Original Article

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Efficacy of Online Versus Offline Group Exercise Program in Knee Osteoarthritis: A Randomized Controlled Trial

Saurabh Agnihotri[1], Naveen Kumar Singh[2], Nalina Gupta[3]

[1]PhD Scholar Department of Physiotherapy, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India.

[2]Principal & Professor, Department of General Surgery, Teerthanker Mahaveer Medical College, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India.

[3]Professor, Department of Physiotherapy, Chitkara School of Health Science, Chitkara University, Punjab, India.

Abstract

Background: Knee osteoarthritis (OA) is a leading cause of pain and disability among older adults. Exercise therapy is a primary non-pharmacological intervention for managing OA symptoms. With the rise of digital health platforms, the effectiveness of online rehabilitation programs compared to traditional offline exercise requires further evaluation. **Objective:** To compare the efficacy of online versus offline group exercise programs in reducing pain, as measured by the Visual Analogue Scale (VAS), in patients with knee osteoarthritis. **Subjects and Methods:** This randomized controlled trial included 160 participants with radiographically confirmed Grade I–III knee OA. Participants were randomized to either an online (n=76) or offline (n=84) group. Both groups followed an identical structured six-week exercise program. Pain levels were assessed using the VAS at baseline, three weeks, and six weeks. Randomization was concealed using the Sequentially Numbered, Opaque, Sealed Envelopes (SNOSE) method. Data were analyzed using independent t-tests and repeated measures ANOVA. The study was approved by the Institutional Ethics Committee of Teerthanker Mahaveer University (Approval No.: PM/ETHICAL/PT/2023/004). Trial registration was not applicable. **Results:** Both groups demonstrated significant reductions in VAS scores over six weeks ($p<0.0001$). The offline group showed a significantly greater reduction at the third week ($p=0.02$) and sixth week ($p<0.001$) compared to the online group. At six weeks, the mean VAS reduction was 5.48 points in the offline group versus 5.03 points in the online group. **Conclusion:** Both online and offline group exercise programs effectively reduced pain among individuals with knee OA. However, offline programs resulted in faster and more substantial pain relief, suggesting that in-person supervision may enhance early clinical outcomes.

Keywords: Knee osteoarthritis, Online exercise, Offline exercise, Pain reduction, Randomized controlled trial, Telerehabilitation, Visual Analogue Scale (VAS).

Corresponding Author: Saurabh Agnihotri, PhD Scholar, Department of Physiotherapy, Teerthanker Mahaveer University, Moradabad. Email: saurabh.mpt@gmail.com

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Introduction

Knee osteoarthritis (OA), a common degenerative joint disorder in older adults, leads to chronic pain, reduced mobility, and impaired quality of life.[1] Among non-pharmacological interventions, exercise therapy is widely recognized as a cornerstone of conservative management.[2] Group-based exercise programs are widely recommended to reduce pain and improve joint function. Recent advancements in technology have enabled the delivery of exercise rehabilitation through online platforms. Although tele-rehabilitation offers improved accessibility, especially for individuals with mobility or transportation limitations, its efficacy compared to traditional in-person exercise programs remains an important question.[3] Pain management is a primary goal in the treatment of knee OA, and rapid pain reduction is often critical for enhancing patient adherence to rehabilitation programs.[4] Therefore, understanding whether online exercise programs can match the effectiveness of offline programs in achieving early pain relief is essential for clinical decision-making.

This study aims to compare the efficacy of online versus offline group exercise programs in reducing pain among individuals with knee OA, with pain intensity measured using the Visual Analogue Scale (VAS).[5]

Objectives

Primary Objective

To compare the effectiveness of online and offline group exercise programs in reducing pain levels, as measured by the Visual Analogue Scale (VAS), in patients with knee osteoarthritis.

Secondary Objective

To determine the magnitude of pain reduction (effect size) and assess the clinical significance of the intervention over a six-week period.

Subjects and Methods

Study Design

This was a single-center, randomized controlled trial conducted between April 2023 and April 2024 at the Physiotherapy Outpatient Department, Teerthanker Mahaveer Hospital, Moradabad.

Participants

A total of 160 participants with radiologically confirmed Grade I–III knee osteoarthritis (Kellgren and Lawrence grading system,[5]) were enrolled. Participants aged 30 years and above, with a minimum baseline VAS score of 3/10,[6] were eligible. Exclusion criteria included recent knee surgery, corticosteroid injections within three months, severe OA (Grade IV), or co-existing systemic arthritis.

All participants provided written informed consent prior to participation. The study was approved by the Institutional Ethics Committee, Teerthanker Mahaveer University. (Approval No.: PM/ETHICAL/PT/2023/004).

Sample Size Calculation

The sample size for the study was calculated based on comparing the proportion of pain relief between the online and offline groups. Using a standard formula for comparing two proportions, with a 95% confidence interval ($Z\alpha/2 = 1.96$) and 80% power ($Z\beta = 0.84$), and assuming a proportion of pain relief of 53.7% in the online group ($P1 = 0.537$) and 31.8% in the offline group ($P2 = 0.318$), the calculated sample size was 79.97 per group, approximately 80 participants. Thus, the total sample size required for the study was 160 participants.

Randomization and Allocation

Participants were randomized into two groups using a computer-generated stratified randomization procedure:

Group A (Online Exercise Group, n=76): Participated in supervised group exercises via Zoom.

Group B (Offline Exercise Group, n=84): Attended in-person supervised group exercises at the hospital.

Randomization was concealed using the Sequentially Numbered, Opaque, Sealed Envelopes (SNOSE) method.

Intervention Protocol

Both groups underwent a standardized, structured group exercise program over six weeks, with sessions conducted three times per week (total 18 sessions). Each session included:

- 10 minutes warm-up
- 30–40 minutes main exercises (isometric and isotonic strengthening)
- 5–10 minutes cool-down (relaxation and breathing exercises)

Exercise intensity progressed from moderate to moderate-high (60–80% of 1RM) over six weeks.

Outcome Measures

Primary Outcome

Pain severity measured by the Visual Analogue Scale (VAS, 0–10 scale).[6]

VAS scores were recorded at:

- Baseline (Week 0)
- Midpoint (Week 3)
- End of intervention (Week 6)

Statistical Analysis

Data analysis was performed using STATA (Version 16). The normality of data distribution was assessed using the Shapiro-Wilk test. The Shapiro-Wilk test indicated that the VAS scores were normally distributed ($p > 0.05$), allowing the use of parametric tests. Between-group comparisons of VAS scores at baseline, three weeks, and six weeks were conducted using independent sample t-tests. Within-group changes over time were evaluated using repeated measures analysis of variance (ANOVA) to determine the effectiveness of the interventions. Effect sizes were calculated using Cohen's d, with values of 0.2, 0.5, and 0.8 interpreted as small, medium, and large effects, respectively.[7] A p-value of less than 0.05 was considered statistically significant.

Results

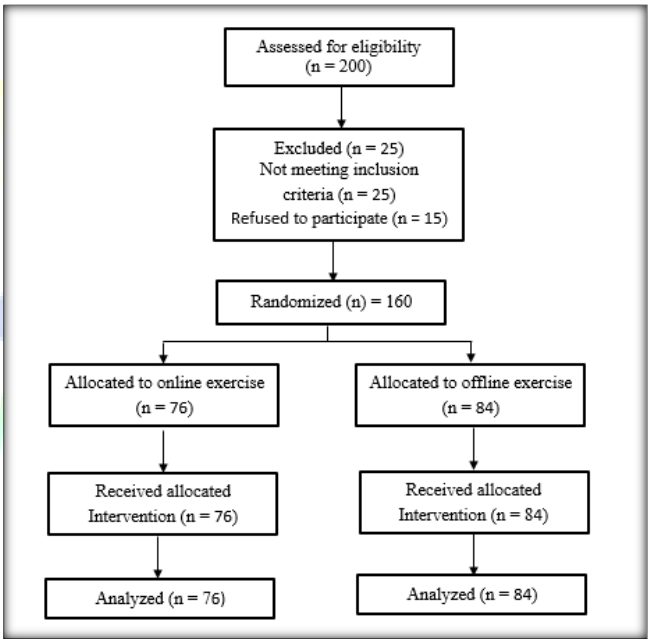

Figure 1: CONSORT Flow Diagram showing participant enrollment, allocation, follow-up, and analysis

A total of 160 participants were enrolled and randomized into two groups: 76 in the online group and 84 in the offline group. The groups were comparable at baseline with respect to age, gender distribution, and place of residence.

At baseline, the mean VAS score was 8.51 ± 0.99 in the online group and 8.64 ± 1.01 in the offline group. The difference between groups was not statistically significant ($p=0.21$), with a negligible effect size (Cohen's $d = -0.13$).

At the third week, both groups showed a reduction in pain scores. The mean VAS score was 5.75 ± 1.47 in the online group and 5.28 ± 1.37 in the offline group. The difference between the groups at this point was statistically significant ($p=0.02$), with a small-to-moderate effect size (Cohen's $d = 0.33$), favoring the offline group.

At the sixth week, further reductions were observed. The

mean VAS score was 3.03 ± 1.39 for the online group and 2.21 ± 1.12 for the offline group. The difference between groups was highly statistically significant ($p<0.001$), with a moderate effect size (Cohen's d = 0.65), again favoring the offline intervention.

Repeated measures ANOVA within both groups demonstrated statistically significant reductions in VAS scores over time ($p<0.00001$ for both groups), confirming the effectiveness of both online and offline exercise interventions in reducing pain. However, the offline group exhibited greater and faster reductions in pain intensity. Table 1 summarizes the comparative VAS scores, statistical significance, and effect sizes across different time points.

The trajectory of mean VAS scores over the study period is illustrated in Figure 2. Both groups experienced a consistent decline in pain levels from baseline to 6 weeks, with the offline group achieving a more pronounced reduction at each assessment point.

Mean Reduction in Pain Scores:

Table 2 displays the average VAS pain score reductions within each group at 3 and 6 weeks. The offline group showed a greater mean reduction in pain at both time points compared to the online group. These changes reflect faster early pain relief in the offline setting. Figure 3 shows the mean reductions in VAS scores across groups.

Table 1: Comparison of Mean Visual Analogue Scale (VAS) Scores Between Online and Offline Groups at Baseline, Three Weeks, and Six Weeks, Including p-values and Effect Sizes (Cohen's d).

Time Point	Online Group (Mean ± SD)	Offline Group (Mean ± SD)	p-value	Cohen's d	Significance
Baseline	8.51 ± 0.99	8.64 ± 1.01	0.21	-0.13	Not Significant
3rd Week	5.75 ± 1.47	5.28 ± 1.37	0.02	0.33	Significant
6th Week	3.03 ± 1.39	2.21 ± 1.12	<0.001	0.65	Highly Significant

Table 2: Comparison of Mean Reduction in Visual Analogue Scale (VAS) Pain Scores Between Online and Offline Groups from Baseline to Three Weeks and Six Weeks

Time Interval	Mean Reduction (Online Group)	Mean Reduction (Offline Group)	Mean Difference (Offline – Online)
Baseline to 3 weeks	2.8	3.3	0.5
Baseline to 6 weeks	5.5	6.4	0.9

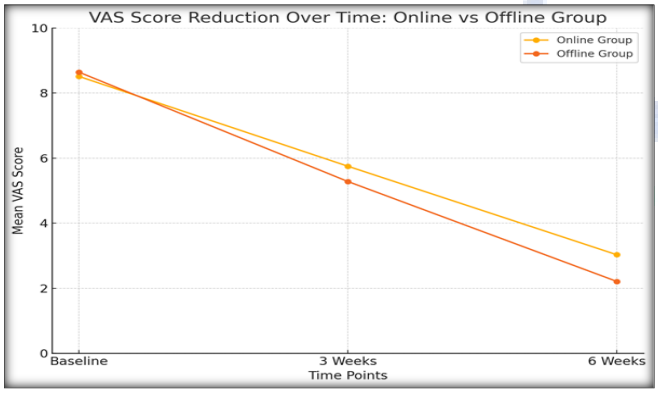

Figure 2: Trajectory of Mean Visual Analogue Scale (VAS) Pain Scores Over Six Weeks in Online and Offline Exercise Groups. (Error bars represent ± standard deviation.)

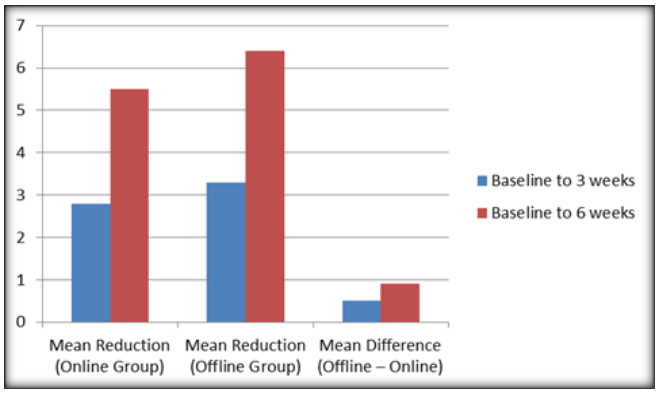

Figure 3: Mean Reduction in Visual Analogue Scale (VAS) Scores from Baseline to Six Weeks in Online and Offline Groups. (Higher reduction indicates greater pain improvement.)

Discussion

This randomized controlled trial compared the efficacy of online and offline group exercise programs in reducing pain among patients with knee osteoarthritis, measured through the Visual Analogue Scale (VAS). The findings demonstrated that while both online and offline interventions were effective in significantly reducing pain over six weeks, the offline exercise program resulted in faster and more substantial pain reduction compared to the online approach.

At baseline, there was no statistically significant difference between groups, indicating effective randomization. By the third week, the offline group had achieved significantly greater pain reduction than the online group ($p=0.02$, Cohen's $d=0.33$), and this difference further widened by the sixth week ($p<0.001$, Cohen's $d=0.65$), suggesting a moderate effect size favoring the offline intervention. The greater effect size observed at six weeks emphasizes not just statistical significance but also the clinical importance of the offline approach for achieving early and meaningful pain relief.

These results are consistent with previous literature emphasizing the role of supervised in-person exercise in optimizing outcomes for musculoskeletal conditions. Karabis et al,[4] demonstrated that early improvements in VAS scores are strong predictors of sustained pain relief, particularly in in-person treatment modalities. The greater improvement observed in the offline group may be attributed to factors such as immediate therapist feedback, more accurate exercise execution, and enhanced patient motivation through direct supervision. Similar findings have been reported by Hinman et al., who observed that face-to-face

supervised rehabilitation produced superior short-term outcomes compared to telehealth-based interventions.[8]

The online group, while showing significant improvement, exhibited a comparatively slower reduction in pain levels. This finding suggests that although tele-rehabilitation offers a valuable and accessible alternative, particularly for individuals facing logistical barriers, it may require further optimization to match the clinical effectiveness of traditional offline interventions in early pain control. Previous studies have demonstrated that tele-rehabilitation can be an effective modality for managing musculoskeletal conditions, especially when designed with real-time supervision and patient engagement features.[9]

Importantly, the inclusion of effect size analysis in this study highlights not only the presence of statistically significant differences but also their practical magnitude. Reporting effect sizes complements p-values by providing a more comprehensive understanding of clinical relevance, which is increasingly expected in evidence-based practice.

Overall, the results of this study reinforce that while both online and offline group exercise programs are effective for pain management in knee osteoarthritis, offline programs may offer superior outcomes for patients seeking faster pain relief. Future strategies may focus on enhancing online interventions by incorporating real-time supervision, feedback mechanisms, and patient engagement techniques to bridge the observed efficacy gap.

Limitations of the Study

Despite the strengths of this randomized controlled trial, several limitations should be noted. First, the study duration was relatively short (six weeks), and long-term follow-up data were not collected to assess sustained pain relief. Second, pain outcomes were measured solely through the Visual Analogue Scale (VAS), a subjective tool, without objective functional assessments. Third, the study did not account for potential variability in participants' adherence to home exercises outside of supervised sessions, particularly in the online group. Finally, although randomization was performed, blinding of participants and therapists was not feasible due to the nature of the interventions, which may have introduced some performance bias. Future studies with longer follow-up periods, additional objective outcome measures, and strategies to enhance adherence monitoring are recommended.

Conclusion

This randomized controlled trial demonstrated that both online and offline group exercise programs effectively reduced pain levels in individuals with knee osteoarthritis over a six-week period. However, offline supervised exercise led to faster and greater reductions in pain intensity compared to online rehabilitation. These findings suggest that while online interventions offer a valuable alternative where accessibility is an issue, traditional in-person programs may provide superior early pain relief outcomes. Future efforts should focus on optimizing online exercise models to bridge this efficacy gap and expand rehabilitation access.

References

1. Guccione AA, Felson DT, Anderson JJ, et al. The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. Am J Public Health. 1994;84:351–8.
2. Jamtvedt G, Dahm KT, Christie A, et al. Physical therapy interventions for patients with osteoarthritis of the knee: an overview of systematic reviews. Phys Ther. 2008;88:123–36.
3. Cottrell MA, Russell TG. Telehealth for musculoskeletal physiotherapy. Musculoskelet Sci Pract. 2020;48:102193.
4. Karabis A, Nikolakopoulos S, Pandhi S, Papadimitropoulou K, Nixon R, Chaves RL, et al. High correlation of VAS pain scores after 2 and 6 weeks of treatment with VAS pain scores at 12 weeks in randomized controlled trials in rheumatoid arthritis and osteoarthritis: meta-analysis and implications. Arthritis Res Ther. 2016;18:1–7.
5. Kellgren JH, Lawrence JS. Radiological assessment of osteoarthrosis. Ann Rheum Dis. 1957;16:494–502.
6. Bellamy N, Buchanan WW. A preliminary evaluation of the dimensionality and clinical importance of pain and disability in osteoarthritis of the hip and knee. Clin Rheumatol. 1986;5:231–41.
7. Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale: Lawrence Erlbaum Associates; 1988.
8. Hinman RS, Delany CM, Campbell PK, et al. Telehealth delivery of exercise interventions for chronic musculoskeletal conditions: a systematic review and meta-analysis. Br J Sports Med. 2017;51(19):1453–1460.
9. Cottrell MA, Galea OA, O'Leary SP, Hill AJ, Russell TG. Real-time telerehabilitation for the treatment of musculoskeletal conditions is effective and comparable to standard practice: a systematic review and meta-analysis. Clin Rehabil. 2017;31(5):625–638.

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