

Original Article

Impact of Physiotherapy on Kinesiophobia and Knee Pain After Knee Replacements

Ayesha Izhar¹, Maham Naeem¹, Eisha-Tur Raazia¹, Mehwish Shahzadi¹, Hafiza Ramal¹, Anam Abbas²

¹ University of Management and Technology, Lahore, Pakistan

² Lecturer, University of Management and Technology, Lahore, Pakistan

*Corresponding author: Anam Abbas, anam.abbas@umt.edu.pk

“Cite this Article” | Received: 21 August 2025; Accepted: 02 December 2025; Published: 30 December 2025

ABSTRACT

Background: Pain and fear of movement may restrict participation in rehabilitation after total knee replacement. Evidence regarding their relationship with routine physiotherapy attendance in Pakistan remains limited. **Objective:** To determine the association of physiotherapy-session exposure with kinesiophobia and knee-pain intensity after total knee replacement. **Methods:** This analytical cross-sectional study included 144 patients aged 40–60 years who were assessed one to three months after total knee replacement at hospitals and private physiotherapy clinics in Lahore. Participants were classified as having higher exposure if they had completed five or more physiotherapy sessions and lower exposure if they had completed fewer than five sessions. Pain was assessed using the Numeric Pain Rating Scale, and kinesiophobia was assessed using the 11-item Tampa Scale for Kinesiophobia. Associations were examined using Pearson's chi-square test. **Results:** Each exposure group included 72 participants. Kinesiophobia was present in 12 (16.7%) participants in the higher-exposure group and 55 (76.4%) in the lower-exposure group ($\chi^2(1)=51.61$, $p<0.001$). The crude risk ratio was 0.22 (95% CI 0.13–0.37). No or mild pain was reported by 75.0% of the higher-exposure group compared with 12.5% of the lower-exposure group, whereas moderate or severe pain was reported by 25.0% and 87.5%, respectively ($\chi^2(3)=59.05$, $p<0.001$). **Conclusion:** Greater physiotherapy-session exposure was associated with lower kinesiophobia and less severe knee pain; however, the cross-sectional design did not establish causality. **Keywords:** Total Knee Replacement; Kinesiophobia; Physiotherapy; Postoperative Rehabilitation; Knee Pain; Tampa Scale for Kinesiophobia.

EDITORIAL INFORMATION

Author Contributions: Concept: AA, AI; Design: AA, MN; Data Collection: AI, MN, ER, MS, HR; Analysis: AA, AI, MN; Drafting: AI, MN, ER, MS, HR, AA.

Ethical Approval: University of Management and Technology, Lahore, Pakistan.

Informed Consent: Written informed consent was obtained from all participants

Conflict of Interest: The authors declare no conflict of interest; **Funding:** No external funding; **Data Availability:** Available from the corresponding author on reasonable request; **Acknowledgments:** N/A.

INTRODUCTION

Total knee replacement is an established surgical procedure for patients with advanced knee-joint disease whose pain and functional limitations are no longer adequately controlled through conservative management. It is commonly performed for severe osteoarthritis and other destructive joint conditions to reduce pain, restore mobility, and improve participation in activities of daily living. Despite generally favourable surgical outcomes, a clinically important proportion of patients continue to experience pain, restricted mobility, functional limitations, and dissatisfaction during postoperative recovery (1,2). These persistent symptoms cannot always be explained by prosthetic, anatomical, or surgical factors alone and may also be influenced by psychological and behavioural responses to pain (3).

Kinesiophobia is an excessive and disabling fear of movement or physical activity arising from the belief that movement may cause pain, injury, or reinjury. Within the fear-avoidance model, pain-related fear may lead patients to restrict movement, avoid therapeutic exercise, and reduce participation in everyday activities. Continued avoidance can contribute to physical deconditioning, impaired joint mobility, reduced confidence, and prolonged disability (4). Kinesiophobia has consequently emerged as an important patient-related factor in recovery after knee surgery, particularly when patients associate postoperative movement with tissue damage or worsening pain.

Evidence indicates that kinesiophobia is associated with poorer functional recovery after total knee replacement. Patients with greater fear of movement may demonstrate reduced knee range of motion, lower physical activity, slower gait, poorer self-reported function, and impaired health-related quality of life. High levels of kinesiophobia at hospital discharge have also been associated with less favourable short-term outcomes after knee replacement surgery (5). A systematic review similarly concluded that greater kinesiophobia was associated with poorer functional outcomes and restricted range of motion during the early and intermediate postoperative periods (6). These findings suggest that postoperative recovery depends not only on surgical correction but also on the patient's willingness and confidence to resume movement.

Pain and kinesiophobia may reinforce one another during rehabilitation. Greater pain can increase fear of movement, while fear-driven activity restriction can interfere with exercise participation and functional restoration. Pain catastrophizing, anxiety, reduced self-efficacy, and limited social support may further strengthen this relationship. Among patients undergoing total knee arthroplasty, pain catastrophizing and kinesiophobia have been negatively associated with exercise adherence, whereas exercise self-efficacy may partially reduce their adverse influence on rehabilitation behaviour (7). Recognition of these psychological and behavioural factors is therefore important when evaluating postoperative pain and recovery.

Physiotherapy is routinely recommended after total knee replacement to facilitate safe mobilization, restore knee movement and muscle performance, improve walking ability, and promote independence in daily activities. Structured rehabilitation may also provide graded exposure to movement, reassurance, therapeutic education, and repeated successful movement experiences that help patients challenge fear-related beliefs. Randomized trials have reported reductions in pain and kinesiophobia following postoperative relaxation exercises and elastic-band exercise programmes, supporting the potential value of structured physical and psychologically informed rehabilitation (8,9). However, the content, frequency, duration, accessibility, and adherence to physiotherapy vary considerably between patients and clinical settings.

Most previous studies have been conducted in healthcare systems outside Pakistan or have evaluated standardized interventions under controlled research conditions. Comparatively limited evidence is available regarding the relationship between routine physiotherapy attendance, postoperative pain, and kinesiophobia among patients receiving care across hospitals and private rehabilitation clinics in Lahore. Evaluation of this association may help identify patients at risk of fear-related movement avoidance and support the development of more responsive postoperative rehabilitation pathways. Therefore, this study aimed to determine the association of physiotherapy-session exposure with kinesiophobia and knee-pain intensity among patients assessed one to three months after total knee replacement. It was hypothesized that patients who had completed five or more physiotherapy sessions would have a lower prevalence of kinesiophobia and a more favourable distribution of knee-pain severity than patients who had completed fewer than five sessions.

MATERIALS AND METHODS

An analytical cross-sectional study was conducted among patients who had undergone total knee replacement and were receiving postoperative care at Ghurki Trust Teaching Hospital, Evercare Hospital, Horizon Hospital, and selected private physiotherapy clinics in Lahore, Pakistan. Data collection was completed over a period of two months following institutional authorization of the research. The study evaluated the association between the number of postoperative physiotherapy sessions attended and the presence of kinesiophobia and knee-pain intensity at a single assessment conducted between one and three months after surgery.

Male and female patients aged 40–60 years who had undergone unilateral or bilateral total knee replacement within the preceding one to three months were eligible. Participants were required to have attended either five or more postoperative physiotherapy sessions or fewer than five sessions by the time of assessment. Patients were excluded if they had a neurological disorder affecting gait or balance,

cognitive impairment that prevented reliable questionnaire completion, a history of psychiatric illness, postoperative cancer or infection, concurrent participation in another research study, or incomplete demographic or surgical information.

A sample size of 143 participants was calculated using the World Health Organization sample-size calculator at a 95% confidence level and 5% margin of error. Recruitment was continued during the approved data-collection period, and 144 eligible participants were ultimately included in the analysis. Participants were selected through non-probability convenience sampling from orthopaedic and physiotherapy services at the participating centres.

For analysis, participants were classified according to the number of postoperative physiotherapy sessions completed before assessment. Those who had attended five or more sessions were categorized as the higher physiotherapy-session exposure group, whereas those who had attended fewer than five sessions were categorized as the lower physiotherapy-session exposure group. These categories represented differences in routine rehabilitation attendance rather than allocation to a standardized research intervention. The content, duration, and frequency of physiotherapy were determined by routine clinical practice at the participating centres.

Data were collected using a demographic and clinical information form, the Numeric Pain Rating Scale, and the 11-item Tampa Scale for Kinesiophobia. Demographic and clinical information included age, sex, laterality of knee replacement, postoperative duration, and number of physiotherapy sessions attended. The type of surgery was classified as right unilateral, left unilateral, or bilateral total knee replacement.

Knee-pain intensity was assessed using the Numeric Pain Rating Scale, on which participants rated their pain from 0 to 10, with 0 representing no pain and 10 representing the worst imaginable pain. For categorical analysis, scores were classified as no pain at 0, mild pain at 1–3, moderate pain at 4–6, and severe pain at 7–10. The Numeric Pain Rating Scale is commonly used as a brief patient-reported measure of pain intensity in musculoskeletal and postoperative populations.

Fear of movement was assessed using the 11-item Tampa Scale for Kinesiophobia. Each item was rated on a four-point Likert scale ranging from 1, strongly disagree, to 4, strongly agree, producing a total score from 11 to 44, with higher scores indicating greater fear of movement or reinjury. In accordance with the operational classification applied in the study, total scores of 25 or less were categorized as no clinically relevant kinesiophobia, whereas scores greater than 25 were categorized as kinesiophobia. The same scoring definition was applied consistently to all participants and analyses (6,10).

Potential participants were approached at the participating hospitals and physiotherapy clinics and were screened against the eligibility criteria. The purpose and procedures of the study were explained before enrolment. Written informed consent was obtained from each participant before data collection. Eligible participants completed the demographic form, Numeric Pain Rating Scale, and Tampa Scale for Kinesiophobia. Questionnaire responses and relevant surgical information were reviewed for completeness before inclusion in the analytical dataset. Participant information was handled confidentially and used solely for research purposes. Administrative permission was obtained from the participating institutions before recruitment and data collection.

Data were entered and analysed using IBM SPSS Statistics version 24.0. Participant characteristics were summarized using frequencies and percentages for categorical variables and means with standard deviations for continuous variables. Age was summarized separately for the higher- and lower-session exposure groups. Sex, type of knee replacement, pain-severity categories, and kinesiophobia categories were presented as frequencies and percentages.

Pearson's chi-square test was used to examine the association between physiotherapy-session exposure and the presence of kinesiophobia and between physiotherapy-session exposure and categorized pain intensity. The assumptions of the chi-square test were assessed using the expected cell frequencies. Test statistics were reported with their corresponding degrees of freedom and p-values. A two-sided p-value of less than 0.05 was considered statistically significant. Because the study was cross-sectional and

physiotherapy exposure was not experimentally assigned, the analyses were interpreted as unadjusted associations and not as evidence of a causal treatment effect.

RESULTS

A total of 144 participants were included in the analysis, with 72 participants in the higher physiotherapy-session exposure group and 72 in the lower physiotherapy-session exposure group. All reported participants were included in the descriptive and inferential analyses.

Table 1. Demographic Characteristics of Participants According to Physiotherapy-Session Exposure

Characteristic	Higher exposure, ≥5 sessions (n=72)	Lower exposure, <5 sessions (n=72)	Total (N=144)	Test statistic	p-value
Age, years, mean ± SD	52.20 ± 5.54	53.47 ± 4.93		t(140.1) = -1.45	0.148
Mean difference (95% CI)	-1.27 (-3.00 to 0.46)	Reference		—	—
Sex, n (%)				$\chi^2(1) = 0.46$	0.497
Male	31 (43.1)	27 (37.5)	58 (40.3)	—	—
Female	41 (56.9)	45 (62.5)	86 (59.7)	—	—

SD: standard deviation; CI: confidence interval. The age comparison was calculated using Welch's independent-samples t-test. Sex distribution was compared using Pearson's chi-square test. The mean age was 52.20 ± 5.54 years in the higher-exposure group and 53.47 ± 4.93 years in the lower-exposure group. The mean between-group difference was -1.27 years (95% CI -3.00 to 0.46), with no statistically significant age difference between the groups (p=0.148). Overall, 86 participants (59.7%) were female and 58 (40.3%) were male. Sex distribution was also similar between the groups (p=0.497).

Table 2. Type of Total Knee Replacement According to Physiotherapy-Session Exposure

Type of surgery	Higher exposure, ≥5 sessions (n=72)	Lower exposure, <5 sessions (n=72)	Total (N=144)
Right unilateral TKR	31 (43.1)	22 (30.6)	53 (36.8)
Left unilateral TKR	32 (44.4)	31 (43.1)	63 (43.8)
Bilateral TKR	9 (12.5)	19 (26.4)	28 (19.4)

Values are presented as n (%). TKR: total knee replacement. Pearson's $\chi^2(2)=5.12$, p=0.077; Cramér's V=0.19. Left unilateral TKR was the most frequent surgical category overall, accounting for 63 of 144 procedures (43.8%). Bilateral TKR was more frequent in the lower-exposure group than in the higher-exposure group, occurring in 19 (26.4%) and 9 (12.5%) participants, respectively. However, the overall distribution of surgical type did not reach statistical significance ($\chi^2(2)=5.12$, p=0.077). The magnitude of association was small (Cramér's V=0.19).

Table 3. Knee-Pain Intensity According to Physiotherapy-Session Exposure

NPRS pain category	Higher exposure, ≥5 sessions (n=72)	Lower exposure, <5 sessions (n=72)	Total (N=144)
No pain	16 (22.2)	0 (0.0)	16 (11.1)
Mild pain	38 (52.8)	9 (12.5)	47 (32.6)
Moderate pain	10 (13.9)	31 (43.1)	41 (28.5)
Severe pain	8 (11.1)	32 (44.4)	40 (27.8)

Values are presented as n (%). NPRS: Numeric Pain Rating Scale. Pearson's $\chi^2(3)=59.05$, p<0.001; Cramér's V=0.64. Pain severity differed significantly according to physiotherapy-session exposure ($\chi^2(3)=59.05$, p<0.001). In the higher-exposure group, 54 participants (75.0%) reported either no pain or mild pain, compared with 9 participants (12.5%) in the lower-exposure group. Conversely, moderate or severe pain was reported by 18 participants (25.0%) in the higher-exposure group and 63 participants (87.5%) in the lower-exposure group. No participant in the lower-exposure group reported being pain-free. The association between physiotherapy-session exposure and pain category was large in magnitude (Cramér's V=0.64).

Table 4. Presence of Kinesiophobia According to Physiotherapy-Session Exposure

TSK-11 classification	Higher exposure, ≥5 sessions (n=72)	Lower exposure, <5 sessions (n=72)	Total (N=144)
No kinesiophobia, score ≤25	60 (83.3)	17 (23.6)	77 (53.5)
Kinesiophobia, score >25	12 (16.7)	55 (76.4)	67 (46.5)

Values are presented as n (%). TSK-11: 11-item Tampa Scale for Kinesiophobia. Pearson's $\chi^2(1)=51.61$, p<0.001; $\phi=0.60$. Kinesiophobia was identified in 12 participants (16.7%) in the higher-exposure group and

55 participants (76.4%) in the lower-exposure group. The prevalence of kinesiophobia therefore differed significantly between the groups ($\chi^2(1)=51.61$, $p<0.001$), with a large association ($\phi=0.60$).

Table 5. Unadjusted Association Between Physiotherapy-Session Exposure and Kinesiophobia

Measure	Estimate	95% CI	p-value
Risk ratio	0.22	0.13–0.37	<0.001
Odds ratio	0.06	0.03–0.14	<0.001
Absolute risk difference	–59.7 percentage points	–72.8 to –46.7	<0.001

The lower physiotherapy-session exposure group was used as the reference category. CI: confidence interval. Estimates are unadjusted and should be interpreted as measures of association rather than causal treatment effects. Participants in the higher physiotherapy-session exposure group had approximately 78% lower crude prevalence of kinesiophobia than those in the lower-exposure group (risk ratio 0.22, 95% CI 0.13–0.37). The unadjusted odds of kinesiophobia were also lower in the higher-exposure group (odds ratio 0.06, 95% CI 0.03–0.14). The absolute difference in kinesiophobia prevalence between the groups was –59.7 percentage points (95% CI –72.8 to –46.7).

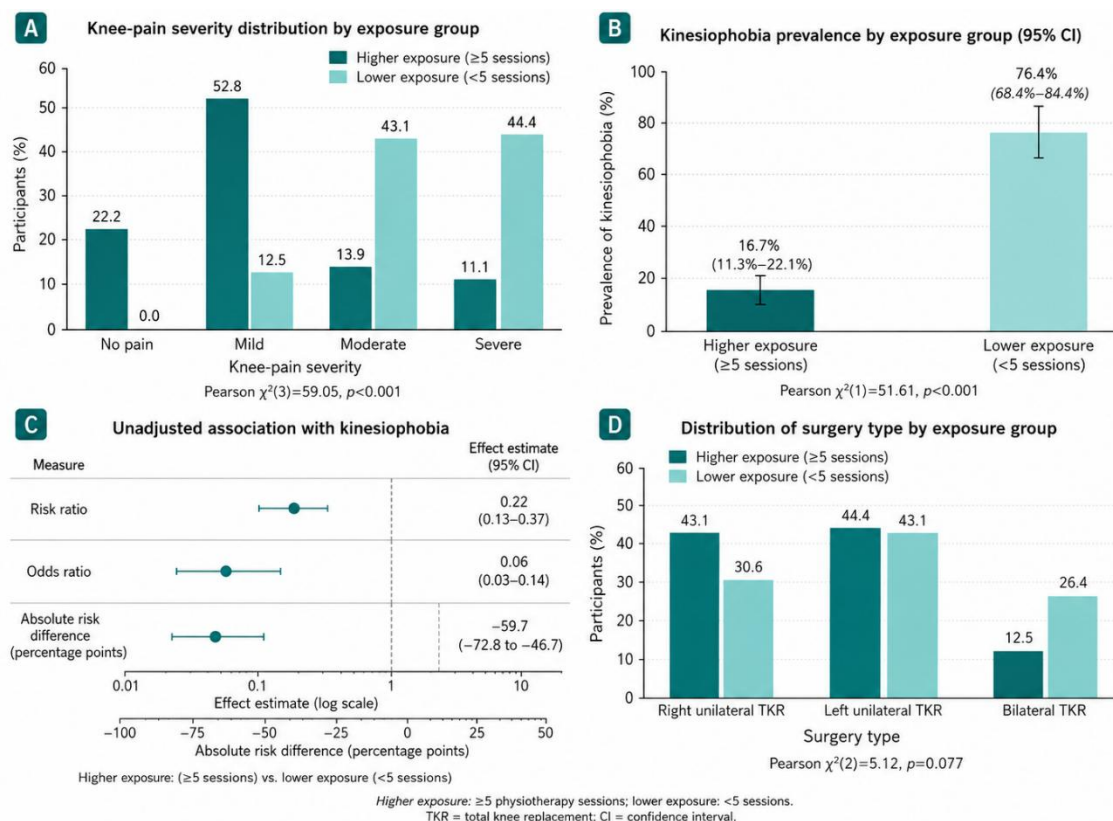


Figure 1 Figure legend: Panel A presents the distribution of knee-pain severity according to physiotherapy-session exposure. Among participants who completed five or more sessions, 22.2% reported no pain and 52.8% reported mild pain, whereas moderate and severe pain predominated in the lower-exposure group at 43.1% and 44.4%, respectively. Panel B shows that kinesiophobia was present in 16.7% of the higher-exposure group compared with 76.4% of the lower-exposure group, with 95% confidence intervals. Panel C displays the unadjusted association estimates for kinesiophobia: risk ratio 0.22 (95% CI 0.13–0.37) and odds ratio 0.06 (95% CI 0.03–0.14). Panel D shows the distribution of surgical type; bilateral total knee replacement was more frequent in the lower-exposure group than in the higher-exposure group, at 26.4% versus 12.5%. The figure demonstrates a pronounced gradient across the principal outcomes. No or mild pain was reported by 75.0% of participants in the higher-exposure group compared with 12.5% in the lower-exposure group, while moderate or severe pain occurred in 25.0% and 87.5%, respectively. Kinesiophobia prevalence differed by 59.7 percentage points between groups and was approximately 78% lower in the higher-exposure group on crude risk-ratio analysis. These estimates represent unadjusted cross-sectional associations and should not be interpreted as independent causal effects of physiotherapy attendance.

Overall, higher physiotherapy-session exposure was strongly associated with a more favourable distribution of knee-pain severity and a lower prevalence of kinesiophobia. These findings remained descriptive and unadjusted because participant-level data required for multivariable modelling were not available in the reported results. Accordingly, the observed associations should not be interpreted as

evidence that the number of physiotherapy sessions independently caused the differences in pain or kinesiophobia.

DISCUSSION

This study identified substantial differences in knee-pain severity and kinesiophobia according to postoperative physiotherapy-session exposure among patients assessed one to three months after total knee replacement. Participants who had completed five or more physiotherapy sessions were more likely to report no or mild pain and were less likely to meet the study-defined threshold for kinesiophobia than those who had completed fewer than five sessions. The crude prevalence of kinesiophobia was 16.7% in the higher-exposure group and 76.4% in the lower-exposure group, representing an absolute difference of 59.7 percentage points. Similarly, 75.0% of participants in the higher-exposure group reported no or mild pain compared with 12.5% in the lower-exposure group. These findings indicate a strong cross-sectional association between greater participation in postoperative physiotherapy and more favourable pain and fear-of-movement outcomes; however, they do not establish that physiotherapy-session attendance independently caused these differences.

The observed association between physiotherapy exposure and kinesiophobia was consistent with previous evidence showing that fear of movement is related to poorer recovery after total knee replacement. De Vroey et al. reported that high kinesiophobia at hospital discharge was associated with less favourable short-term patient-reported and performance-based outcomes following knee replacement surgery (5). Brown et al., in a systematic review, similarly concluded that greater kinesiophobia was associated with poorer functional outcomes and reduced knee range of motion during postoperative recovery (6). These findings support the clinical relevance of identifying fear-related movement avoidance early, particularly because patients who anticipate pain or reinjury may restrict activity and participate less fully in rehabilitation.

The lower prevalence of kinesiophobia among participants with greater physiotherapy-session exposure was also compatible with findings from controlled rehabilitation studies. Eymir et al. found that relaxation exercise therapy improved pain, muscle strength, and kinesiophobia during short-term recovery after total knee arthroplasty (8). Cetinkaya and Karakoyun likewise reported improvements in pain, functional status, psychological outcomes, and kinesiophobia following an elastic-band exercise programme (9). Although these trials evaluated standardized interventions and therefore differ methodologically from the present observational study, they suggest that structured exercise, therapeutic guidance, and repeated exposure to movement may help reduce fear-related avoidance.

Several mechanisms may plausibly explain the relationship observed in the present study. Physiotherapy can provide graded exposure to movement, progressive strengthening, gait practice, functional retraining, reassurance, and education regarding expected postoperative symptoms. Repeated completion of movements without injury may reduce threat perception and improve confidence in the operated knee. Physiotherapist supervision may also assist patients in distinguishing expected postoperative discomfort from symptoms requiring medical review. Within the fear-avoidance framework, these experiences may reduce pain-related fear, avoidance behaviour, and physical deconditioning while promoting movement self-efficacy (4). However, these mechanisms were not measured directly and should be considered explanatory hypotheses rather than demonstrated pathways.

The association between pain and physiotherapy-session exposure was also clinically notable. Moderate or severe pain was reported by 87.5% of participants in the lower-exposure group compared with 25.0% in the higher-exposure group. Persistent pain after total knee replacement can arise from several interacting factors, including inflammatory responses, arthrofibrosis, prosthetic or anatomical problems, altered pain processing, and psychosocial influences (1,2). Pain may increase fear of movement and discourage participation in exercise, while activity restriction may contribute to stiffness, weakness, and reduced functional tolerance. Yao et al. reported that patients with kinesiophobia experienced greater pain and poorer rehabilitation outcomes during hospitalization after total knee replacement (11). Zhou et al. also found that pain catastrophizing and kinesiophobia were negatively associated with exercise adherence and

that exercise self-efficacy contributed to this relationship (7). These observations suggest that pain and fear of movement should be assessed together rather than treated as independent postoperative concerns.

The direction of the relationship identified in this study remains uncertain. Greater physiotherapy attendance may have contributed to lower pain and fear, but patients with lower pain, greater mobility, better financial resources, stronger family support, or easier access to rehabilitation may also have been more able to attend physiotherapy. Conversely, severe pain, postoperative complications, bilateral surgery, transportation difficulties, or fear of movement may have reduced attendance. This possibility of reverse causation is particularly important because physiotherapy-session exposure and outcomes were assessed during the same postoperative period.

The distribution of surgery type may also have influenced the results. Bilateral total knee replacement was more frequent in the lower-exposure group than in the higher-exposure group, although the overall difference in surgery-type distribution did not reach statistical significance. Bilateral surgery may be associated with greater postoperative symptom burden and more demanding rehabilitation requirements. Age and sex distributions were broadly similar between the exposure groups, but other clinically relevant factors—including baseline pain, preoperative function, diagnosis, postoperative duration, analgesic use, comorbidities, psychological status, socioeconomic circumstances, rehabilitation content, and treatment adherence—were not included in adjusted analyses. The crude association estimates may therefore reflect residual confounding.

The study had several strengths. It included an equal number of participants in the two exposure groups, recruited patients from multiple hospitals and private physiotherapy settings, and evaluated both a physical symptom and a psychologically relevant rehabilitation outcome. The use of the Numeric Pain Rating Scale and the 11-item Tampa Scale for Kinesiophobia also provided clinically interpretable patient-reported measures. In addition, the reported contingency-table data were internally sufficient to verify the principal chi-square analyses and derive crude risk-based association estimates.

The findings should nevertheless be interpreted in view of important limitations. The cross-sectional design prevented determination of temporality and causal inference. Convenience sampling may have introduced selection bias and limited generalizability beyond the participating Lahore facilities. Physiotherapy exposure was defined only by the number of sessions and did not account for treatment content, duration, intensity, progression, therapist expertise, home-exercise adherence, or care received at different centres. The one-to-three-month postoperative assessment period was broad, and recovery stage was not incorporated into the reported analysis. Pain and kinesiophobia were categorized, resulting in loss of information from their original continuous scores. The TSK-11 cutoff requires confirmation against the validated version used in the study, including language and scoring procedures. Baseline pain and kinesiophobia were unavailable, and no multivariable analysis was conducted to control for clinical, surgical, psychological, or socioeconomic confounding. The study also did not assess functional performance, range of motion, quality of life, exercise adherence, or long-term recovery.

Despite these limitations, the findings have practical implications. Postoperative services may benefit from routinely screening for pain severity and fear of movement, particularly among patients attending relatively few physiotherapy sessions. Patients with high kinesiophobia may require additional education, graded activity, confidence-building strategies, and closer follow-up to support participation in rehabilitation. Future prospective studies should assess patients before surgery and at standardized postoperative intervals, document the precise physiotherapy programme, retain continuous outcome scores, and adjust for relevant confounders. Randomized trials or well-designed longitudinal studies would be required to determine whether increasing physiotherapy exposure directly reduces pain and kinesiophobia after total knee replacement.

CONCLUSION

Among patients assessed one to three months after total knee replacement, completion of five or more physiotherapy sessions was associated with a lower prevalence of kinesiophobia and a more favourable distribution of knee-pain severity than completion of fewer than five sessions. These findings support the clinical importance of monitoring rehabilitation attendance, pain, and fear of movement during early postoperative recovery. Because the study was cross-sectional and the analyses were unadjusted, the observed differences should be interpreted as associations rather than independent effects of physiotherapy.

REFERENCES

1. Li JW, Ma YS, Xiao LK. Postoperative pain management in total knee arthroplasty. *Orthop Surg.* 2019;11(5):755-61. doi:10.1111/os.12535.
2. Li CY, Ng Cheong Chung KJ, Ali OME, Chung NDH, Li CH. Literature review of the causes of pain following total knee replacement surgery: prosthesis, inflammation and arthrofibrosis. *EFORT Open Rev.* 2020;5(9):534-43. doi:10.1302/2058-5241.5.200031.
3. Belford K, Gallagher N, Dempster M, Wolfenden M, Hill J, Blaney J, et al. Psychosocial predictors of outcomes up to one year following total knee arthroplasty. *Knee.* 2020;27(3):1028-34. doi:10.1016/j.knee.2020.03.006.
4. Phansopkar P. Fear avoidance model of kinesiophobia and rehabilitation. *J Med Pharm Allied Sci.* 2021;10(5):3529-33. doi:10.22270/jmpas.V10I5.1267.
5. De Vroey H, Claeys K, Shariatmadar K, Weygers I, Vereecke E, Van Damme G, et al. High levels of kinesiophobia at discharge from the hospital may negatively affect the short-term functional outcome of patients who have undergone knee replacement surgery. *J Clin Med.* 2020;9(3):738.
6. Brown OS, Hu L, Demetriou C, Smith TO, Hing CB. The effects of kinesiophobia on outcome following total knee replacement: a systematic review. *Arch Orthop Trauma Surg.* 2020;140(12):2057-70. doi:10.1007/s00402-020-03582-5.
7. Zhou Y, Gao W, Gao S, Guo X, Liu M, Cao C. Pain catastrophizing, kinesiophobia and exercise adherence in patients after total knee arthroplasty: the mediating role of exercise self-efficacy. *J Pain Res.* 2023;16:3993-4004. doi:10.2147/JPR.S432106.
8. Eymir M, Unver B, Karatosun V. Relaxation exercise therapy improves pain, muscle strength, and kinesiophobia following total knee arthroplasty in the short term: a randomized controlled trial. *Knee Surg Sports Traumatol Arthrosc.* 2022;30(8):2776-85. doi:10.1007/s00167-021-06657-x.
9. Cetinkaya F, Karakoyun A. The effects of elastic band exercise on the pain, kinesiophobia, functional, and psychological status after total knee arthroplasty: a randomized controlled trial. *Clin Rheumatol.* 2022;41(10):3179-88. doi:10.1007/s10067-022-06266-0.
10. Sayilan AA, Saltan A, Mert S, Ankarali H. Identifying relationships between kinesiophobia, functional level, mobility, and pain in older adults after surgery. *Aging Clin Exp Res.* 2022;34(4):801-9. doi:10.1007/s40520-021-02011-w.
11. Yao Y, Zhang Q, Cui S, Guo X. Impact of kinesiophobia after total knee replacement on rehabilitation outcomes during hospitalization. *Research Square.* 2024. doi:10.21203/rs.3.rs-4112352/v1.
12. Nunez-Cortes R, Lopez-Bueno L, Lopez-Bueno R, Cuenca-Martinez F, Suso-Marti L, Silvestre A, et al. Acute effects of in-hospital resistance training on clinical outcomes in patients undergoing total knee arthroplasty: a randomized controlled trial. *Am J Phys Med Rehabil.* 2024;103(5):401-9. doi:10.1097/PHM.0000000000002366.

13. Isaji Y, Nakamura M, Mori K, Aoyama N. Trends and associations between kinesiophobia and knee function from preoperatively to three and six months postoperatively in patients after anterior cruciate ligament reconstruction surgery. *J Bodyw Mov Ther.* 2024;37:290-5. doi:10.1016/j.jbmt.2023.11.036.
14. Hidaka R, Tanaka T, Hashikura K, Oka H, Matsudaira K, Moro T, et al. Association of high kinesiophobia and pain catastrophizing with quality of life in severe hip osteoarthritis: a cross-sectional study. *BMC Musculoskelet Disord.* 2023;24(1):388. doi:10.1186/s12891-023-06496-6.
15. Ohji S, Aizawa J, Hirohata K, Ohmi T, Mitomo S, Koga H, et al. Association between landing biomechanics, knee pain, and kinesiophobia in athletes following anterior cruciate ligament reconstruction: a cross-sectional study. *PM R.* 2023;15(5):552-62. doi:10.1002/pmrj.12827.
16. Raizah A, Alhefzi A, Alshubruqi AAM, Hoban M, Ahmad I, Ahmad F. Perceived kinesiophobia and its association with return to sports activity following anterior cruciate ligament reconstruction surgery: a cross-sectional study. *Int J Environ Res Public Health.* 2022;19(17):10776. doi:10.3390/ijerph191710776.
17. Bello AI, Kanebi L, Iyor FT, Adegoke BOA. A survey of kinesiophobia as a correlate of lower-limb function in patients with lower-extremity fractures during inpatient postoperative rehabilitation. *Health Sci Investig J.* 2020;1(2):128-34. doi:10.46829/hsijournal.2020.12.1.2.128-134.
18. Everhart JS, Chafitz AJ, Harris KM, Schiele SE, Emery CF, Flanigan DC. Pain perception and coping strategies influence early outcomes following knee surgery in athletes. *J Sci Med Sport.* 2020;23(1):100-4. doi:10.1016/j.jsams.2019.09.011.
19. Domenech J, Sanchis-Alfonso V, Lopez L, Espejo B. Influence of kinesiophobia and catastrophizing on pain and disability in anterior knee pain patients. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(7):1562-8. doi:10.1007/s00167-012-2238-5.
20. Lai YF, Lin PC, Chen CH, Chen JL, Hsu HT. Current status and changes in pain and activities of daily living in elderly patients with osteoarthritis before and after unilateral total knee replacement surgery. *J Clin Med.* 2019;8(2):221.
21. O'Brien P, Bunzli S, Ayton D, Dowsey MM, Gunn J, Manski-Nankervis JA. What are the patient factors that impact on decisions to progress to total knee replacement? A qualitative study involving patients with knee osteoarthritis. *BMJ Open.* 2019;9(9):e031310.