International Journal of Science and Healthcare Research
[Indexed, Peer-Reviewed Journal]
Vol. 10; Issue: 1; January-March 2025
Website: ijshr.com
Original Research Article *ISSN: 2455-7587*

Analyzing the Efficacy of Kinesthesia and Perturbation Training in Kinesiophobia Among OA Knee Patients

Sonumol Ramanan[1], Suchithra C[2], A. K. Vijay Krishna Kumar[3]

[1]Lecturer, Department of Physiotherapy, Dr. B. R. Ambedkar Medical College and Hospital, Bangalore, Karnataka, India
[2]Intern, Department of Physiotherapy, Dr. B. R. Ambedkar Medical College and Hospital, Bangalore, Karnataka, India
[3]Principal, Department of Physiotherapy, Dr. B. R. Ambedkar Medical College and Hospital, Bangalore, Karnataka, India

Corresponding Author: Sonumol Ramanan

DOI: https://doi.org/10.52403/ijshr.20250112

ABSTRACT

BACKGROUND: Osteoarthritis in the knee is a prevalent joint disease in the elderly, affecting around 80% of those over 55. It leads to reduced function, making walking and stair-climbing challenging, potentially impacting lower body abilities. Balance is crucial for daily tasks and operations.
OBJECTIVE: The study is to determine the efficacy of kinesthesia and perturbation training in Kinesiophobia among OA knee patients.
MATERIALS AND METHODOLOGY: Thirty subjects with knee osteoarthritis will be assigned to control (group B) and experimental (group A) based on specific criteria. Group A receives perturbation training alongside conventional treatment, while Group B is treated with traditional methods like ultrasound. Each group undergoes 10 treatment sessions. Outcome measures include Numerical Pain Rating Scale (NPRS), Tampa Scale of Kinesiophobia(TSK).
RESULTS: Following training, both groups experienced a statistically significant decrease in the numerical pain rating scale ($p<0.001$). Following training, both groups' scores on the Tampa Scale of Kinesiophobia decreased, and this difference was statistically significant($p<0.001$). Nonetheless, when comparing the two groups, the experimental group's decrease in TSK and NPRS scores was greater, and this difference was statistically significant ($p<0.001$).
CONCLUSION: The study found that OA knee patients in Experimental group A demonstrated reduced pain and improvement in perturbation training both statistically and clinically.

KEYWORDS: Kinesiophobia, Kinesthesia, Knee osteoarthritis, Perturbation training, Physiotherapy management.

INTRODUCTION

One prevalent chronic degenerative joint ailment that primarily affects the elderly is osteoarthritis (OA)[1]. Increased articular cartilage breakdown and smoothing, as well as capsule fibrosis, are observed in knee osteoarthritis. Individuals with osteoarthritis are prone to experience issues with decreased mobility and everyday tasks[2]. Globally, OA is the primary cause of disability. Currently, some 250 million individuals worldwide suffer with osteoarthritis (OA), and during the next several decades, the condition's

prevalence is predicted to increase, possibly as a result of the combined effects of aging and the obesity epidemic as well as an increase in joint injuries[1].

Individuals with osteoarthritis (OA) encounter a reduction in their range of motion, which intensifies their requirement for jobs that were previously effortless. A decrease in balance may result from arthritic knee pain. Pain can impair soft and muscular tissues, which can undermine the active and prompt motor responses necessary for maintaining postural integrity. This can impact a person's capacity to keep his center of mass inside the support base. Research has indicated that sway is significantly attributed to pain in individuals with osteoarthritis; however, no study established a correlation between pain levels and balance abnormalities[2].

A poor prognosis for lower limb OA has been linked to characteristics that are biological, physical, cognitive, behavioral, social, and occupational. There has been limited research on the impact of various maladaptive psychological factors, including fear of falling, fear of movement, and the perception of imbalance. The majority of patients with lower limb OA suffer from kinesiophobia, an intense, irrational, and incapacitating fear of movement and activity triggered by a feeling of vulnerability to pain, damage, or re-injury. Kinesiophobia increases stiffness, discomfort, sedentary behavior, and impairment while impeding movement and exercise therapy[3].

The TSK-17 is a widely-used 17-item questionnaire to measure movement anxiety, but Shelby et al. introduced the BFOM, a 6-question scale specific to OA that proved simpler and more useful clinically. Patients with OA responded well to it, yet there are few studies on kinesiophobia in knee OA despite established exercise benefits and its crucial role in pain pathogenesis and physical inactivity[4].

Exercise is essential for knee osteoarthritis (OA) management, even if recent systematic studies have demonstrated a moderate influence on pain and function. This means that exercise treatment plans need to be well planned[5].

Patients with knee OA commonly undergo proprioceptive exercises to enhance joint proprioceptive acuity and stability, reducing pain and improving function. These exercises, which include weight-bearing and non-weight-bearing postures, aim to address compromised aspects like kinesthesia. Other exercise interventions for knee OA include aerobic, flexibility, and skills/balance or strengthening activities[1].

The study aims to assess the effectiveness of combining conventional physiotherapy with kinesthesia and perturbation training for managing knee osteoarthritis. It also aims to compare the efficacy of perturbation training and traditional physiotherapy on kinesiophobia and function in knee osteoarthritis management.

The study employed a quasi-experimental approach and was carried out at the Dr. B. R. Ambedkar Medical College and Hospital in Bangalore. Using rigorous criteria and convenient sampling, 30 participants were selected. Participants were divided into two groups: group A received standard treatment plus perturbation training, and group B received ultrasonic stretching and strengthening. The impact of kinesthesia and perturbation training on kinesiophobia in individuals with OA knees was evaluated during ten sessions.

Inclusion criteria

- Aged between 40-60yrs
- Female and Male with complain of knee pain.
- Duration of symptoms between 4-12 months
- Numerical pain rating scale ≥ 6
- Scores above 37 are generally considered to indicate kinesiophobia (Tampa scale of kinesiophobia)

Exclusion criteria

- Recent trauma.
- Knee joint infection.
- Recent surgery (TKR, THR)
- Recent lower limb fracture

Outcome measures

- Numerical pain rating scale (NPRS)
- Tampa scale of kinesiophobia (TSK)

Experimental procedure

CONTROL GROUP

Table 1 provides specifics about the strengthening and stretching workouts.

Table 1: Stretching and strengthening exercises (CONSERVATIVE TREATMENT)

	EXERCISE DOSAGE/PRESCRIPTION
Ultrasound therapy	The frequency of 1 MHz was given in continuous mode for 10 min
Active, relaxed free exercises • In high sitting • In prone lying	 2 sets × 10 repetitions 2 sets× 10 repetitions
Strengthening exercises • Static quadriceps • Static hamstring • Straight leg raise	 2 sets × 10 repetitions 2 sets× 10 repetitions 2 sets×10 repetitions
Stretching exercise • Hamstring stretching • Calf stretching	 5min stretch per day 5minutes

EXPERIMENTAL GROUP

Table 2: Kinesthesia and balance exercises (PERTURBATION TRAINING)

EXERCISES	EXERCISE DOSAGE/ PROGRESSION
Side stepping	15-75 steps×3sets
Tandem walk	15-75 steps×3sets
Toe walk	10-30s×3sets
Heel walk	10-30s×3sets
Crossover forward walk	15-75 steps×3sets
Crossover backward walk	15-75 steps×3sets
Crossover forward walk with eyes open	15-75 steps×3sets
Crossover backward walk with eyes closed	15-75 steps×3sets
One leg stand on hard surface with eyes open	10-30s×3sets
One leg stand on hard surface with eyes closed	10-30s×3sets
One leg stand on a foam surface with eyes open	10-30s×3sets
One leg stand on a foam surface with eyes closed	10-30s×3sets

STATISTICAL ANALYSIS

Statistical analysis of the data was performed using SPSS 20.0. The Categorical variables were presented as frequency and percentage. The continuous variables were presented as mean ± SD. Pre post comparison was done using paired t test and between group comparisons was done using unpaired t test. A p value <0.05 was considered statistically significant.

Table 3: Showing mean and standard deviation of age in years in Experimental group and Control group

	GROUP	N	Mean	Std. Deviation	t value	p value
AGE	Experimental group	15	47.87	5.10	0.44	0.665 (p>0.05)
	Control group	15	48.60	4.01		

Interpretation: The above table shows that the average age for the Experimental group was 47.87 ± 5.10 years, while the average age for the Control group was 48.60 ± 4.01 years with t-value 0.44 and the p-value 0.665 (p > 0.05). This analysis indicates that there is no significant difference in age between the Experimental and Control groups.

Table 4: Showing distribution of Gender in Experimental group and Control group

		Group		Total
		Experimental group	Control group	
GENDER	FEMALE	9	9	18
		60.0%	60.0%	60.0%
	MALE	6	6	12
		40.0%	40.0%	40.0%
Total		15	15	30
		100.0%	100.0%	100.0%

Interpretation: The table shows that both the Experimental and Control groups each consist of 9 females (60%) and 6 males (40%). The overall gender distribution is 60% female and 40% male, indicating a balanced gender composition within and between the groups.

Table 5: Showing pre-post comparison of NPRS in Experimental group

Experimental group		Mean	Std. Deviation	Mean difference	t value	p value
NPRS	Pre	9.13	0.74	3.93	21.65	0.000 (p<0.001)
	Post	5.20	0.94			

Interpretation: In the Experimental group, the average pre-NPRS score was 9.13 ± 0.74, which decreased to 5.20 ± 0.94 post-intervention with decrement of 3.93 and t-value of 21.65. This analysis indicates a significant difference in NPRS with $p < 0.001$

Table 6: Showing pre-post comparison of NPRS in Control group

Control group		Mean	Std. Deviation	Mean difference	t value	p value
NPRS	Pre	9.33	0.90	1.80	10.31	0.000 (p<0.001)
	Post	7.53	0.83			

Interpretation: In the Control group, the average pre-NPRS score was 9.33 ± 0.90, which decreased to 7.53 ± 0.83 post-intervention with decrement of 1.80 and t-value of 10.31. The analysis shows there is a significant difference in NPRS with $p < 0.001$.

Table 7: Showing pre-post comparison of TSK in Experimental group

Experimental group		Mean	Std. Deviation	Mean difference	t value	p value
TSK	Pre	41.20	2.96	6.93	7.82	0.000 (p<0.001)
	Post	34.27	2.05			

Interpretation: In the Experimental group, the average pre-TSK score was 41.20 ± 2.96, which decreased to 34.27 ± 2.05 post-intervention with decrement of 6.93, with a t-value of 7.82. The analysis shows there is a significant difference in TSK with $p < 0.001$

Table 8: Showing pre-post comparison of TSK in Control group

Control group		Mean	Std. Deviation	Mean difference	t value	p value
TSK	Pre	40.40	0.91	3.53	11.53	0.000 (p<0.001)
	Post	36.87	1.36			

Interpretation: In the Control group, the average pre-TSK score was 40.40 ± 0.91, which decreased to 36.87 ± 1.36 post-intervention with decrement of 3.53, with a t-value of 11.53. The analysis shows there is a significant difference in TSK with $p < 0.001$.

Table 9: Comparison of NPRS between Experimental group and Control group

GROUP		Mean	Std. Deviation	t value	p value
NPRS	Experimental group	3.93	0.70	8.47	0.000 (p<0.001)
	Control group	1.80	0.68		

Interpretation: In the comparison of NPRS scores between the Experimental and Control groups, the average score for the Experimental group was 3.93 ± 0.70, while for the Control group it was 1.80 ± 0.68. The t-value was 8.47. This analysis indicates NPRS improvement is significantly high in Experimental group ($p < 0.001$).

Table 10: Comparison of TSK between Experimental group and Control group

GROUP		Mean	Std. Deviation	t value	p value
TSK	Experimental group	6.93	3.43	3.63	0.001 (p<0.05)
	Control group	3.53	1.19		

Interpretation: In the comparison of TSK scores between the Experimental and Control groups, the average score for the Experimental group was 6.93 ± 3.43, while for the Control group it was 3.53 ± 1.19. The t-value was 3.63, and the p-value was 0.001. This analysis indicates TSK improvement is significantly high in Experimental group ($p < 0.05$)

RESULTS

To perform the statistical analysis of the data, SPSS 20.0 was utilized. They displayed the categorical variables using percentage and frequency. The mean ± standard deviation served as the representation for the continuous variables. We used the paired t test for pre-post comparisons and the unpaired t test for between-group comparisons. For statistical significance, a p-value of less than 0.05 was considered.

In the comparison of NPRS scores between the Experimental and Control groups, the average score for the Experimental group was 3.93 ± 0.70, while for the Control group it was 1.80 ± 0.68. The t-value was 8.47. This analysis indicates NPRS improvement is significantly high in Experimental group ($p <0.001$).

In the comparison of TSK scores between the Experimental and Control groups, the average score for the Experimental group was 6.93 ± 3.43, while for the Control group it was 3.53 ± 1.19. The t-value was 3.63, and the p-value was 0.001. This analysis indicates TSK improvement is significantly high in Experimental group ($p < 0.05$).

The post mean values of components were used to assess group differences. Results were significant ($p<0.05$) for both groups. Patients with knee osteoarthritis receiving perturbation exercises (Group A) improved knee function more than those only on standard treatment (Group B). Hence, perturbation exercises are more beneficial for enhancing knee function in patients.

DISCUSSION

The majority prevalent orthopaedic problem that is impacted is degenerative alterations of the knee joint area, which affects 30–40% of the population and causes structural and functional limitations in the elderly. Individuals with osteoarthritis may experience difficulties with their regular activities and mobility. People who have osteoarthritis (OA) have a decrease in their range of motion, making them more dependent on jobs that they used to perform with ease. Arthritis in the knee may cause a reduction in balance. In this study, we looked at how kinesthesia and perturbation training affected kinesiophobia in patients with osteoarthritis in the knee.

Two groups participated in the study: group A got conservative therapy and perturbation training. Only conservative measures, such as ultrasounds and strengthening and stretching exercises, were given to group B. Patients who met the inclusion criteria were included, and TSK and NPRS were employed as the outcome measures.

The timing of the extensor muscle's spinal reaction in reaction to an anteromedial movement improved with perturbation training. Additionally, there was an improvement in the cortical response time of the lateral quadriceps, medial hamstring, and gastrocnemius muscles. These elements may have improved knee function, which in turn may have improved dynamic joint stability and overall functioning. Gamma motor activity rises, stimulating mechanoreceptors and increasing muscle spindle sensitivity. Training with perturbations may reinforce the activity of the proprioceptors, GTO, and muscle spindle [6].

According to our research, both groups had significant outcomes ($p<0.05$), however the experimental group's improvement was marginally greater than the control group 's. Our study's findings were in line with a study

by Brillya Bhaskar et al. that revealed that providing perturbation training in addition to conventional treatment had a considerably better impact on OA knee patients' ability to function in their lower limbs[6].

According to one study, participants in perturbation training programs may be able to resume high-intensity physical exercise 10. Additionally, perturbation training helps the therapist treat patients more dynamically while also enhancing balance and function. According to a study by Fitzgerald GK et al., people who participate in perturbation training programs are able to sustain their functional status over extended periods of time and are less likely to experience recurring instances of their knee giving way while participating in sports. for the nonoperative rehabilitation program of the anterior cruciate ligament[1].

A patient with kinesiophobia experiences an overwhelming, irritable, and incapacitating fear of moving or engaging in physical activities because they believe they could be injured or harmed again. In order to determine the prevalence of kinesiophobia in patients with OA knee, Vishnu Vardhan GD did a study. Thus, the study came to the conclusion that when OA progresses in degree or stage, there is an increase in pain intensity, which causes a subsequent increase in kinesiophobia in those with knee OA. All of these factors contribute to people with OA knees having less physical functioning[7].

The pre- and post-mean NPRS of Group A were determined to be 9. 13 and 5. 20, respectively, according to the findings of our investigation. 9. 33 and 7. 53, respectively, were Group B's pre- and post-mean NPRS scores. In the same way, Group B's before and post TSK means were 40. 40 and 36. 87, respectively, while Group A's pre and post TSK means were 41. 20 and 34. 27. Good progress was seen in both groups according to this research. NPRS and TSK improvement, however, is much higher ($p < 0.05$) in the experimental group.

CONCLUSION

Balance and function are altered by osteoarthritis in the knee. In addition to traditional physiotherapy, the current study shows that perturbation training helps participants with OA knee improve their function and balance. Pinch training helps people knee osteoarthritis become more stable and functional. Enhancing function and balance, perturbation training allows the therapist to administer treatment with greater dynamism. Treatment success may be increased if participants with knee degeneration receive probation training in addition to a standard rehabilitation program. Utilizing the technology in clinical settings is possible because it is also a financially viable approach. It is therefore recommended that perturbation training be incorporated into a patient's treatment plan while managing osteoarthritis of the knee. Although both intervention groups exhibited significant improvements in self-reported outcome measures, perturbation training combined with conventional therapy had slightly greater impact on enhancing lower extremity function in the experimental group

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: I want to express my gratitude to all of my study participants, without whom this assignment would not have been feasible.

Source of Funding: None

Conflict of Interest: No conflicts of interest are disclosed by the author.

REFERENCES

1. Fitzgerald GK, Childs JD, Ridge TM, Irrgang JJ. Agility and perturbation training for a physically active individual with knee osteoarthritis. Physical therapy. 2011; 91(4):452-69
2. Ekediegwu EC, Akpaenyi CE, Nwosu IB, Onyeso OK. Demographic and disease characteristics associated with pain intensity, kinesiophobia, balance, and fall self-efficacy among people with osteoarthritis: a cross-sectional study. BMC musculoskeletal disorders. 2022;23(1):544.

3. Diracoglu D, Aydin R, Baskent A, Celik A. Effects of kinesthesia and balance exercises in knee osteoarthritis. JCR: Journal of Clinical Rheumatology. 2005;11(6):303-10.
4. Rogers MW, Tamulevicius N, Semple SJ, Krkeljas Z. Efficacy of home-based kinesthesia, balance & agility exercise training among persons with symptomatic knee osteoarthritis. Journal of sports science & medicine. 2012;11(4):751.
5. Aykut Selcuk M, Karakoyun A. Is there a relationship between kinesiophobia and physical activity level in patients with knee osteoarthritis? Pain Medicine. 2020;21(12): 3458-69.
6. Bhaskar B, T U J, Solomen S. Efficacy of perturbation training in improving balance and function in the management of knee osteoarthritis. International Journal of Physiotherapy. 2019 Aug 1;6(4).
7. Kanniappan SP, Vardhan G.D V. Prevalence of Kinesiophobia in Patients with Osteoarthritis Knee: A Cross Sectional Study. International Journal of Physiotherapy and Research. 2021 Jul 11;9(4):3907–12.

How to cite this article: Sonumol Ramanan, Suchithra C, A. K. Vijay Krishna Kumar. Analyzing the efficacy of kinesthesia and perturbation training in kinesiophobia among OA knee patients. *International Journal of Science & Healthcare Research.* 2025; 10(1): 90-96. DOI: *https://doi.org/10.52403/ijshr.20250112*

******