

# Use of virtual reality in musculoskeletal conditions – Examining the evidence

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**Abstract**—We conducted a review to examine the effectiveness of virtual reality (VR) platforms in the rehabilitation of musculoskeletal conditions. The study was conducted using standard methodology. 7 studies met the inclusion criteria. The studies described VR interventions in a variety of conditions such as low back pain, ankle sprains, post total knee replacement, carpal tunnel syndrome and shoulder pain. Effect sizes ranged from 0.15 to 0.9. In spite of limited evidence, use of VR in these conditions looks promising.

**Keywords**—*virtual reality, musculoskeletal rehabilitation, systematic review*

## I. INTRODUCTION

Virtual reality (VR) platforms are being used extensively in rehabilitation in people with neurological conditions. This is because VR systems typically allow task-oriented and repetitive practice of functional movements in an interesting and challenging environment [1]. In people with chronic conditions, such environments can help improve adherence to therapy and motivation.

Musculoskeletal conditions such as chronic low back pain, knee osteoarthritis, etc. often involve several physical and functional impairments. As the conditions become chronic, psychosocial issues such as depression, fear of movement and pain catastrophizing can impact activity [2]. Given that there is a growing shift from interventions having a focus on impairments to those having a task-oriented focus in musculoskeletal rehabilitation [3], there is a need to examine the utility of VR-based therapy in these conditions. We therefore conducted a review of literature to examine the evidence for use of VR in musculoskeletal conditions.

## II. METHODS

A comprehensive search of studies published in English between 2000-2018 was conducted. Databases searched included MEDLINE, Google Scholar, ISI Web of Science and Science Direct. Combinations of MeSH terms and key words such as virtual reality, arthritis, low back pain, shoulder pain, ankle pain, musculoskeletal rehabilitation, were used. In addition, reference lists of retrieved studies were searched to

identify other pertinent articles. Articles were included if: i) the study was conducted in an adult population; ii) involved use of traditional VR or an exergaming platform; iii) VR was used as an intervention in a musculoskeletal condition. Articles were excluded if they involved management of musculoskeletal pain post neurological conditions.

Retrieved articles were grouped according to the condition and type of VR used. Study details were summarized according to author, research design, VR intervention, outcomes and results. Effect sizes were calculated to quantify improvement. Effect sizes were classified as small (0.2 to 0.49), moderate (0.5 to 0.79) and large ( $\geq 0.8$ ).

## III. RESULTS

7 studies were identified that met the inclusion criteria [4-10]. Studies involved VR interventions in a variety of conditions: low back pain (n=1), ankle sprains (n=2), post total knee replacement (n=2), carpal tunnel syndrome (n=1) and shoulder pain due to impingement (n=1). Nintendo Wii Fit was a commonly used VR platform in several studies. In patients with carpal tunnel syndrome, a haptic glove was used in a VR environment. Primarily, VR was used to address balance and co-ordination issues in patients with ankle sprains and post-total knee replacement. Range of motion and strength were targeted by interventions in patients with carpal tunnel syndrome and shoulder pain. Moderate effect sizes (0.5 to 0.7) were seen for VR interventions in patients with total knee replacement, ankle sprains and shoulder pain. A large effect size (0.9) was seen in the study with VR intervention for low back pain patients.

## IV. CONCLUSION

While the use of VR is encouraging in musculoskeletal conditions, the evidence available remains limited. We definitely need more studies to further examine use of VR-based interventions in these as well as other conditions with similar functional impairments. Most of the studies reviewed used VR as an adjunct to regular therapy. Given that adherence to therapy and lack of motivation is an important

concern in chronic musculoskeletal conditions such as low back pain and hip and knee arthritis, use of VR in addition to regular therapy seems promising.

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