and tracking improvement following patelloplasty. Pre-operative images show prominent bony bridges and osteophytes, while post-operative images demonstrate smoothened patellar surfaces and restored alignment, confirming surgical correction.

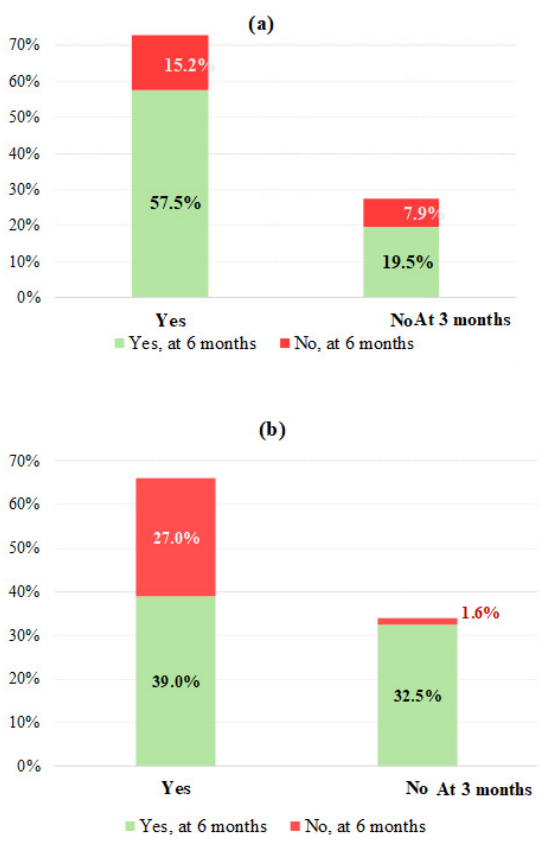

Figure 3. Post-operative functional outcomes: (a) Walking flat unaided and (b) walking up/down stairs. Visual representation highlights improvements in functional independence, correlating with the decrease in reported pain from 3 months (8.8%) to 6 months (2.7%) post-surgery.

These findings align with previous literature indicating that patelloplasty may reduce AKP and enhance mobility when compared to traditional patellar retention techniques (Župan et al. 2014; De Padua et al. 2024). Župan et al. reported improved functional outcomes and pain relief with patelloplasty compared to conventional methods (Župan et al. 2014), while De Padua et al. found its results comparable to patellar resurfacing, positioning it as a bone-preserving alternative (De Padua et al. 2024).

Our 6-month functional outcomes—86.0% achieving full ROM, defined as flexion of ⩾110°, 77.9% walking unaided, and 72.1% climbing stairs—mirror or exceed published benchmarks (Župan et al. 2014; Feng et al. 2023). Similarly, our low complication rate is consistent with literature supporting patelloplasty as a safe approach with reduced revision or MUA needs (De Padua et al. 2024).

While meta-analyses suggest resurfacing may reduce AKP compared to retention (OR ~1.84) (Simpson et al. 2023), patelloplasty appears to deliver comparable clinical benefits while avoiding prosthetic-related complications (De Padua et al. 2024). From a biomechanical standpoint, reshaping the patella can improve tracking, reduce focal contact pressures, and enhance stress distribution—potentially lowering AKP incidence (De Padua et al. 2024). It also preserves bone stock, reduces fracture risk, and may facilitate future revision in younger patients or those with atypical patellar morphology (De Padua et al. 2024; Kedia 2022).

The lack of technique standardization remains a key limitation in current literature (De Padua et al. 2024). In our cohort, consistent intraoperative correction of trochlear mismatch and peripheral trimming may have contributed to favorable outcomes. This underscores the need for establishing reproducible, widely adopted surgical protocols.

Registry data further suggest that, when using patella-friendly implants, differences in AKP between resurfacing and non-resurfacing strategies diminish (McConaghy et al. 2021; Kedia 2022). Patelloplasty may be particularly beneficial for patients with anatomical complexity or those in resource-constrained environments. Economically, it may reduce implant costs and complication-driven revisions (McConaghy et al. 2021; Kedia 2022).

Our findings are also in line with literature suggesting that patelloplasty can offer lasting improvements in ROM and satisfaction, especially for patients with irregular patellar morphology (Feng et al. 2023; Kedia 2022). Though this study captured outcomes only through the 6-month mark, the positive functional trajectory supports the hypothesis that long-term durability is likely.

Regarding patient-reported outcomes (PROMs), previous studies using KOOS and OKS have shown minimal differences between patelloplasty and resurfacing (De Padua et al. 2024; Kedia 2022). PROMs were not uniformly collected in our cohort, but functional outcomes were consistently documented through predefined clinical assessments.

Patient-specific variables influenced recovery: obesity and diabetes correlated with higher AKP, in line with previous reports (Feng et al. 2023), likely reflecting biomechanical loading and delayed healing. Interestingly, women were more likely to report AKP but also regained ambulation sooner, reinforcing the multifactorial nature of recovery trajectories.

While these findings are promising, several limitations must be acknowledged. This was a retrospective, observational study lacking a comparator cohort (resurfaced or retained patellae), which limits the strength of causal inferences. Additionally, range of motion was recorded by trained clinicians using angle-based categories, but inter-rater reliability was not formally tested. PROMs such as the KOOS, OKS, or VAS were not administered systematically, precluding direct comparison with validated patient-centered instruments. Finally, follow-up was limited to 6 months, which may not capture delayed complications or long-term durability. These limitations underscore the need for prospective, randomized trials with standardized outcome measures and longer follow-up, as emphasized in prior studies of long-term TKA outcomes and radiological comparisons (Eshnazarov, Seon, and Song 2016; Chun et al. 2017).

In conclusion, while causality cannot be established due to the absence of a comparator group, our findings suggest that patelloplasty may support early postoperative recovery following TKA by reducing AKP, improving ROM, and preserving function—all with low complication rates. When performed with precise intraoperative reshaping, the technique may offer a viable middle ground between retention and resurfacing strategies. Nevertheless, further prospective studies with validated PROMs, longer follow-up, and comparative cohorts are essential to confirm the long-term value and generalizability of patelloplasty in TKA.

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