



Systematic review

Effectiveness of virtual reality rehabilitation for children and adolescents with cerebral palsy: an updated evidence-based systematic review

D.K. Ravi^{a,*}, N. Kumar^a, P. Singhi^b

^a Biomedical Instrumentation Division, CSIR-Central Scientific Instruments Organization, Chandigarh, India

^b Department of Paediatric Medicine, Post Graduate Institute of Medical Education and Research, Chandigarh, India

Abstract

Background The use of virtual reality systems in the motor rehabilitation of children with cerebral palsy is new, and thus the scientific evidence for its effectiveness needs to be evaluated through a systematic review.

Objective To provide updated evidence-based guidance for virtual reality rehabilitation in sensory and functional motor skills of children and adolescents with cerebral palsy.

Data sources PubMed, PEDro, Web of Science, OTseeker, PsycINFO and Cochrane Library were searched from their earliest records up to 1 June, 2016.

Study selection Two reviewers applied the population intervention comparison outcome (PICO) question to screen the studies for this review.

Data extraction Information on study design, subjects, intervention, outcome measures and efficacy results were extracted into a pilot-tested form. Method quality was assessed independently by two reviewers using the Downs and Black checklist.

Data synthesis Thirty-one studies included 369 participants in total. Best evidence synthesis was applied to summarize the outcomes, which were grouped according to International Classification of Functioning, Disability and Health. Moderate evidence was found for balance and overall motor development. The evidence is still limited for other motor skills.

Conclusions This review uncovered additional literature showing moderate evidence that virtual reality rehabilitation is a promising intervention to improve balance and motor skills in children and adolescents with cerebral palsy. The technique is growing, so long-term follow-up and further research are required to determine its exact place in the management of cerebral palsy.

Systematic review registration number PROSPERO 2015:CRD42015026048.

© 2016 Chartered Society of Physiotherapy. Published by Elsevier Ltd. All rights reserved.

Keywords: Cerebral palsy; Rehabilitation; Review; Virtual reality

Introduction

Cerebral palsy refers to a category of non-progressive neurological disorders appearing in infancy or early childhood that have a permanent effect on sensory motor capabilities [1]. The worldwide prevalence of cerebral palsy is estimated to be 1.5 to 4 per 1000 live births, making it the most common motor disability in childhood [1]. The child's normal

functioning is affected by a variety of neuromuscular and musculoskeletal impairments. Besides motor functioning, cerebral palsy also affects cognitive, affective and behavioral performances. To date, there is no single agreed cure for cerebral palsy, but motor functional outcomes of affected individuals can be improved with early therapeutic intervention [1,2]. A variety of treatments are available and appear to be effective, including physical therapy, occupational therapy, medications, surgery and orthotic devices. Physical therapy plays a central role in disease management, focusing on posture, balance, mobility, strength and function improve-

* Correspondence: Biomedical Instrumentation Division, CSIR-Central Scientific Instruments Organization, Chandigarh 160030, India.

E-mail address: depakroshanblu@gmail.com (D.K. Ravi).

ment. However, children find physical therapy to be mundane and monotonous when undergoing it for a longer period [2].

Virtual reality rehabilitation is an emerging therapy for motor rehabilitation of children with cerebral palsy [2]. The therapy is provided through a computer-simulated environment where they interact with real-world-like objects and events through sight, sound, smell and touch. Virtual reality technologies vary greatly in immersion, cost and complexity. The interacting interface could be anything from a simple joystick (*e.g.* Wii Remote) to a complex motion camera (*e.g.* Kinect sensor), and display hardware include standard computer/television screens and head mount displays. Accordingly, virtual reality rehabilitation is categorized as immersive, semi-immersive and non-immersive. Neuroplasticity studies have demonstrated that virtual reality rehabilitation is positively associated with active engagement and motivation during interventions. In addition to motivation, virtual therapy also enhances neural re-organization that appears to optimize rehabilitation outcomes in children with cerebral palsy [2,3]. A review of growing research found increasing evidence for the use of virtual therapy to improve sensory and functional motor abilities. The virtual scenario seems to foster motor learning, retention of learned skills, and skill transfer to real-world situations [4]. Specifically, a few studies have shown that virtual therapy improves posture and balance, upper limb function, joint control and gait [4,5]. Establishing augmented biofeedback in neuromotor rehabilitation has allowed therapists to methodically design and control intervention strategies.

Although virtual therapy is highly recommended for active engagement of participants, there is a lack of research consensus to support it for improvement in motor skills. Chen *et al.* [6] focused on upper extremity function, and reported significant improvement in the treatment group compared with the control group. However, their meta-analysis, which included three randomized controlled trials (RCTs), found no significant difference between pre and post intervention. Nonetheless, the number of high-quality studies was limited and evidence on other important motor skills, such as balance, was lacking. Similarly, a critical review [7] reported inconclusive evidence for the effectiveness of virtual therapy on body structure and functions, and found only moderate evidence for a positive effect of the technique on personal factors in children with cerebral palsy. The results of these reviews were largely based on a very small number of quality research designs (RCTs), and there was insufficient high-level evidence on the improvement of motor skills to support clinical application of virtual therapy. More recent studies have used therapeutically relevant virtual reality environments from off-the-shelf gaming systems, and the number of RCTs addressing the various motor skills has increased; as such, there is a need for an updated systematic review. This article seeks to update the latest evidence and summarize the current body of literature. The findings should be useful to optimize approaches in clinical research and clinical practice on virtual therapy for treatment of cerebral palsy.

This systematic review aims to update previous reviews, and incorporate the latest evidence for efficacy of virtual reality rehabilitation in the treatment of children and adolescents with cerebral palsy; and to provide recommendations for future clinical research.

Methods

Search strategy

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [8]. A comprehensive literature search of PubMed, PEDro, Web of Science, OTseeker, PsycINFO and Cochrane Library was performed for articles published prior to 1 June, 2016. The search strategy was based on medical subject heading (MeSH) and non-MeSH search terms (see Appendix A, online Supplementary material). Additionally, articles in the reference lists of systematic reviews and studies were hand searched. There was no restriction based on the study type. Studies in languages other than English were not considered during the entire search.

Selection criteria

A PICO question (see Appendix B, online Supplementary material) was established and followed during the literature selection process. Early screening of the articles based on titles and abstracts was performed by two authors (DK and NK). The full text of the screened articles was examined if: (1) the study included children and/or adolescents with cerebral palsy aged 5 to 18 years; (2) the intervention employed virtual reality systems; (3) baseline or intergroup comparisons were performed; (4) outcomes on motor functions were reported; and (5) any study design was followed. Two authors (DK and NK) applied the above inclusion criteria independently to select the studies, and any disagreements were resolved through discussion. This study included both commercial and non-commercial systems that use the concept of virtual reality irrespective of the degree of immersive experience (*e.g.* Sony PlayStation, CAREN system), input device (*e.g.* Kinect motion camera, Haptic console) and display device (*e.g.* TV screen, curved projection display).

Data extraction and assessment of methodological quality

Two reviewers (MK and MS) extracted the following information independently from the included studies: study design, sample size, age, sex, type of cerebral palsy, treatment and assessment protocols, outcome measures and study conclusion. A predesigned and pilot-tested review form was used to collect this information. The reviewers were not blinded to the authors, but were blinded to each other. The review-

Download English Version:

<https://daneshyari.com/en/article/5564849>

Download Persian Version:

<https://daneshyari.com/article/5564849>

[Daneshyari.com](https://daneshyari.com)