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Interactive Web-Based Education for Musculoskeletal Pain: A Non-Randomized 2-Arm Pre-Post Study on Engagement and Health Outcomes

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ABSTRACT

Background: Musculoskeletal disorders such as back, knee, and neck pain are highly prevalent and often linked to poor posture. Physiotherapy plays a crucial role in alleviating symptoms, but adherence to home exercise programs is often poor, limiting long-term benefits. Digital platforms may offer a more effective alternative by improving accessibility and engagement, yet evidence comparing them with conventional home-based exercise remains limited.

Aim: To evaluate and compare the effectiveness of an interactive web-based exercise education platform with a traditional home-based program in improving pain, exercise adherence, and quality of life among individuals with musculoskeletal conditions.

Method: A 4-week non-randomized two-arm study was conducted with 60 adults (18–65 years) experiencing back, neck, or knee pain. Participants were allocated to a web-based interactive program (Group A, n=30) or a home-based program (Group B, n=30). Pain was assessed using the Visual Analogue Scale (VAS), quality of life with the SF-12 (Physical and Mental Components), and adherence with the Exercise Adherence Rating Scale (EARS).

Results: Group A showed greater improvements: pain reduced from 4.90 to 1.56, PCS improved from 39.34 to 46.83, MCS from 38.50 to 47.71, and adherence was higher (EARS: 16.43 vs. 14.93).

Conclusion: A brief interactive web-based program significantly improved adherence, reduced pain, and enhanced quality of life compared to home-based exercise.

Plain Language Summary

Musculoskeletal pain, including back, neck, and knee pain, is very common and affects daily life for millions of people. Physiotherapy exercises can reduce pain and improve quality of life, but many people find it difficult to follow home-based exercise programs regularly. Digital platforms may provide a better solution by

offering clear instructions, videos, reminders, and flexible access. This study aimed to test whether an interactive web-based program would be more effective than traditional home-based exercises. A total of 60 adults aged 18 to 65 years with musculoskeletal pain were included. They were divided into two groups: one group of 30 people used the web-based platform with exercise videos, progress tracking, and reminders, while the other group of 30 people followed the same program at home using written instructions. Both groups performed the exercises for four weeks. At the beginning and end of the program, pain, quality of life, and exercise adherence were measured. The results showed that the people using the web-based program experienced greater improvements. Their pain decreased from about 5 out of 10 to around 1.5 out of 10, and both physical and mental quality of life scores increased. They also followed their exercise plan more consistently compared to those in the home-exercise group. These findings suggest that interactive digital physiotherapy can make treatment easier to access, more engaging, and more effective. Such web-based tools could be especially helpful for people who live in rural areas or those who cannot attend regular clinic visits.

Keywords: Digital health, Musculoskeletal disorder, Patient engagement, Quality of life, Web-based physiotherapy

INTRODUCTION

Digital technology has reshaped healthcare by improving patient care, accessibility and outcomes with advanced technologies. Digital physiotherapy helps people with muscle and joint problems feel better by giving easy care from home.[1] The primary causes of pain encompass musculoskeletal disorders including knee, neck and back pain, which may be reduced using online self-management services.[2] Musculoskeletal pain, prevalent globally, is classified as acute or chronic; acute pain arises suddenly after damage and usually fades within three months and the chronic musculoskeletal pain persists for more than three months often continues even after the original injury has healed. The World Health Organisation estimates that around 1.75 billion individuals globally experience chronic musculoskeletal pain.[3] Ongoing musculoskeletal discomfort forces individuals to seek self-directed, customised treatment beyond conventional clinical visits. Numerous individuals, especially those in rural areas, find it difficult to make regular clinic visits because they lack access to physiotherapy due to location, mobility or limited time. Even in urban areas, travel, mobility issues and busy schedules make regular clinic visits difficult, as fixed appointments often lack needed flexibility.[4] Studies suggest that between 40% and 80% of medical advice given verbally is quickly forgotten, frequently within minutes of leaving the medical centre.[5] The success of physiotherapy treatment, particularly in the management of musculoskeletal problems, is greatly affected by patient adherence.[6] Digital physiotherapy can help improve patients quality of life by making care easier to access, boosting their confidence and supporting their physical, mental and social needs.[7] Through education, guidance and feedback, digital technologies such as calls, websites and apps allow patients to control their care, which improves motivation and recovery.[8] For individuals with restricted access to medical centres, web-based physiotherapy platform provide an easily accessible and flexible solution for standard therapy. Specific guidance and consistent observation help improve adherence, alleviate pain and enhance overall quality of life. Improving the ongoing management of musculoskeletal disorders involves assessing its effectiveness. This study is designed to study the effectiveness and feasibility of digital physiotherapy interventions to enhance accessibility, adherence, and outcomes in individuals suffering from musculoskeletal pain.

METHODOLOGY

This prospective interventional study was conducted at the Outdoor Patient Department of the University College of Physiotherapy and Department of Orthopaedics, Guru Gobind Singh Medical College and Hospital, Faridkot. The study included 60 adults as it was designed as a small-scale feasibility trial to evaluate preliminary effectiveness and adherence, rather than a large-scale clinical trial. A total of 60 adults aged 18 to 65 years were randomly assigned into two equal groups. The mean ages of Group A and Group B were 40.3 and 39.13 years, respectively. Group A (n = 30) received a digital intervention using a web-based platform, while Group B (n = 30) followed a home-based exercise program. Written consent was obtained from each participant after they were informed about the study. Both groups followed the same treatment protocol but in different ways. Before and after the intervention, outcomes were assessed using the Visual Analogue Scale (VAS) for pain, the Quality of life for physical and mental health (SF-12). The Exercise Adherence Rating Scale (EARS) was used for patient adherence after the intervention. Statistical analysis was used to analyse the data and paired and unpaired t-tests were used to compare within and between the groups.

TIDieR Table:

Item	Description
1. Brief name	Interactive web-based physiotherapy exercise program for musculoskeletal pain.
2. Why (Rationale)	To improve accessibility, engagement, and adherence to physiotherapy exercises for musculoskeletal pain by providing a digital, user-friendly platform with visual guidance, automated plans, and progress tracking.
3. What (Materials)	- Web-based platform ("soulsync-wellness.iceiy.com") with login credentials. - Exercise videos, self-assessment forms, automated treatment plan, progress-tracking dashboard, calendar, and adherence forms. - Devices: smartphone, tablet, or laptop with internet.
4. What (Procedures)	Participants underwent baseline assessment (VAS, SF-12). Group A: Used the interactive web-based platform for 4 weeks. Group B: Followed home exercise program with same exercise protocol but manual instructions. Both groups performed 10 repetitions, 10-second hold, 2 sessions per week for 4 weeks.
5. Who provided	Physiotherapy researchers/clinicians supervised design and delivery of the intervention. Automated website provided exercise guidance.
6. How (Mode of delivery)	Group A: Web-based interactive platform (self-directed digital physiotherapy). Group B: Home-based exercise program (manual instructions).
7. Where	Outdoor Patient Department (University College of Physiotherapy, Faridkot) and Department of Orthopaedics (Guru Gobind Singh Medical College & Hospital, Faridkot). Home-based execution of exercise programs.
8. When and how much	Duration: 4 weeks. Frequency: 2 sessions/week. Dose: 10 repetitions per exercise, 10-second hold, with rest between repetitions.
9. Tailoring	Exercises customized based on baseline assessment forms and health questionnaires (VAS, SF-12). Web-based platform generated individualized plans.
10. Modifications	No modifications reported during the study.
11. How well (Planned fidelity)	Web platform automatically tracked logins, exercise completion, and calendar entries. Orientation was provided for usability.
12. How well (Actual fidelity)	Adherence assessed post-intervention using Exercise Adherence Rating Scale (EARS). Engagement measured via platform usage data.

RESULT

Intra-group analysis revealed significant improvements across all outcome measures following intervention. As shown in Table 1, both Group A and Group B demonstrated reductions in pain (VAS), alongside improvements in physical and mental component scores (PCS and MCS of SF-12). Exercise adherence was also rated higher in Group A compared to Group B.

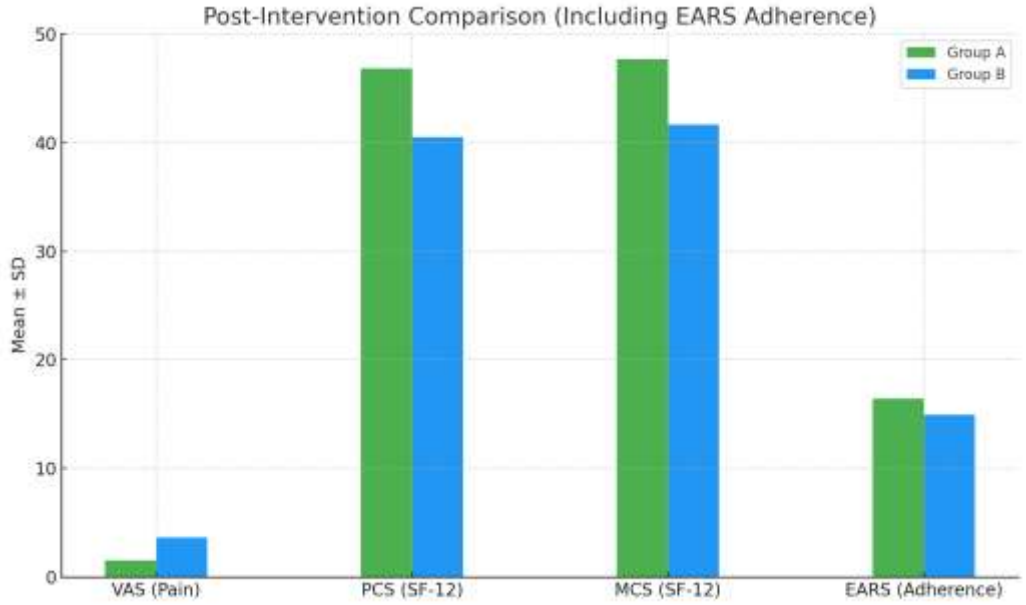
Post-intervention comparison between groups indicated that Group A achieved significantly better outcomes than Group B in terms of pain reduction, quality of life (PCS and MCS), and exercise adherence. These findings, presented in Table 2, highlight the superior effectiveness of the intervention applied to Group A.

Table 1: Comparison of Pre and Post-Intervention Scores Within Groups

Outcome Measure	Group A (Pre)	Group A (Post)	Group B (Pre)	Group B (Post)
VAS (Pain)	4.90 ± 1.27	1.56 ± 0.86	4.83 ± 1.31	3.63 ± 1.27
PCS (SF-12)	39.34 ± 6.66	46.83 ± 5.46	38.56 ± 6.36	40.52 ± 6.00
MCS (SF-12)	38.50 ± 4.57	47.71 ± 3.66	38.73 ± 4.59	41.67 ± 4.21
Exercise Adherence Rating Scale (EARS)	—	16.43 ± 2.40	—	14.93 ± 1.93

Table 2: Post-Intervention Comparison Between Groups

Outcome	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value	Result
VAS (Pain)	1.56 ± 0.86	3.63 ± 1.27	< 0.001	Significant
PCS (SF-12)	46.83 ± 5.46	40.52 ± 6.00	< 0.001	Significant
MCS (SF-12)	47.71 ± 3.66	41.67 ± 4.21	< 0.001	Significant
EARS (Adherence)	16.43 ± 2.40	14.93 ± 1.93	0.009	Significant



Combined Graph: Post-Intervention Comparison Between Groups (VAS, PCS, MCS, EARS)

DISCUSSION

This study examined the impact of a web-based exercise platform, soulsync.wellness helped people with back, knee and neck pain. After just four weeks, those using the website showed better results in terms of pain relief (VAS), quality of life (SF-12) and Exercise Adherence Rating Scale (EARS) compared to those following a traditional home exercise plan. Francisco Jesús Villatoro-Luque[9] et al and Rachel K. Nelligan[10] et. al. which found that digital rehab can improve motivation, reduce pain and boost function. Participants in the digital group said the platform was easy to use, flexible and gave them more control over their recovery.

Because the website used personalized plans based on each person's pain level and needs, it helped people stay consistent, something also shown in research by Rob Argent et al[11] and Sara Keel et al.[12] It also solved common problems, such as a lack of time or travel issues, since people could do the exercises whenever it suited them.

Overall, the results suggest that digital physiotherapy tool i.e., soulsync. wellness can be a helpful, accessible and effective option for improving pain, function and long-term exercise habits, especially for those in remote or rural areas.

CONCLUSION

The interactive web-based physiotherapy platform significantly enhanced exercise adherence, reduced pain levels and improved quality of life as compared to the home-based exercise. The digital platform was beneficial since it was simple to use, displayed clear videos, provided specific assistance and 24/7 accessibility addressed many common barriers associated with non-adherent physiotherapy. Digital physiotherapy education tools like *soulsync. wellness* can be a helpful, easy-to-reach and wide-reaching option, especially for people living in rural areas.

Limitations

This study has some limitations that should be considered. The sample size was relatively small, which may limit how well the findings apply to larger or more diverse populations. The short duration of the follow-up period also makes it difficult to assess the long-term effectiveness of the intervention. Additionally, exercise adherence was measured only once, which may not fully capture participants consistency or engagement over time. Lastly, the lack of participant diversity means the results may not reflect the experiences of all demographic groups.

Recommendation

Web-based physiotherapy platforms can play an important role in helping people manage musculoskeletal problems like back, knee or neck pain. These platforms should offer clear video demonstrations, personalized exercise plans and easy access so that patients can follow their routines without confusion. To make them more effective, features like regular reminders, feedback and progress tracking can be added. It would also help if future programs involve people from different age groups and backgrounds, so the results apply to a wider population. Longer follow-up and multiple checks on exercise adherence will give a better idea of how useful these platforms are over time. Such digital tools can make rehabilitation easier, especially for people who live far from clinics or have busy schedules.

Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Declaration by Authors

Ethical Approval: This study did not involve any invasive procedures, drug trials, or interventions posing physical or psychological risk to participants. It was purely educational and exercise-based, using standard physiotherapy practices delivered either through a web platform or home exercise program. Therefore, formal ethical approval was not required as per institutional guidelines. However, written informed consent was obtained from all participants after explaining the purpose and voluntary nature of the study.

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