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RESEARCH ARTICLE

Circumferential patellar denervation does not reduce anterior knee pain in total knee arthroplasty without patellar resurfacing; a prospective comparison

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Abstract

Background This study aimed to evaluate the effectiveness of circumferential patellar denervation in reducing anterior knee pain (AKP) and improving clinical outcomes after total knee arthroplasty (TKA) without patellar resurfacing.

Materials and methods This prospective, non-randomized, observational study included patients who underwent primary TKA at our institution between August 2023 and January 2024. Patients were divided into two groups: those who received patellar denervation (PD group) and those who did not (NPD group). The primary outcome was the reduction in anterior knee pain (AKP), measured by the Visual Analog Scale (VAS). Secondary outcomes included the Kujala Knee Score, Western Ontario and McMaster Universities Arthritis Index (WOMAC), and range of motion (ROM). Assessments were conducted preoperatively and at 3 and 6 months postoperatively.

Results Four patients in the PD group and five in the NPD group were excluded from the study due to failure to complete follow-up. Thus, 74 female and 16 male patients with a mean age of 67.4 ± 4.2 years were included in the final analysis. There were no significant differences between the two groups with respect to age, sex, side of surgery, height, weight, BMI, grade of patellofemoral osteoarthritis, preoperative ROM, VAS score, Kujala score, and WOMAC score (p: n.s. for all variables). No significant differences were found between the groups for VAS, Kujala, and WOMAC scores at any time point (p: n.s.). Significant improvements in these scores over time were indicated by repeated measures ANOVA ($p = 0.001$ for both groups). Pairwise comparisons showed significant improvements from preoperative to postoperative months three and six and from postoperative months three to six ($p = 0.001$ for all comparisons). Both groups experienced decreased knee ROM at third month, which returned to preoperative values at sixth month with no significant differences. No complications were observed during the study.

Conclusions Circumferential patellar denervation does not provide additional benefit in reducing anterior knee pain or improving functional outcomes compared to the non-denervation approach in TKA without patellar resurfacing.

Level of evidence Level III, Prospective comparative study.

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Keywords Anterior knee pain, Total knee arthroplasty, Patellar denervation, Kujala score, WOMAC score, Visual Analog Scale

Introduction

Total knee arthroplasty (TKA) is a well-established surgical treatment used to relieve pain and restore function in patients with end-stage knee osteoarthritis. Despite the success of total knee arthroplasty (TKA), a significant proportion of patients continue to experience postoperative anterior knee pain (AKP), which can interfere with recovery and satisfaction. AKP after TKA is a common and challenging complication, with documented prevalence rates ranging from 17.5 to 29% [1, 2]. This persistent pain can significantly impair knee function, lead to patient dissatisfaction, and even necessitate revision surgery. Several strategies have been developed to treat AKP after TKA, including patellar resurfacing, infrapatellar fat pad excision, and patellar denervation [2]. In two recent meta-analysis studies, patellar resurfacing was associated with a lower rate of AKP and revision rate and emerged as the optimal treatment modality [3, 4]. However, patellar resurfacing is not without complications. It can cause patellar fractures, osteonecrosis, implant loosening, and technical errors such as asymmetric cuts [5–7]. Furthermore, it cannot be performed in cases of insufficient patellar bone stock [8]. In addition, modern implant designs are more patella-friendly and allow for successful TKA without resurfacing [9, 10]. Based on surveys of arthroplasty surgeons, a significant number of surgeons still do not routinely resurface the patella in their clinical practice [11, 12].

In the absence of patellar resurfacing, patellar denervation (PD) may be a viable approach to reduce the risk of anterior knee pain following TKA. PD involves circumferential electrocautery of the patella to deactivate pain sensory nerves, theoretically reducing the incidence and intensity of AKP [4, 13]. Despite its theoretical benefits, the clinical efficacy of PD in reducing postoperative AKP and improving knee function remains controversial. While some studies report a significant reduction in the prevalence of AKP with PD, others find no substantial difference compared to non-denervation (NPD) techniques [13–21]. Several meta-analyses and systematic reviews have attempted to synthesize the available evidence on the efficacy of PD in reducing AKP, with inconsistent conclusions [4, 22]. Given the conflicting evidence and the clinical significance of AKP, this study aimed to provide a comprehensive evaluation of PD versus non-denervation on postoperative outcomes in TKA without patellar resurfacing. Specifically, we hypothesized that PD would reduce the severity of AKP and improve functional outcomes without increasing complications. The results may provide clearer guidance for surgical practice and potentially improve patient outcomes.

Materials and methods

Patients and study design

This prospective, non-randomized, observational study was conducted at our institution in patients who underwent primary TKA between August 2023 and January 2024. All consecutive patients undergoing primary TKA were considered for inclusion in the study. Patients with previous knee surgery or procedures, cognitive impairment such as dementia or Parkinson's disease that would interfere with accurate functional and pain assessment, severe ligamentous instability, patients undergoing patellar realignment procedures during surgery including lateral release, patients undergoing TKA for inflammatory arthritis, and patients with lower extremity neuromuscular disorders were excluded from the study. This study was not randomized and the decision to perform patellar denervation was left to the discretion of the operating surgeon. Written informed consent was obtained from all participants prior to enrollment to ensure ethical compliance and acknowledgment of the research process. The study was conducted in accordance with the tenets of the Declaration of Helsinki, ensuring the highest standards of ethical conduct and patient rights. The institutional ethics committee reviewed and approved the research methodology (approval ID: 2023-16/9). Patients were divided into two groups: those who received patellar denervation (PD group) and those who did not (NPD group).

Sample size calculation

Since the primary outcome measure was anterior knee pain, we used the Kujala anterior knee pain score to calculate the sample size. The minimum clinically important difference (MCID) for the Kujala score has been reported to range from 8.5 to 13.5 points in the current literature [23]. Based on previous studies, the effect size for the Kujala Score was determined to be 0.53 [24]. Therefore, the sample size required per group to detect an MCID of at least 10 points in the Kujala Score with 80% power and a significance level of 0.05, given an effect size of 0.53 in an independent t-test, was 45 participants per group. A total of 50 patients were included in each group to account for potential dropouts.

Surgical technique and postoperative management

The patient was positioned in a supine position on the operating table under spinal or epidural anesthesia. A tourniquet was applied to the proximal thigh, and standard sterile draping and aseptic techniques were employed. A midline incision was made, extending from the superior pole of the patella to the tibial tuberosity, and the subcutaneous tissue was meticulously dissected. A medial parapatellar approach was employed to expose the joint. Subsequently, the eversion of the patella was performed, accompanied by the excision of the surrounding hypertrophic fat pad and synovia. This was done in order to delineate the precise borders with particular attention paid to preserving the extensor mechanism. Subsequently, the surrounding osteophytes were removed with a rongeur and filed to create a smooth contour, thereby facilitating enhanced patellar tracking. Lateral facetectomy was not performed in any of the patients as part of the surgical protocol. No further procedure was conducted in the control group following this stage. In the patellar denervation group, circumferential denervation of the patella is performed using electrocautery. This procedure involves the ablation of peripatellar soft tissues at a depth of 1–2 mm, which disrupts the sensory nerve fibers that innervate the patella. Following the placement of the components, patellar tracking was evaluated with the "no-hands-on technique" along the entire arc of knee motion. Patients who had undergone lateral retinacular release due to patellar maltracking were excluded from the study. A standard closure procedure was performed, including the closure of the joint capsule, followed by the closure of the subcutaneous tissue and skin in layers. Subsequently, a compression bandage was applied after the tourniquet was released. All patients underwent total knee arthroplasty utilizing a posterior-stabilized fixed-bearing tibial insert without patellar resurfacing.

A suction drain was employed and subsequently removed 24 h postoperatively. On the first postoperative day, weight-bearing with the use of walkers and a program of knee active and passive range of motion exercises were initiated. Patients who had reached a stable condition were discharged on the second or third postoperative day. After discharge, all patients were provided with a standardized rehabilitation protocol, including instructions for home-based exercises to maintain knee mobility and strength. All patients received similar postoperative pain management, which included standard analgesics. Pain medications were discontinued by the end of the first postoperative month. At the time of the 3- and 6-month evaluations, none of the patients were using pain medication, ensuring that pain scores reflected natural recovery.

Clinical assessments and outcome measures

All patients underwent a comprehensive general physical examination prior to undergoing surgery, and compliance with the inclusion criteria was verified. The preoperative data set included the subject's age, gender, height, and weight. The range of motion (ROM) of the knee was quantified using a goniometer. The Kellgren-Lawrence classification was used to grade osteoarthritis of the PF on preoperative radiographs. The primary outcome was the reduction in anterior knee pain (AKP), assessed by the Visual Analog Scale (VAS). Secondary outcomes included the Kujala Knee Score for patellofemoral functionality, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for functional assessment, and range of motion (ROM). These assessments were conducted preoperatively and at 3 and 6 months postoperatively. All evaluations were conducted by the senior author (F.D), who was blinded to the treatment.

Statistical analysis

Continuous variables were presented as means and standard deviations (SD), while categorical variables were expressed as frequencies and percentages. The normality of the data distribution was assessed using the Shapiro-Wilk test, Kolmogorov-Smirnov test, and histograms. For the comparison between the independent groups, the student's t-test was utilized for normally distributed continuous variables, and the Mann-Whitney U test was employed for non-normally distributed continuous variables. The Chi-square test was applied to compare categorical variables. Repeated Measures of analysis of variance (ANOVA) and post-hoc analysis were conducted to evaluate the changes over time within each group. The significance level was set at $p<0.05$, and all p-values reported were two-sided.

Results

Patient flow during the study period

A total of 124 total knee arthroplasties were performed at our clinic over the course of the six-month study period. Of the remaining patients, 19 were excluded from the study because they did not meet the inclusion criteria, three were excluded because they did not consent to participate, and two were excluded because the preoperative data were missing. A total of 100 patients were monitored, with 50 patients in each group. Four patients in the PD group and five in the NPD group were excluded from the study due to failure to complete the follow-up. Consequently, the final analysis included 74 female and 16 male patients with a mean age of 67.4±4.2 years (Fig. 1).

There were no significant differences between the two groups in terms of age, sex, side of the operation, height, weight, BMI, patellofemoral osteoarthritis grade, preoperative ROM, VAS, Kujala score, and WOMAC score. The baseline characteristics of the patients in the denervation and non-denervation groups are summarized in Table 1.

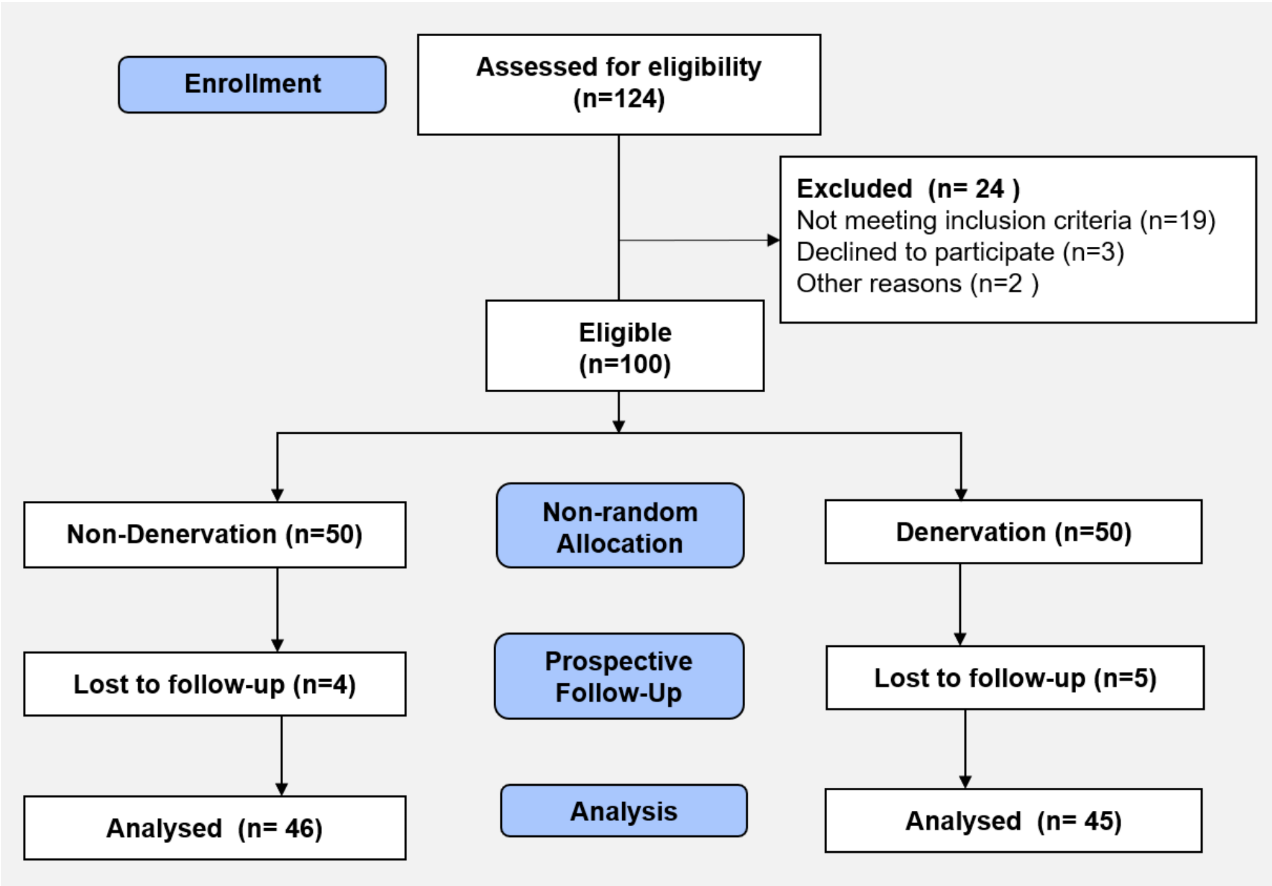

Fig. 1 Patient enrollment and follow-up flowchart

No notable discrepancies were observed between the groups with regard to VAS, Kujala, and WOMAC scores at each designated time point ($p>0.05$ for all comparisons). Repeated measures of ANOVA indicated significant improvements in VAS, Kujala, and WOMAC scores over time within each group ($p=0.001$ for both groups) (Fig. 2). Pairwise comparisons revealed statistically significant improvements from preoperative to postoperative third and sixth months, as well as from postoperative third to sixth months ($p=0.001$ for all comparisons). In both groups, the preoperative knee ROM demonstrated a decline in the third month, followed by an increase in the sixth month, reaching the preoperative knee ROM values. Similarly, no significant differences were observed in the knee range of motion between the two groups at each measurement point. None of the patients exhibited extension deficits or fixed extension contractures at the 3rd and 6th month postoperative evaluation. The postoperative follow-up results are presented in Table 2. No complications were observed in the study population during the study period.

Discussion

This study aimed to evaluate the effectiveness of circumferential PD in reducing anterior knee pain and improving clinical outcomes following TKA without patellar resurfacing. Our findings suggest that while both the PD and NPD groups showed significant improvements in pain and functional scores over time, there were no significant differences between the groups regarding pain reduction, functional improvement, or range of motion at each time point of assessments. Circumferential patellar denervation does not provide additional benefits in reducing AKP or improving functional outcomes compared to the non-denervation approach in TKA without patellar resurfacing.

Our findings align with prior studies that found no significant differences in AKP or overall clinical outcomes between PD and NPD groups. In a randomized controlled trial (RCT) with 126 patients, Pulavarti et al. observed short-term improvements in pain, but these benefits did not persist beyond three months, indicating limited long-term efficacy [25]. Similarly, Budhiparama et al. reported no significant differences in anterior knee pain, functional outcomes, or complications between

Table 1 Comparison of baseline characteristics of the patients

Variables	Non-denervation Group *n*:46	Denervation Group *n*:45	*p*-value
Age (years ± SD)	67.9 ± 6.9	67.2 ± 9.4	0.775[a]
Sex (n, %)			0.589[b]
Male	8 (17.4%)	8 (17.8%)	
Female	38 (82.6%)	37 (82.2%)	
Side (n, %)			0.303[b]
Left	19 (41.3%)	22 (48.9%)	
Right	27 (58.7%)	23 (51.1%)	
Height (cm ± SD)	160.1 ± 8.7	163.1 ± 7.5	0.098[c]
Weight (kg ± SD)	80.8 ± 12.8	83.6 ± 10.7	0.254[a]
BMI (kg/m^2 ± SD)	31.5 ± 5.6	31.5 ± 4.6	0.796[c]
PF Osteoarthritis Grade (n, %)			0.559[b]
Grade 3	15 (32.6%)	15 (33.3%)	
Grade 4	31 (67.4%)	30 (66.7%)	
Preop ROM (°±SD)	118.3 ± 10.1	114.6 ± 10.0	0.080[c]
Preop VAS (score ± SD)	8.9 ± 0.8	9.1 ± 0.6	0.407[a]
Preop Kujala Score (score ± SD)	23.4 ± 10.4	23.8 ± 9.8	0.872[a]
Preop WOMAC (score ± SD)	77.7 ± 11.9	79.7 ± 13.6	0.457[a]

[a] Student t-test [b] Chi-square test [c] Mann-Whitney U test

Abbreviations, SD: Standard deviation, BMI: Body mass index, PF: Patellofemoral, VAS: Visual analog scale, WOMAC: Western Ontario and McMaster Universities Arthritis Index

the groups in a quasi-randomized study involving 78 patients, suggesting no substantial benefit of PD in TKA without patellar resurfacing [20]. Spencer et al., in a double-blind RCT with 142 participants, also found no significant differences in key outcomes such as the Oxford Knee Score, Bartlett Patella Score, WOMAC, and 12-Item Short Form Survey, concluding that patellar rim electrocautery does not offer clinical benefits and should not be recommended. Soo Jae Yim et al. similarly found no notable differences in outcomes between the electrocautery and non-electrocautery groups in 50 bilateral TKA patients [17]. Although some studies have shown the short-term efficacy of PD in reducing AKP, most evidence suggests no significant difference in pain relief or functional outcomes compared to standard TKA. This indicates that the clinical benefits of PD may be limited and not universally applicable, supporting our study's findings.

In contrast, several studies advocate for PD in TKA, reporting significant reductions in AKP and improved functional outcomes. However, a detailed analysis of the intergroup differences raises questions about the clinical relevance of these benefits. For example, Altay et al. found a 15-point improvement in KSS and a VAS reduction from 8.6 to 2.2 in the PD group, compared to a 9-point KSS improvement and a VAS reduction from 8.4 to 2.8 in the control group [14]. However, the intergroup differences for KSS (6 points) and VAS (0.6 points) do not exceed the MCID thresholds, suggesting limited clinical meaning [26, 27]. Similarly, Alomran reported better outcomes in the PD group for AKP and WOMAC scores, but these differences were below the MCID thresholds [15, 26–28]. Van Jonbergen et al. observed a 24% greater incidence of pain relief, but the absolute reduction in pain scores (1.8 points) fell short of the MCID [13, 26]. Other studies, such as those by Kanugula et al. and Eken et al., also reported differences in pain relief and functional scores that did not meet the MCID thresholds [21, 29]. Although these studies show statistically significant improvements, the differences are often not clinically meaningful, suggesting the benefits of PD may be overstated. Thus, the perceived advantages of PD do not always translate into real clinical practice.

To our knowledge, only 16 studies have compared PD versus non-denervation in TKA without patellar resurfacing (Table 3) [13–21, 25, 30, 29–34]. These studies show conflicting results, with some advocating PD for reducing AKP and improving functional outcomes, while others challenge its clinical benefits and long-term efficacy. Differences in study design, outcome measures, prosthesis design, and follow-up intervals also contribute to the mixed findings. Notably, few studies have used sample size calculation and MCID in their protocols or analyses [30]. In a recent meta-analysis, Zhou et al. included 15 studies with 1,232 patients, finding statistically significant differences favoring PD in several outcomes [22]. However, these differences were often not clinically meaningful, particularly regarding pain reduction. For instance, although the incidence of AKP was lower in the PD group (OR 0.58; 95% CI: 0.44–0.76), the reduction in pain scores (1.8 points) did not exceed the MCID of 1.37 points [26]. The meta-analysis also found no significant difference in VAS scores (MD = -0.14; 95% CI: -0.44 to 0.15; p=0.33) or ROM (MD=4.68; 95% CI: -1.58 to 10.93; p=0.14). Although KSS showed a statistically significant improvement (MD=1.54), it fell short of the MCID of 9 points. Similarly, the reduction in Oxford Knee Score (OKS) (MD = -0.76) did not meet the MCID threshold of 5 points [35]. A significant increase in the patellar score (PS) was also observed (MD=0.77), but this did not meet the MCID of 3 points. Zhou et al. concluded that while the differences favoring PD were statistically significant, they were not clinically meaningful, suggesting limited practical benefits [22].

The primary limitation of this study is the non-randomized design, which may introduce selection bias. Although we ensured that several baseline characteristics, including age, sex, BMI, grade of osteoarthritis, and preoperative clinical scores, were well-matched between the two groups, randomization would have provided a higher level of evidence by minimizing potential biases. Additionally, the decision to perform patellar denervation was at the discretion of the operating surgeon, which may

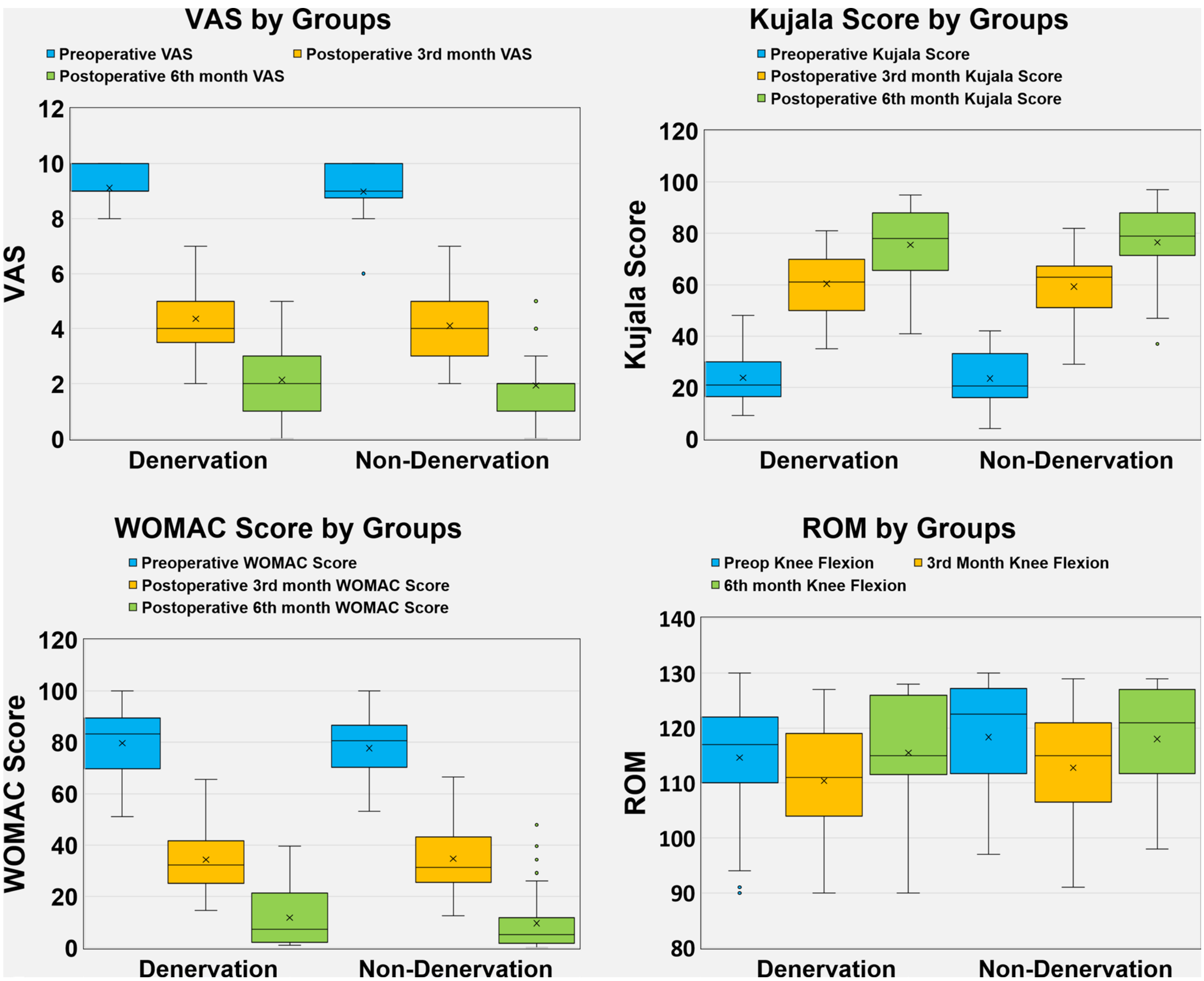

Fig. 2 Box-plot graphs showing the outcome measures for the denervation and non-denervation groups at different time points

introduce variability in treatment. However, all procedures were performed by the same surgical team, which minimizes variability in surgical technique and ensures consistency in care. The relatively short follow-up period of six months is another limitation, as it may not capture long-term outcomes. Nevertheless, this follow-up duration was sufficient to evaluate early postoperative effects, as previous studies have demonstrated that the short-term benefits of patellar denervation, if present, typically dissipate within three weeks to three months [25, 34]. The study's strengths include its prospective design, strict inclusion and exclusion criteria, and the use of validated outcome measures such as the Kujala score, WOMAC, and VAS. Furthermore, the study was adequately powered to detect clinically significant differences, enhancing the reliability of our findings.

In conclusion, the evidence does not support the use of circumferential PD as an additional method for reducing AKP or improving functional outcomes in TKA without patellar resurfacing, when compared to the non-denervation approach. Our findings support the use of a conservative approach to patellar management in TKA, reserving denervation for cases with specific clinical indications. Further studies exploring patient-specific factors that may predict better outcomes with PD could assist in the tailoring of surgical interventions to individual patient needs. Given the multifactorial nature of anterior knee pain after TKA, investigations into the mechanisms underlying AKP following TKA and the role of different patellar management strategies in addressing these mechanisms could also provide valuable insights.

Table 2 Comparison of outcome measures between and within groups

Variables	**Non-denervation Group *n*:46**	**Denervation Group *n*:45**	**Between groups comparisons *p*-value**
Preop VAS	9.0 ± 0.8	9.1 ± 0.7	0.406 [a]
Postop 3rd month VAS	4.1 ± 1.1	4.4 ± 1.1	0.298 [a]
Postop 6th month VAS	1.9 ± 1.3	2.1 ± 1.2	0.442 [a]
Repeated ANOVA	0.001	0.001	
Preop vs. Postop 3rd month	0.001 [b]	0.001 [b]	
Postop 3rd vs. 6th month	0.001 [b]	0.001 [b]	
Preop vs. Postop 6th month	0.001 [b]	0.001 [b]	
Preop Kujala Score	23.5 ± 10.4	23.8 ± 9.9	0.872 [a]
Postop 3rd month Kujala Score	59.3 ± 12.3	60.4 ± 12.4	0.654 [a]
Postop 6th month Kujala Score	76.5 ± 13.5	75.6 ± 14.2	0.752 [a]
Repeated ANOVA	0.001	0.001	
Preop vs. Postop 3rd month	0.001 [b]	0.001 [b]	
Postop 3rd vs. 6th month	0.001 [b]	0.001 [b]	
Preop vs. Postop 6th month	0.001 [b]	0.001 [b]	
Preop WOMAC Score	77.7 ± 12.0	79.7 ± 13.6	0.457 [a]
Postop 3rd month WOMAC Score	34.7 ± 13.1	34.3 ± 11.5	0.876 [a]
Postop 6th month WOMAC Score	9.6 ± 10.8	11.8 ± 11.2	0.347 [a]
Repeated ANOVA	0.001	0.001	
Preop vs. Postop 3rd month	0.001 [b]	0.001 [b]	
Postop 3rd vs. 6th month	0.001 [b]	0.001 [b]	
Preop vs. Postop 6th month	0.001 [b]	0.001 [b]	
Preop ROM	118.3 ± 10.1	114.6 ± 10.0	0.045 [c]
Postop 3rd month ROM	112.7 ± 11.0	110.3 ± 10.5	0.179 [c]
Postop 6th month ROM	118.0 ± 9.9	115.5 ± 9.9	0.188 [c]
Repeated ANOVA	0.001	0.001	
Preop vs. Postop 3rd month	0.030 [d]	0.123 [d]	
Postop 3rd vs. 6th month	0.045 [d]	0.046 [d]	
Preop vs. Postop 6th month	0.985 [d]	0.905 [d]	

Data is presented as mean ± SD, [a] Student t-test, [b] Paired Sample t-test with Bonferroni correction, [c] Mann-Whitney U test. [d] Tukey's HSD with Bonferroni Correction

Abbreviations VAS: Visual analog scale, WOMAC: Western Ontario and McMaster Universities Arthritis Index, ANOVA: Analysis of variances

Table 3 List of the previous studies comparing patellar denervation versus non-denervation without resurfacing in TKA in the current literature

#	Author	Year	Study design	Sample size (D/ND)	Mean Follow-up (months)	Outcome Measures	Conclusions
1	van Jonbergen et al.	2011	RCT	131/131	12	Waters and Bentley AKP Scale American Knee Society Score WOMAC	PD is better
2	Altay et al.	2012	RCT	35 R / 35 L knees Single-stage bilateral TKA	36	Knee Society Clinical Rating System Feller AKP Score, VAS and ROM	PD is better
3	Baliga et al.	2012	RCT	94/91	12	VAS for AKP and Oxford Knee Score	No difference
4	Sun et al.	2012	RS	76/76	55	AKP, Knee Society Score, Feller AKP Score, ROM, Satisfaction	PD is better.
5	Pulavarti et al.	2014	RCT	63/63	26	VAS, Oxford scores, Knee Society Score, Knee Society Function score, Bartlet patellar score, ADL and UCLA scores	AKP was better in PD at 3rd month but not in the 12th and 24th months
6	Yim et al.	2012	RCT	50 R / 50 L knees Single-stage bilateral TKA	21	Knee Society Clinical Rating Score Feller's AKP score, ROM	No difference
7	Alomran et al.	2015	RCT	92/92	37.4	Waters and Bentley AKP Scale WOMAC	PD is better
8	Kwon et al.	2015	RCT	50/50	60	American Knee Society Feller's AKP score and WOMAC	No difference
9	Al-Shamari	2017	PC	19/16	12	VAS, Knee Society Score	Better VAS but similar functional score
10	Sadigursky et al.	2017	RC	41/40	NR	VAS, Knee Score System, WOMAC, ROM	No difference in VAS, but better function
11	Motififard et al.	2018	PC	46/46	10	VAS for AKP, Knee Society Score, PF Score	PD is better in the first 3 weeks, but no difference later
12	Shetty et al.	2019	PC	33/33	4	Feller's AKP score and WOMAC ROM, Knee Society Score	No difference
13	Budhiparama et al.	2020	RCT	73 R / 73 L knees Single-stage bilateral TKA	30	ROM, Kujala score, VAS, Oxford knee score, and Knee Injury and Osteoarthritis Outcome Score	No difference
14	Kanugula et al.	2020	PC	65 / 65	18	VAS, WOMAC, Feller's AKP score, Knee Society Score	PD is better
15	Eken et al.	2022	RC	131/147	32	Knee Society Clinical Rating System, SF-36, VAS, Feller's AKP score	PD is better
16	Spencer et al.	2023	RCT	40/78	12	Oxford Knee Score, WOMAC, Bartlett Patella Score, 12-Item Short Form Survey	No difference
17	Current study	2024	PC	46/47	6	VAS, Kujala Score, WOMAC, ROM	No difference

Abbreviations RCT: Randomized clinical trial, PC: Prospective cohort, RC: Retrospective cohort, R: Right, L: Left, TKA: Total knee arthroplasty, D: Denervation, ND: Non-denervation, AKP: Anterior knee pain, VAS: Visual analog scale, ROM: Range of motion, PF: Patellofemoral, WOMAC: Western Ontario and McMaster Universities Arthritis Index, ADL: Activity of daily living, UCLA: University of California Los Angeles, SF-36: Short-form 36

Abbreviations

AKP Anterior Knee Pain
TKA Total Knee Arthroplasty
PD Patellar Denervation
NPD Non-Patellar Denervation
ROM Range of Motion
WOMAC Western Ontario and McMaster Universities Arthritis Index
VAS Visual Analog Scale
MCID Minimum Clinically Important Difference
RCT Randomized Controlled Trial
KSS Knee Society Score
OKS Oxford Knee Score
PS Patellar Score

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Author contributions
FD, AY, VB and OK conceived and designed the study. Data was acquired by VB, IE, AY, and OK. VB, OK, OFE, FD and AY were responsible for the analysis and interpretation of data. The manuscript was drafted by OFE, FD, OK, and AY, while critical revisions were made by OFE, FD, OK, and IE. All authors have read and approved the final manuscript.

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Data availability
Data are available from the authors upon reasonable request.

Declarations

Ethical approval
The Institutional Review Board approved the study protocol (23.11.2023-16/9).

Informed consent
Informed consent was obtained from the participants.

Competing interests
The authors declare no competing interests.

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