Research Square

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Comparative Functional Outcomes of Patellar Resurfacing in Patients Undergoing Posterior Stabilized and Cruciate Retaining Total Knee Arthroplasty: A Prospective Non-Randomized Clinical Trial

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Abstract

Background: Total knee arthroplasty (TKA) is an established treatment for end-stage osteoarthritis of the knee. Cruciate-Retaining (CR) and Posterior-Stabilised (PS) are the two most commonly used TKA designs. The role of patellar resurfacing in TKA in these designs remains controversial, and it is unclear whether outcomes differ between cruciate-retaining (CR) and posterior-stabilised (PS) TKA designs. Limited literature exists comparing the functional results of patellar resurfacing between these two implant categories.

Methods: This was a non-randomised clinical trial including 122 patients aged 50–75 years undergoing primary TKA for primary osteoarthritis. Patients were allocated into four groups: CR without patellar resurfacing, PS without patellar resurfacing, CR with patellar resurfacing, and PS with patellar resurfacing using non-random allocation method (surgeon preference). Outcomes were assessed preoperatively, at 6 weeks, and at 6 months, including KOOS, WOMAC, VAS, SF-12 (PCS/MCS), Kujala score, FJS, Tegner-Lysholm score, Hip-Knee-Ankle (HKA) alignment, range of motion (ROM), and surgical duration.

Results: Baseline demographics were comparable between the groups. Patellar resurfacing significantly increased surgical duration (p value <0.0001). KOOS scores were better in the resurfacing groups, especially in the PS with resurfacing group ($p < 0.05$). Kujala scores were significantly higher in the resurfacing groups at both follow-ups, with maximal improvement in the PS group. WOMAC and VAS scores improved similarly across all groups without significant intergroup differences. ROM at 6 weeks and 6 months was significantly higher in PS knees (mean 122°, SD at 6 months, $p < 0.001$). FJS and SF-12 MCS scores showed no differences, whereas SF-12 PCS showed a small but significant improvement in favour of the PS group with resurfacing.

Conclusion: Patellar resurfacing combined with PS knee design provides modest early benefits in ROM, patellofemoral function, and KOOS outcomes. However, by 6 months, overall functional recovery is similar across all the groups. All groups achieved substantial pain relief and patient satisfaction.

Level of Evidence: Therapeutic Level III, prospective non-randomized clinical trial.

Introduction

Total knee arthroplasty (TKA) is a well-established treatment for end-stage osteoarthritis. The role of patellar resurfacing in TKA remains controversial. A common complaint of patients after total knee arthroplasty (TKA) is anterior knee pain/ discomfort [1]. The patella plays a crucial role in knee function, and the decision to resurface it remains a subject of ongoing investigation and clinical consideration. Clinical studies have not shown clear benefits of patellar resurfacing, and opinions remain divided on its use [2, 3].

Two common designs for TKA are posterior-stabilized (PS) and cruciate-retaining (CR). Studies have reported similar clinical outcomes, including pain relief and functional improvement, between PS and CR designs [4, 5]. Limited literature exists comparing the functional results of patellar resurfacing between these two implant categories. Since the kinematics of CR and PS knee designs are entirely different, it is possible that the two may behave differently with patellar resurfacing. There is some evidence in the literature that resurfacing the patella in conjunction with a CR prosthesis is associated with a reduced incidence of anterior knee pain [6, 7]. Conversely, when patellar resurfacing is combined with PS implants, it has been shown to improve knee-specific functional outcomes [8, 9].

The aim of this study was to compare the functional outcomes of patellar resurfacing between posterior-stabilized (PS) and cruciate-retaining (CR) implant designs in patients undergoing primary total knee arthroplasty.

Methods

This study was a prospective non-randomized controlled trial conducted at a single tertiary care teaching hospital in North India. Ethical approval was obtained from the Institutional Ethics Committee, and the study protocol was registered with the Clinical Trials Registry of India prior to commencement of the study. Written informed consent was obtained from all the participating patients. The study was conducted over an 18-months period from March 2024 to September 2025.

Patients of either gender aged 50–75 years undergoing primary total knee arthroplasty were included in the study. Patients were excluded if they had: 1) revision total knee arthroplasty, 2) previous patellar fracture, 3) hip or ankle pathology, 4) inflammatory arthritis, 5) previous fracture around the knee, or 6) previous history of patellar instability. Sample size was calculated based on detecting a minimal clinically important difference (MCID) in the Knee Injury and Osteoarthritis Outcome Score (KOOS) between patellar resurfacing and non-resurfacing groups [10]. Assuming an MCID of 12(+/- 2) points, 80% power, 95% confidence interval (alpha = 0.05), a minimum of 28 patients per group was required. A total of 122 patients were enrolled after potential attrition.

This study was a parallel-group, open-label, non-randomised controlled trial. Patients underwent one of four treatment combinations: 1) CR TKA without patellar resurfacing, 2) PS TKA without patellar resurfacing, 3) CR TKA with patellar resurfacing, and 4) PS TKA with patellar resurfacing. These four treatment combinations represented the four cells of a 2 × 2 factorial design - with TKA design (CR versus PS) and patellar treatment (resurfacing versus non-resurfacing) as the two treatment factors. Patients were blinded to their patellar resurfacing status, whereas the operating surgeon was not. All femoral and tibial components were cemented. Patients were evaluated pre-operatively and at 6 weeks and 6 months post-operatively.

The **primary outcome** studied was the KOOS score. **Secondary outcomes** included the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Visual Analog Scale (VAS) for pain, Forgotten Joint Score (FJS), Kujala Anterior Knee Pain Score, Tegner-Lysholm Knee Score, Short Form-12 (SF-12;

Physical and Mental Component Scores), knee ROM, surgical duration, and post-operative complications including infection, revision, and patellar complications. Radiographic assessment included measurement of hip-knee-ankle alignment using full-length standing radiographs.

Statistical Analysis

Statistical analysis was performed using SPSS version 22.0 (IBM Corp., Chicago, IL, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages.

The study was analysed using a 2 × 2 factorial framework - with TKA design (cruciate-retaining [CR] versus posterior-stabilized [PS]) and patellar treatment (resurfacing versus non-resurfacing) as the two between-subject factors. The four treatment combinations were therefore analysed as the four cells of the factorial design rather than as four independent groups. This approach allowed assessment of the independent effects of TKA design and patellar treatment, as well as the interaction between these two factors.

For clinical and functional outcomes measured repeatedly over time, including pre-operative, 6-week, and 6-month assessments, a linear mixed-effects model was used. TKA design, patellar treatment, time, and their interaction terms were included as fixed effects, while a patient-specific random intercept was included to account for the correlation between repeated measurements within the same patient. The primary factorial effect of interest was the interaction between TKA design and patellar treatment, which assessed whether the effect of patellar resurfacing differed between CR and PS TKA. The three-way interaction between TKA design, patellar treatment, and time was also assessed to determine whether the factorial treatment effect changed during the follow-up period.

For outcomes assessed at a single time point, a 2 × 2 factorial model was used to evaluate the main effects of TKA design and patellar treatment and their interaction. Adjusted estimated marginal means, mean differences, 95% confidence intervals (CIs), and corresponding p-values were reported where appropriate. Where post-hoc pair-wise comparisons were required, adjustment for multiple comparisons was applied. Adjusted analyses incorporated clinically relevant baseline covariates that could potentially influence treatment allocation and postoperative outcomes, including BMI, preoperative ROM, flexion contracture, preoperative HKA alignment, and the corresponding baseline outcome score.

Categorical outcomes, including post-operative complications, were analysed using the Chi-square test or Fisher's exact test, as appropriate. All statistical tests were two-sided, and p value of < 0.05 was considered statistically significant.

Ethical Approval

and Trial Registration:

This study was approved by the Institutional Ethics Committee (IEC) of All India Institute of Medical Sciences (AIIMS), Bathinda (Ref No: IEC/AIIMS/BTI/527; Dated: 24-01-2024). The study was registered with the Clinical Trials Registry – India (CTRI) as per the committee's directive. The CTRI registration process was completed prior to study initiation.

Results

The two groups were matched in age, sex distribution, laterality, and BMI (Table 1). There was no difference in pre-operative fixed flexion deformity, range of motion and HKA axis between the two groups. Functional outcome scores for the knee joint, pain scores, and Kujala scores were similar between the two groups pre-operatively.

Radiological and functional parameters are summarized in Tables 3,4 & 5. Postoperatively, the knee range of motion was significantly better in the PS group than in the CR group (Groups 2,4 vs. Groups 1,3). But there was no difference in the range of motion for patellar resurfacing (Group 1 vs Group 3, and Group 2 vs Group 4). Hence, no significant effect of patellar resurfacing on post-operative range of motion was observed.

Lower limb alignment (HKA axis) was similar between the two groups after the surgery. There was no significant difference between post-operative WOMAC score, VAS pain score, FJS, Tegner Lysholm Knee score and SF-12 MCS score. THE SF-12 PCS score was statistically better in Groups 2 and 4, which did not appear to be clinically significant. Significant improvements occurred across all the groups, with resurfacing groups showing marginally better post-operative KOOS score. Post-operative KUJALA scores at 6 weeks and 6 months differed significantly, with resurfacing groups – especially PS TKA with resurfacing – displaying better scores.

The mean patellar implant size was 29.4 mm in the CR with patellar resurfacing group and 34.5 mm in the PS with patellar resurfacing group (p-value was 0.419). There was one intra-operative avulsion fracture of the medial femoral epicondyle in Group 1, which was treated with screw fixation, and the routine prosthesis was used. The patient was kept on non-weight-bearing for four weeks, after which standard rehabilitation protocol was started. There was one instance of patellar tendon rupture in group 4, which was treated with primary repair with non-absorbable suture. Active quadriceps and straight-leg raise exercises were restricted for four weeks, after which standard rehabilitation protocol was initiated. Three cases of anterior femoral notching were observed in group 1, two in group 2, and one in group 3. Mean tourniquet time and mean blood loss are summarized in Table 2. Mean tourniquet time was significantly higher in Groups 2 & 4 (45.50 +/- 3.35 and 46.29 +/- 3.49 respectively with p value < 0.0001).

After adjustment, patellar resurfacing improved KOOS by 3.54 points (95% CI 1.28–5.79; $p = 0.002$), while PS TKA improved ROM by 5.89° (95% CI 2.97–8.81; $p < 0.001$). No significant interaction was observed between TKA design and patellar resurfacing; the corresponding effect estimates and 95% CIs are presented in Table 6.

Discussion

In the present study, selected early postoperative outcomes differed across the treatment combinations, with higher KOOS and Kujala scores observed in the resurfacing groups and greater postoperative ROM observed in PS TKA. However, these differences were not consistent across all outcome measures. WOMAC, VAS, FJS, and SF-12 MCS showed no significant adjusted differences at six months, and the factorial interaction between TKA design and patellar resurfacing was not statistically significant. Therefore, the observed differences should be interpreted as associations rather than evidence of a causal functional benefit of combining PS TKA with patellar resurfacing.

Similar findings were reported by Aunan et al. [11], who observed improved KOOS scores in patients who underwent patellar resurfacing. Grela et al. [14] found reduced anterior knee pain and revision rates with resurfacing. In contrast, several studies have demonstrated no meaningful difference in global functional scores between resurfacing and non-resurfacing groups [15, 16]. Together, these results indicate a modest but consistent benefit of resurfacing on patient-reported knee function. However, long-term recovery was largely equivalent between resurfaced and non-resurfaced knees [11, 12].

Clement et al. [17] reported superior knee-specific function with PS TKA compared to CR TKA. However, the clinical relevance was modest. Simpson et al. [7] reported that patellar resurfacing combined with CR knee implants reduced anterior knee pain, whereas resurfacing combined with PS knee implants improved functional outcomes. Burnett et al. [18] demonstrated similar long-term outcomes between patellar resurfacing and non-resurfacing, although non-resurfaced knees had higher patellofemoral-related revision rates. Pilling et al. [19] and Teel et al. [20] also reported higher secondary patellar resurfacing rates in non-resurfaced cohorts.

No statistically significant inter-group differences in WOMAC scores were observed in our study, although all groups showed marked improvement compared to preoperative values. Kaseb et al. and Grela et al. [21, 22] reported similar findings with comparable WOMAC scores between resurfaced and non-resurfaced knees. FJS values were similar across all the groups without significant differences. Roberts et al. [23] similarly reported that by six months, patients achieve similar levels of joint awareness regardless of patellar resurfacing status.

Patellar resurfacing was associated with a longer operative time. Tang et al. demonstrated that resurfacing consistently increased surgical duration due to additional preparation steps [13]. Despite this longer timing, no increase in early complications was noted. No surgical site infections (SSI) or revisions were observed in this study. Burnett et al. and Tang et al. [13, 18] reported the need for revision in larger cohorts. In the present study, there were no statistically significant differences in the hip–knee–ankle (HKA) axis between the four groups, either before surgery or at the 6-month follow-up period. However, all groups showed marked improvement after surgery, with correction of deformity towards a near-neutral mechanical alignment. This indicates that both cruciate-retaining (CR) and posterior-stabilized (PS) TKA implants, regardless of patellar resurfacing, are equally effective in restoring coronal plane alignment when standard mechanical alignment principles are carefully applied. Similar observations

have been reported in the literature. Breeman et al. [15] found no significant difference in patient-reported outcomes or revision rates between resurfaced and non-resurfaced knees when alignment goals were appropriately achieved. Tang et al. [13], in their pooled analysis of 50 RCTs, also demonstrated that resurfacing did not independently influence mechanical alignment parameters or overall limb axis correction.

Post-operative range of motion (ROM) differed between the groups. Patients receiving PS TKA had greater knee flexion at both 6 weeks and 6 months. This observed difference may reflect differences associated with the PS implant design, although the non-randomized allocation precludes a causal interpretation. One possible explanation is the cam–post mechanism of the PS implant, which promotes greater femoral rollback during knee flexion. As described by Simpson et al. [7], this mechanism may facilitate knee bending during the early post-operative period.

Table 1
Distribution of demographic parameters between different groups

Variable	Group 1 (n = 28)	Group 2 (n = 30)	Group 3 (n = 29)	Group 4 (n = 35)	p-value
Age in years (mean ± SD)	62.3 +/- 7.7	62.6 +/- 5.8	64.5 +/- 6.1	61.1 +/- 5.9	0.213
Sex (Male/Female)	10/18	10/20	16/13	10/25	
Side (Right/left)	18/10	13/17	12/17	20/15	
BMI (mean ± SD)	24.7 +/- 2.4	26.9 +/- 5.6	24.9 +/- 3.9	24.5 +/- 3.1	0.033

SD – Standard deviation, BMI – Body mass index.

Table 2
Distribution of functional and radiological parameters pre-operatively and 6 months post-operatively between different groups

Variable	Group 1 (n = 28)	Group 2 (n = 30)	Group 3 (n = 29)	Group 4 (n = 35)	p-value
Blood loss (in ml)	210 ± 120 mL	240 ± 130 mL	260 ± 140 mL	300 ± 160 mL	0.08
Joint line height	16.06 +/-2.46	18.45 +/- 2.06	18.0 +/- 1.64	17.73 +/- 2.56	0.00055
Polyethylene thickness (mm)	8.54 +/-2.10	7.77+/-1.32	11.03 +/-2.47	9.83+/-1.16	< 0.0001
Anterior cortex notching (n, %)	3 (10.71%)	1 (3.33%)	2 (6.89%)	0	
Tourniquet time	41.39 +/-3.45	45.50 +/-3.35	41.24 +/- 5.27	46.29 +/- 3.49	< 0.0001

All values should be in mean +/- SD.

SD – Standard deviation.

Table 3
Changes in functional and radiological parameters pre-operatively and 6 months post-operatively between different groups

WOMAC				
	Pre-operative	**Post-operative**	**Mean improvement**	**p-value**
Group 1 (n = 28)	68.50 +/- 4.20	13.14 +/- 4.47	55.36	**< 0.0001**
Group 2 (n = 30)	67.23 +/- 4.11	16.83 +/- 7.47	50.4	**< 0.0001**
Group 3 (n = 29)	66.28 +/- 4.06	14.76 +/- 5.87	51.52	**< 0.0001**
Group 4 (n = 35)	68.49 +/- 3.92	15.54 +/- 6.72	52.95	**< 0.0001**
KOOS				
	Pre-operative	Post-operative	Mean improvement	p-value
Group 1 (n = 28)	35.89 +/-4.54	79.96 +/- 4.88	44.07	**< 0.0001**
Group 2 (n = 30)	36.90 +/-2.86	82.17 +/- 6.13	45.27	**< 0.0001**
Group 3 (n = 29)	33.45 +/- 2.83	80.72 +/- 5.25	47.27	**< 0.0001**
Group 4 (n = 35)	37.97 +/-3.37	83.0 +/- 5.54	45.03	**< 0.0001**
FJS				
	Pre-operative	Post-operative	Mean improvement	p-value
Group 1 (n = 28)	22.82 +/- 3.59	87.18 +/- 4.51	64.36	**< 0.0001**
Group 2 (n = 30)	22.27 +/- 2.76	85.27 +/- 7.17	63.0	**< 0.0001**
Group 3 (n = 29)	23.76 +/- 3.07	85.79 +/-5.63	62.03	**< 0.0001**
Group 4 (n = 35)	21.34 +/- 2.32	86.37 +/- 5.64	65.03	**< 0.0001**
VAS for pain				
	Pre-operative	Post-operative	Mean improvement	p-value
Group 1 (n = 28)	7.5 +/- 0.5	1.25 +/- 0.51	6.25	**< 0.0001**
Group 2 (n = 30)	7.57 +/- 0.49	1.37 +/-0.76	6.2	**< 0.0001**
Group 3 (n = 29)	7.52 +/- 0.5	1.31 +/- 0.64	6.21	**< 0.0001**
Group 4 (n = 35)	7.43 +/- 0.5	1.40 +/- 0.59	6.03	**< 0.0001**
Kujala score				
Group 1 (n = 28)	34.00 +/- 3.48	85.04 +/- 5.99	51.04	**< 0.0001**
Group 2 (n = 30)	34.40 +/- 2.78	86.67 +/- 7.42	52.27	**< 0.0001**

WOMAC				
	Pre-operative	**Post-operative**	**Mean improvement**	**p-value**
Group 3 (n = 29)	34.21 +/- 1.42	83.41 +/- 5.36	49.2	**< 0.0001**
Group 4 (n = 35)	34.20 +/- 1.97	84.46 +/- 6.09	50.26	**< 0.0001**
SF12(PCS)				
	Pre-operative	Post-operative	Mean improvement	p-value
Group 1 (n = 28)	34.66 +/- 1.15	51.84 +/- 0.81	17.18	**< 0.0001**
Group 2 (n = 30)	34.38 +/- 1.28	51.22 +/- 1.55	16.84	**< 0.0001**
Group 3 (n = 29)	33.72 +/- 1.00	52.09 +/- 0.67	18.37	**< 0.0001**
Group 4 (n = 35)	34.75 +/-1.40	51.52 +/- 1.10	16.77	**< 0.0001**
SF12(MCS)				
	Pre-operative	Post-operative	Mean improvement	p-value
Group 1 (n = 28)	40.47 + 0.72	51.24 +/- 0.34	10.77	**< 0.0001**
Group 2 (n = 30)	40.40 +/- 0.70	51.38 +/- 0.81	10.98	**< 0.0001**
Group 3 (n = 29)	40.45 +/- 0.58	51.31 +/- 1.69	10.86	**< 0.0001**
Group 4 (n = 35)	40.47 +/- 1.04	51.29 +/- 0.57	10.82	**< 0.0001**
HKA axis				
	Pre-operative	Post-operative	Mean improvement	p-value
Group 1 (n = 28)	166.97 +/- 5.8	179.36 +/- 1.24	12.39	**< 0.0001**
Group 2 (n = 30)	167.53 +/- 4.15	180.02 +/-0.74	12.49	**< 0.0001**
Group 3 (n = 29)	167.69 +/- 9.2	179.64 +/- 1.07	11.95	**< 0.0001**
Group 4 (n = 35)	169.65 +/-4.69	179.83 +/- 0.74	10.18	**< 0.0001**
Preoperative ROM				
	Pre-operative	Post-operative	Mean improvement	p-value
Group 1 (n = 28)	113.93 +/- 11.59	115.89 +/- 6.81	1.96	0.32
Group 2 (n = 30)	112.0 +/- 10.30	115.83 +/- 9.78	3.83	0.046
Group 3 (n = 29)	114.14 +/- 11.44	123.62 +/- 5.03	9.48	< 0.0001
Group 4 (n = 35)	114.0 +/- 9.71	122.14 +/- 7.06	8.14	< 0.0001

WOMAC – Western Ontario and McMasters Universities Osteoarthritis Index, KOOS – Knee injury and Osteoarthritis Outcome score, FJS – Forgotten Joint score, VAS – Visual Analogue Scale, SF12–12 Item Short form Health Survey, PCS – Physical Component Summary, MCS – Motor Component Summary, HKA – Hip Knee Ankle axis, ROM – Range of Motion.

Table 4
Comparison of functional and radiological outcomes within PS and CR groups

Variable	Group 1 (n = 28)	Group 2 (n = 30)	p-value	Group 3 (n = 29)	Group 4 (n = 35)	p-value
WOMAC (preoperative)	68.50 +/- 4.20	67.23 +/- 4.11	0.25	66.28 +/- 4.06	68.49 +/- 3.92	0.04
WOMAC (6 months)	13.14 +/- 4.47	16.83 +/- 7.47	0.04	14.76 +/- 5.87	15.54 +/- 6.72	0.63
KOOS (preoperative)	35.89 +/-4.54	36.90 +/-2.86	0.31	33.45 +/- 2.83	37.97 +/-3.37	< 0.001
KOOS (6 months)	79.96 +/- 4.88	82.17 +/- 6.13	0.13	80.72 +/- 5.25	83.0 +/- 5.54	0.11
VAS for pain (preoperative)	7.5 +/- 0.5	7.57 +/- 0.49	0.61	7.52 +/- 0.5	7.43 +/- 0.5	0.47
VAS for pain (6 months)	1.25 +/- 0.51	1.37 +/-0.76	0.49	1.31 +/- 0.64	1.40 +/- 0.59	0.58
FJS (preoperative)	22.82 +/- 3.59	22.27 +/- 2.76	0.52	23.76 +/- 3.07	21.34 +/- 2.32	0.002
FJS (6 months)	87.18 +/- 4.51	85.27 +/- 7.17	0.24	85.79 +/-5.63	86.37 +/- 5.64	0.69
Kujala score (preoperative)	34.00 +/- 3.48	34.40 +/- 2.78	0.62	34.21 +/- 1.42	34.20 +/- 1.97	0.98
Kujala score (6 months)	85.04 +/- 5.99	86.67 +/- 7.42	0.35	83.41 +/- 5.36	84.46 +/- 6.09	0.46
SF-12 PCS (preoperative)	34.66 +/- 1.15	34.38 +/- 1.28	0.39	33.72 +/- 1.00	34.75 +/-1.40	0.002
SF-12 PCS (6 months)	51.84 +/- 0.81	51.22 +/- 1.55	0.07	52.09 +/- 0.67	51.52 +/- 1.10	0.02
SF-12 MCS (preoperative)	40.47 + 0.72	40.40 +/- 0.70	0.70	40.45 +/- 0.58	40.47 +/- 1.04	0.92
SF-12 MCS (6 months)	51.24 +/- 0.34	51.38 +/- 0.81	0.41	51.31 +/- 1.69	51.29 +/- 0.57	0.94
Preoperative Flexion contracture	5.18 +/- 7	4.17 +/- 4.79	0.52	6.03 +/- 5.99	1.86 +/- 3.15	0.002
Preoperative ROM	113.93 +/- 11.59	112.0 +/- 10.30	0.51	114.14 +/- 11.44	114.0 +/- 9.71	0.96
Preoperative HKA	166.97 +/- 5.8	167.53 +/- 4.15	0.67	167.69 +/- 9.2	169.65 +/-4.69	0.30

Variable	Group 1 (n = 28)	Group 2 (n = 30)	p-value	Group 3 (n = 29)	Group 4 (n = 35)	p-value
Post-operative Flexion contracture	0	0	-	0	0	-
Postoperative ROM	115.89 +/- 6.81	115.83 +/- 9.78	0.98	123.62 +/- 5.03	122.14 +/-7.06	0.37
Postoperative HKA	179.36 +/- 1.24	180.02 +/-0.74	0.02	179.64 +/- 1.07	179.83 +/- 0.74	0.45

WOMAC – Western Ontario and McMasters Universities Osteoarthritis Index, KOOS – Knee injury and Osteoarthritis Outcome score, FJS – Forgotten Joint score, VAS – Visual Analogue Scale, SF12–12 Item Short form Health Survey, PCS – Physical Component Summary, MCS – Motor Component Summary, HKA – Hip Knee Ankle axis, ROM – Range of Motion.

Table 5
Comparison of functional and radiological outcomes of patellar resurfacing between CR and PS knees

Variable	Group 2 (n = 30)	Group 4 (n = 35)	p-value
WOMAC (preoperative)	67.23 +/- 4.11	68.49 +/- 3.92	0.23
WOMAC (6 months)	16.83 +/- 7.47	15.54 +/- 6.72	0.48
KOOS (preoperative)	36.90 +/-2.86	37.97 +/-3.37	0.18
KOOS (6 months)	82.17 +/- 6.13	83.0 +/- 5.54	0.56
VAS for pain (preoperative)	7.57 +/- 0.49	7.43 +/- 0.5	0.29
VAS for pain (6 months)	1.37 +/-0.76	1.40 +/- 0.59	0.84
FJS (preoperative)	22.27 +/- 2.76	21.34 +/- 2.32	0.16
FJS (6 months)	85.27 +/- 7.17	86.37 +/- 5.64	0.47
Kujala score (preoperative)	34.40 +/- 2.78	34.20 +/- 1.97	0.74
Kujala score (6 months)	86.67 +/- 7.42	84.46 +/- 6.09	0.18
SF-12 PCS (preoperative)	34.38 +/- 1.28	34.75 +/-1.40	0.28
SF-12 PCS (6 months)	51.22 +/- 1.55	51.52 +/- 1.10	0.39
SF-12 MCS (preoperative)	40.40 +/- 0.70	40.47 +/- 1.04	0.68
SF-12 MCS (6 months)	51.38 +/- 0.81	51.29 +/- 0.57	0.63
Preoperative Flexion contracture	4.17 +/- 4.79	1.86 +/- 3.15	0.06
Preoperative ROM	112.0 +/- 10.30	114.0 +/- 9.71	0.45
Preoperative HKA	167.53 +/- 4.15	169.65 +/-4.69	0.07
Post-operative Flexion contracture	0	0	-
Postoperative ROM	115.83 +/- 9.78	122.14 +/-7.06	0.003
Postoperative HKA	180.02 +/-0.74	179.83 +/- 0.74	0.36

WOMAC – Western Ontario and McMasters Universities Osteoarthritis Index, KOOS – Knee injury and Osteoarthritis Outcome score, FJS – Forgotten Joint score, VAS – Visual Analogue Scale, SF12–12 Item Short form Health Survey, PCS – Physical Component Summary, MCS – Motor Component Summary, HKA – Hip Knee Ankle axis, ROM – Range of Motion, PS – Posterior Stabilized, CR – Cruciate Retaining.

Table 6
Adjusted 6-month outcomes according to TKA design and patellar treatment

Outcome	Comparison	Adjusted mean difference	95% CI; p-value
KOOS	Patellar resurfacing vs. no resurfacing	3.54	1.28 to 5.79; p = 0.002
	PS vs. CR TKA	1.02	−1.10 to 3.14; p = 0.344
	TKA design × patellar resurfacing	1.32	−3.23 to 5.87; p = 0.567
WOMAC	Patellar resurfacing vs. no resurfacing	1.59	−0.87 to 4.05; p = 0.203
	PS vs. CR TKA	0.40	−2.00 to 2.81; p = 0.740
	TKA design × patellar resurfacing	−2.72	−7.58 to 2.15; p = 0.271
VAS	Patellar resurfacing vs. no resurfacing	−0.01	−0.23 to 0.21; p = 0.929
	PS vs. CR TKA	0.05	−0.17 to 0.27; p = 0.644
	TKA design × patellar resurfacing	0.01	−0.44 to 0.45; p = 0.978
FJS	Patellar resurfacing vs. no resurfacing	−0.15	−2.54 to 2.23; p = 0.898
	PS vs. CR TKA	−0.16	−2.40 to 2.09; p = 0.890
	TKA design × patellar resurfacing	1.77	−3.00 to 6.53; p = 0.464
Kujala	Patellar resurfacing vs. no resurfacing	2.03	−0.35 to 4.40; p = 0.093
	PS vs. CR TKA	−2.15	−4.53 to 0.22; p = 0.075
	TKA design × patellar resurfacing	−0.88	−5.75 to 3.98; p = 0.719
SF-12 PCS	Patellar resurfacing vs. no resurfacing	−0.51	−0.92 to − 0.10; p = 0.016
	PS vs. CR TKA	0.23	−0.20 to 0.65; p = 0.289

Outcome	Comparison	Adjusted mean difference	95% CI; p-value
	TKA design × patellar resurfacing	−0.11	−0.90 to 0.68; p = 0.784
SF-12 MCS	Patellar resurfacing vs. no resurfacing	0.05	−0.34 to 0.43; p = 0.803
	PS vs. CR TKA	0.07	−0.25 to 0.40; p = 0.666
	TKA design × patellar resurfacing	−0.04	−0.88 to 0.80; p = 0.932
ROM (°)	Patellar resurfacing vs. no resurfacing	−0.11	−3.21 to 2.99; p = 0.942
	PS vs. CR TKA	5.89	2.97 to 8.81; p < 0.001
	TKA design × patellar resurfacing	−0.22	−6.16 to 5.72; p = 0.941

WOMAC – Western Ontario and McMasters Universities Osteoarthritis Index, KOOS – Knee injury and Osteoarthritis Outcome score, FJS – Forgotten Joint score, VAS – Visual Analogue Scale, SF12–12 Item Short form Health Survey, PCS – Physical Component Summary, MCS – Motor Component Summary, CI – Confidence Interval, ROM – Range of Motion, PS – Posterior Stabilized, CR – Cruciate Retaining.

Limitations:

Our study has several limitations. The follow-up period was only limited to 6 months and therefore does not allow assessment of long-term outcomes such as implant survivorship, late patellofemoral complications, or revision rates (if any). Although this was a non-randomized controlled trial, the sample size within each subgroup was relatively small, which may have limited the ability to detect subtle differences between implant designs and resurfacing strategies. In addition, the study was conducted at a single tertiary center and all procedures were performed by a single senior arthroplasty surgeon, which may limit the generalizability of the findings. Finally, the analysis focused primarily on short-term functional and patient-reported outcomes, and detailed radiographic assessment of patellofemoral tracking or component rotational alignment was not included.

Conclusion

In this prospective non-randomized clinical trial, PS TKA with patellar resurfacing was associated with modest differences in selected early postoperative measures, including ROM, Kujala score, and KOOS. However, pain relief and several global patient-reported outcomes were largely similar across treatment groups at six months. Because treatment allocation was based on surgeon preference, these findings should be interpreted as associations rather than evidence of a causal benefit of PS design or patellar

resurfacing. Longer-term randomized studies are required to determine whether these early differences translate into clinically meaningful and sustained benefits.

Declarations

Author Contribution

Author contribution:1. Conceptualization: [Dr. Tarun Goyal, Dr. Vipin Sharma]2. Methodology: [Dr. Shashank Suman, Dr. Vipin Sharma] 3. Data Collection: [Dr. Shashank Suman, Dr. Mosharaf Hossain Sarkar, Dr. Dipesh Mittal]4. Analysis: [Dr. Vipin Sharma, Dr. Lakshmana Das] 5. Manuscript Drafting: [Dr. Shashank Suman, Dr. Vipin Sharma] 6. Critical Revision: [Dr. Tarun Goyal, Dr. Lokendra Singh] 7. Supervision: [Dr. Tarun Goyal]

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