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Review Article

Effect of virtual reality-based interventions in the management of work-related musculoskeletal disorders among office workers: a narrative review

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ABSTRACT

Office workers commonly have neck, back, and shoulder pain owing to poor posture and repetitive duties. They often result in pain, decreased mobility and poor work performance. Virtual reality (VR) based interventions have been developed as novel rehabilitation tools, offering immersive and interactive therapeutic environments. A narrative review was carried out through PubMed, ResearchGate and Google Scholar. Studies published from 2011 to 2025 were screened and 25 relevant studies that evaluated VR-based interventions for WMSDs among office workers were included. The VR based interventions were successful in reducing the pain and improving the functional outcomes in the reviewed studies. "VR has enhanced motivation and engagement in rehab programs with real-time feedback and interactive exercises. VR based rehabilitation can be used as an adjunct to conventional physiotherapy for the management of WMSDs among office workers. Higher quality RCTs are needed to standardise protocols and assess long-term efficacy.

Keywords: Musculoskeletal disorders, Virtual reality, Interventions, Office workers, Work-related.

INTRODUCTION

Musculoskeletal disorders (MSDs) are among the most frequent work-related problems. MSDs concern the muscles, joints, tendons and nerves and can affect body regions like the neck, upper limbs and the back [1]. In addition, MSDs are also referred to as work-related musculoskeletal disorders (WMSDs), which are linked to occupational exposures such as repetitive motions, prolonged static postures, excessive workload and poor ergonomic practices and constitute a significant and growing global public health issue [2, 3]. Working conditions of office workers: Office workers who sit long hours and work in front of computers, often at poorly designed workstations and with little physical activity, are more likely to develop WMSDs. The neck, shoulders, lower back and upper limbs are the parts of the body most often affected [4]. WMSDs represent a major occupational health problem worldwide and are a major cause of absenteeism, decreased work productivity, long-term disability and increasing healthcare costs [5]. Previous studies have reported a high prevalence of WMSDs in office workers worldwide, with a prevalence rate ranging from 40% to 75%. However, other studies in developing countries have shown even higher rates [6, 7]. The most common conventional physiotherapy treatments used for the management of WMSDs include therapeutic exercise, posture correction, ergonomic training and manual therapy. These interventions are effective in reducing symptoms, but long-term adherence to rehabilitation programs is often difficult due to lack of motivation and the repetitive nature of traditional exercise protocols. Therefore, there is an increasing demand for novel rehabilitation modalities to increase patient engagement and compliance with treatment. Virtual Reality (VR) has emerged as a promising technology in rehabilitation. It is described as an interactive environment generated by computers that offers users immersion and the possibility of interacting with simulated objects in real time. VR in physiotherapy allows for task-oriented, repetitive and goal-directed exercises with real-time auditory and visual feedback, thereby promoting motor learning and functional recovery [8].

Moreover, VR can decrease the perception of pain through distraction mechanisms and can increase the motivation of

patients through interactive and gamified therapeutic interventions [9]. Recent evidence suggests that VR based interventions can improve pain, mobility, posture, functional performance and adherence to rehabilitation programs in people with MSDs [10].

Need for the review

There is a growing interest in VR-assisted rehabilitation. However, the evidence of its effectiveness in managing WMSDs among office workers is fragmented. Therefore, the aim of the present narrative review is to assess the effectiveness of VR-based interventions in the management of WMSDs among office workers, focusing on pain reduction and improvements in functional outcomes such as posture, mobility and work performance.

MATERIAL AND METHOD

Study design

The present study was conducted as a narrative review to assess the effectiveness of virtual reality (VR)-based interventions in the management of work-related musculoskeletal disorders among office workers.

Data sources and search strategy

The literature was searched in electronic databases, including PubMed, MEDLINE, ScienceDirect and Google Scholar. We used keywords relevant to the topic, such as "musculoskeletal disorders", "virtual reality", "interventions", "work-related" and "office workers". MeSH terms (Medical Subject Headings) were employed where appropriate to refine the search strategy further for each individual database. We also manually searched the reference lists of relevant articles for other eligible studies.

Inclusion criteria

Studies published in English in peer-reviewed journals.

Studies published up to August 2025.

Studies of office workers with work-related musculoskeletal disorders.

Studies examining virtual reality interventions

Studies reporting outcomes such as improvement in pain relief and/or functional improvement.

Exclusion criteria

Studies focusing on non-work-related musculoskeletal conditions.

Studies on neurological diseases or post-surgery rehabilitation.

Studies addressing other pain conditions such as burn injuries, phantom limb pain, spinal cord injury, or experimental pain.

Articles not available in full text.

Outcome measures

The effectiveness of Virtual Reality (VR)-based interventions was evaluated in terms of improvement in pain intensity, mobility, posture and work performance in office workers with work-related musculoskeletal disorders. These outcomes were analysed to determine the overall impact of VR-based rehabilitation on reducing symptoms and enhancing functional and occupational outcomes.

RESULTS

Table 1: Studies showing effectiveness of VR interventions in reducing pain intensity

Author/ Year	Aim of the Study	Methodology	Outcome measures	Result	Conclusion
Hoffman et al., 2011	To evaluate immersive VR in reducing pain perception.	Clinical trial using immersive VR during procedures.	Pain intensity (Visual Analogue Scale (VAS), Pain Perception Assessment).	Significant reduction in pain intensity.	Immersive VR effectively reduces pain perception, supporting its role as a pain management tool.
Pekyavas and Ergun, 2017	To compare VR exercise with conventional therapy	RCT with VR vs traditional exercises	Pain intensity (Visual Analogue Scale (VAS).	Greater pain reduction in VR group.	VR-based exercises enhance pain reduction through engagement and active participation.
Li et al., 2018	To assess VR in WMSDs management	RCT comparing VR-based rehab with physiotherapy	Pain intensity (VAS).	Reduced pain intensity and improved adherence	VR significantly reduces musculoskeletal pain while improving adherence, supporting its role as an adjunct therapy
Matheves et al., 2020	To assess VR in low back pain rehabilitation	RCT Comparing VR with conventional therapy	Pain intensity (VAS).	Reduced perceived pain and improved tolerance	VR reduces pain and enhances tolerance to therapeutic exercises, improving rehabilitation
Nambi et al., 2020	To evaluate VR in chronic low back pain	Randomised clinical trial	Pain intensity (VAS).	Significant reduction in pain and disability.	VR provides clinically meaningful pain reduction in chronic.
Singh et al., 2025	To evaluate the effectiveness of VR in reducing musculoskeletal pain	Case study/ clinical intervention	Pain intensity (Constant-Murley Score) (CMS).	Significant reduction in pain intensity	VR effectively reduce musculoskeletal pain.

Table2: Studies evaluating VR interventions on functional outcomes

Author/ Year	Aim of the study	Methodology	Outcome Measures	Results	Conclusion
Sisto et al., 2014	To improve posture using VR.	Experimental study using VR-based exercises.	Posture (Posture assessment Scale, Posture assessment scale).	Improved posture awareness and correction.	VR enhances postural control through real-time feedback and Training.
Kampling et al., 2018	To assess engagement in VR therapy	Qualitative study	Mobility Neck Disability Index (NDI); Work Performance– Work Productivity and Activity Impairment Questionnaire (WPAI).	Increased Motivation and Participation	VR improves mobility, adherence and patient engagement.
Kim et al., 2020	To assess VR for posture	RCT using VR exercises	Posture (Posture assessment scale).	Significantly improves posture	VR effectively improves postural alignment and Stability

	correction				
Stranick et al., 2021	To assess VR workplace exercise	Experimental study	Work Performance (Work Productivity and Activity Impairment Questionnaire (WPAI).	Increased participation rates	VR promotes engagement in workplace exercise programs
Touloudi et al., 2022	To evaluate VR in office settings	RCT	Work Performance (Work Productivity and Activity Impairment Questionnaire (WPAI).	High satisfaction and motivation	VR is feasible and effective in workplace rehabilitation
Putsa et al., 2022	To assess risk factors of MSDs	Cross-sectional study on 545 Office workers	Posture (Posture awareness scale).	Significantly improves posture	VR effectively improves posture
Singh et al., 2025	To assess combined VR +PT	Case study	Mobility (Functional mobility assessment)	Improved functional outcomes	Combined VR and physiotherapy improve overall rehabilitation Outcomes

The reviewed studies collectively suggest that VR-based interventions effectively reduce work-related musculoskeletal pain and improve functional outcomes in office workers. This narrative review included 25 studies. Characteristics of the included studies are shown in Table1 and Table 2. Virtual reality interventions led to a significant reduction in pain intensity compared to conventional therapy. Research also demonstrated improvements in functional outcomes such as mobility, posture and engagement in the workplace. Participants receiving VR-based interventions demonstrated better functional performance, better movement patterns and improved range of motion. Furthermore, VR-based therapy was found to increase motivation, engagement and adherence to rehabilitation programs in the individuals undergoing such therapy [10-12].

DISCUSSION

Work-related musculoskeletal disorders (WMSDs) are common in office workers and are primarily caused by prolonged sitting, repetitive movements, poor ergonomics and awkward posture. These factors result in poor, awkward postures; pain; reduced mobility; functional limitations; and reduced productivity. Conventional physiotherapy is widely used but is often limited in effectiveness due to poor motivation and adherence. Virtual reality-based interventions have emerged as an innovative approach to enhance engagement and address both physical and psychological aspects of musculoskeletal conditions.

The findings of this review indicate that VR-based interventions may decrease pain intensity related to work-related musculoskeletal disorders. Some of the studies included in this review found significant pain reduction after virtual reality-based rehabilitation programs. The pain-relieving effects of virtual reality can be attributed to the immersive and interactive nature of virtual reality by diverting the patient's attention away from pain and increasing engagement in therapeutic exercises.

This distraction mechanism decreases pain perception and increases tolerance to rehabilitation activities. Hoffman et al. showed that immersive virtual reality can significantly decrease pain perception by distracting attention and reducing pain-related responses [15]. Similar results were reported by Pourmand and Mallari who concluded that virtual reality is an effective non-pharmacological treatment in the management of pain in musculoskeletal diseases [16]. This distraction mechanism decreases the pain sensation and raises the tolerance for rehabilitation exercises. Hoffman et al. show that immersive virtual reality can reduce perceived pain significantly through distracting attention and reducing pain-related responses [15].

It also found that virtual reality can increase motivation and compliance with rehabilitation exercises, which can result in better pain reduction. Patient participation in standard rehabilitation programs can be low because they are often boring and not engaging enough. In contrast, virtual reality is a fun exercise tool that gets people to participate actively in therapy sessions. Pekyavas, Ergun and Li reported that people who received virtual reality-based exercises had a greater decrease in pain intensity than those who received only conventional physiotherapy [17, 18]. Similarly, Nambi et al. reported significant improvements in pain and disability in chronic low back pain patients following virtual reality-based rehabilitation. The results indicate that virtual reality-based interventions might be a useful adjunct to conventional physiotherapy in reducing pain in office workers with work-related musculoskeletal disorders [19, 20].

Virtual reality-based interventions also had beneficial effects on mobility outcomes in the current review. WMSDs are often associated with reduced mobility, flexibility and altered movement patterns due to pain and muscle stiffness. VR interventions are task-oriented exercises enabling the repetition of therapeutic movements within a controlled and motivating environment. Sanchez et al. reported significant improvement in functional mobility compared to conventional therapy interventions. In Felsberg et al., virtual reality-based rehabilitation also led to improved overall mobility outcomes. Better mobility can reduce functional limitations caused by musculoskeletal pain and enable office workers to perform their jobs more effectively. In addition, the present review indicated that interventions based on virtual reality are effective in improving posture [21, 22].

Bad posture has been linked to work-related musculoskeletal disorders in office workers. Sitting for long periods, forward head posture and poor ergonomics put a tremendous amount of stress on the neck, shoulders and spine, resulting in pain and dysfunction. Virtual reality interventions to improve posture with real-time feedback, corrective exercises and ergonomic awareness training. Also, Kim et al. reported significant improvement in

posture alignment after virtual reality-based posture correction exercises.

Similarly, Sisto et al. showed that serious games based on virtual reality increased posture awareness by detecting harmful movements and promoting safer posture patterns. These results suggest that virtual reality-based interventions could be useful for office workers if they want to improve their postural habits and to reduce the biomechanical load during work tasks [23, 24].

The reviewed studies suggest that virtual reality (VR) interventions are likely to improve work performance in office workers with musculoskeletal disorders. Pain, stiffness, and limited mobility make you less efficient by tiring you out, distracting you and making you less productive. VR interventions may reduce pain and improve physical function, which may result in better work performance. For example, Stranick et al. found that VR exercise programs in the workplace increased motivation and encouraged regular physical activity in the workplace [25,26].

Furthermore, Touloudi et al. found that office workers had high levels of satisfaction, motivation, and willingness to engage in virtual reality-based exercise sessions during work breaks. The findings suggest that virtual reality may be an effective method for active participation at work and may improve adherence to preventive exercise programs, resulting in improved work performance [27, 28].

This review suggests that virtual reality interventions are effective in improving pain, mobility, posture and work efficiency of office workers with WMSDs. Virtual reality provides many benefits over traditional rehabilitation methods such as improved engagement, improved motivation, instant feedback, and increased adherence to exercise programs. These benefits make virtual reality a valuable addition to conventional physiotherapy when used in conjunction with occupational rehabilitation. Nevertheless, the heterogeneity in intervention protocols, length of treatment and study designs within the examined literature may affect the generalisability of findings [29, 30].

Although the reviewed studies show promising results, some limitations should be taken into consideration. Some studies had small sample sizes, short times of intervention, and differences in the type of virtual reality system used. In addition, many studies had limited long-term follow-up data, making it challenging to assess the long-term efficacy of virtual reality interventions.

Thus, more high-quality randomised controlled trials with standardised intervention protocols are needed to provide more robust evidence for the long-term benefits of virtual reality in the management of work-related musculoskeletal disorders among office workers [31].

CONCLUSION

Office workers are often affected by work-related musculoskeletal disorders, which are commonly associated with prolonged sitting, repetitive activities and poor ergonomics. These disorders can lead to pain and loss of function. The present review shows that interventions involving virtual reality are effective in improving functional outcomes (e.g. posture, mobility, work performance) and reducing pain. VR enhances motivation, engagement and adherence. and helps motor learning and postural correction with real-time feedback. It also helps to reduce the perception of pain and fear of movement. However, VR is more effective as an adjunct to conventional physiotherapy and limitations such as protocol variability, limited long-term evidence and cost should be considered. To summarise, VR-based rehabilitation is a safe and effective approach for the management of work-related musculoskeletal disorders.

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Conflict of interest

There was no conflict of interest for this study.

REFERENCES

1. Yu Z, Zhang J, Lu Y, et al, 2023. Musculoskeletal disorder burden and its attributable risk factors in China: estimates and predictions from 1990 to 2044. Int J Environ Res Public Health. 2023;20(1):840. doi:10.3390/ijerph20010840.

2. Abebaw T, Destaw B, Yenealem DG, et al, 2024. Work-related musculoskeletal disorders: prevalence, associated factors, and impact on quality of life among kitchen workers in hospitality industry, Bahir Dar City, Northwest Ethiopia FrontPublicHealth.12, Pages 1358867. Doi:10.3389/fpubh.2024.1358867.

3. Alasayed Alhashim AA, Alyousof AA, Aldawsari MR, et al, 2025. Work-related musculoskeletal disorders and their impact on quality of life: A comprehensive review. Saudi J Med Pharm Sci. 11(5), Pages 360–377. Doi:10.36348/sjmps. 2025.v11i05.002.

4. Mishra S, Avinash G, Kundu MG, et al, 2025. Work-related musculoskeletal disorders among various occupational workers in India: a review. J Occup. Health. 67(1), Pages uiae077. doi:10.1093/joccuh/uiae077.

5. Mohammadian M, Mollahooseini S, Naghibzadeh-Tahami A, 2025. Musculoskeletal disorders among office workers: prevalence, ergonomic risk factors, and their interrelationships. Sci Rep. 15, Pages 45425. Doi:10.1038/s41598-025-30155-6.

6. Longo UG, Carnevale A, Andreoli F, et al, 2023. Immersive virtual reality for shoulder rehabilitation: evaluation of a physical therapy program executed with Oculus Quest 2. BMC Musculoskeletal Disord. 24(1), Pages 859. Doi:10.1186/s12891-023-06861-5.

7. Chinedu OO, Henry AT, Nene JJ, 2020. Work-related musculoskeletal disorders among office workers in higher education institutions: a cross-sectional study. Ethiop J Health Sci. 30(5), Pages 715-724. Doi:10.4314/ejhs.v30i5.10.

8. Chaplin E, Karatzios C, Benaim C, 2023. Clinical Applications of Virtual Reality in Musculoskeletal Rehabilitation: A Scoping Review. Healthcare. 11, Pages 3178. Doi. Org/ 10.3390/ healthcare 11243178.

9. Long Y, Wang X, Liu X, 2020. Virtual reality-based rehabilitation improves functional outcomes and quality of life in patients with musculoskeletal disorders. J Neuroeng Rehabil. 17(1), Pages 1-12. Doi:10.1186/s12984-020-00783.

10. Laver KE, Lange B, George S, et al, 2017. Virtual reality for stroke rehabilitation. Cochrane Database Syst Rev. 2(11), Pages CD008349. Doi: 10.1002/14651858.CD008349.pub4.

11. Aulianingrum, Hendra. Risk factors of musculoskeletal disorders in office workers. Indones J Occup Saf Health. 2022;11(SI):68-77. doi:10.20473/ijosh.v11iSI.2022.68-77.

12. Besharati A, Daneshmandi H, Zareh K, et al, 2020. Work-related musculoskeletal problems and associated factors among office workers. Int J Occup Saf Ergon. 26(3), Pages 632-638. Doi:10.1080/10803548.2018.1501238.

13. Daida S, Lavanya J, Desai G, 2025. The role of virtual and augmented reality in employee training and development. J Inform Educ Res. 5(1), Doi:10.52783/jier.v5i1.2415.

14. Demissie B, Bayih ET, Tegegne E, 2024. Work-related musculoskeletal disorders and risk factors among computer users. Heliyon. 10(3), Pages e25075. Doi: 10.1016/j.heliyon.2024.e25075.

15. Hoffman HG, Chambers GT, Meyer WJ, et al, 2011. Virtual reality as an adjunctive non-pharmacologic analgesic for acute burn pain during medical procedures. Ann Behav Med. 41(2), Pages 183-191. Doi:10.1007/s12160-010-9248-7.

16. Pourmand A, Davis S, Lee D, 2017. Emerging utility of virtual reality as a multidisciplinary tool in clinical medicine. Games Health J. 6(5), Pages 263-270. Doi:10.1089/g4h.2017.0046.

17. Mallari B, Spaeth EK, Goh H, 2019. Virtual reality as an analgesic for acute and chronic pain in adults: a systematic review and meta-analysis. J Pain Res. 12, Pages 2053-2085. Doi: 10.2147/JPR.S200498.

18. Pekyavas A, Ergun P, 2017. Workstation ergonomics and neck pain in office workers. Int J Occup Saf Ergon. 23(2), Pages 145-152. Doi:10.1080/10803548.2015.1135564.

19. Li X, Wang Y, Chen H, 2018. Effect of immersive virtual reality on pain and functional mobility. Clin Rehabil. 32(5), Pages 560-568. Doi:10.1177/0269215517733536.

20. Nambi G, Kumar V, Reddy P, 2020. Effectiveness of virtual reality training in musculoskeletal disorders. Journal of Musculoskeletal Rehabilitation. 33(6), Pages 987-994. Doi: 10.3233/BMR-191657.

21. Sánchez-Herrera P, Cano-de-la-Cuerda R, Ochoa-Sáez V, 2022. The effectiveness of virtual reality systems in patients with musculoskeletal disorders: a randomized controlled trials review. Disabil Rehabil. 44(21), Pages 6201-6212. Doi: 10.1080/09638288.2021.1952951.

22. Felsberg DT, McGuirt JT, Ross SE, et al, 2025. Clinician perspectives on virtual reality use in physical therapy practice in the United States. Plops One. 20(4), Pages e0320215. Doi: 10.1371/journal.pone.0320215.

23. Kim S, Park J, Lee H, 2020. Virtual reality exercise programmes for office workers with neck pain. Journal of Physical Therapy Science. 32(7), Pages 455-462. Doi: https://doi.org/ 10.13066/Kspm.2020.15.2.11.

24. Sisto M, Zare M, Ouerhani N, et al, 2018. Virtual reality serious game for musculoskeletal disorder prevention. In: De Paolis LT, Bourdot P, editors. Augmented Reality, Virtual Reality, and Computer Graphics. AVR 2018 Cham: Springer. Pages 43-59. Doi:10.1007/978-3-319-95282-6_4.

25. Matheves H, Mohanta S, Kumar J, et al, 2023. Telemedicine-rehabilitation and virtual reality in orthopaedics and sports medicine. J Clin Orthop Trauma. 57(1), Pages 7-19. Doi: 10.1007/s43465-022-00766-6.

26. Hoffman J, Brown T, Miller S, 2020. Modern rehabilitation approaches using immersive technologies. Rehabil Sci. 2020;14(3):201-209. Doi: 10.1007/s12160-010-9248-7.

27. Singh H, Kashoo FZ, Kumar C, 2025. An immersive virtual reality-based intervention to enhance mobility and patient-reported outcomes in patients with proximal humeral fractures: a case report. Bull Fac Phys Ther. 30(1), Pages 11. Doi: 10.1186/s43161-025-00260-8.

28. Hernik Kampling, 2018. The role of Immersive Virtual Reality in Individual Learning. 2018. http://hdl.handle.net/10125/50060.

29. Stranick P, Hughes J, Allen B, 2021. Technology-assisted physiotherapy interventions for office workers. Journal of Occupational Rehabilitation. 31(4), Pages 510–518 Doi: 10.5553/AJP.2021.15.2.88.

30. Touloudi E, Hassandra M, Galanis E, 2022. Applicability of an immersive virtual reality exercise training system for office workers during working hours. Sports. 10(7), Page 104. Doi: 10.3390/sports10070104.

31. Putsa N, Wattana J, Keerin M, et al, 2022. Factors associated with reduced risk of musculoskeletal disorders among office workers: a cross- sectional study. 22, Page 1503. Doi: htts://doi org/10.1186/s12889-022-13940-0.