THE EFFECTS ON THE USE OF VIRTUAL REALITY IN REHABILITATION OF NEUROLOGICAL PATIENTS WITH MOTOR DEFICIT

https://doi.org/10.56238/sevened2025.008-016

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ABSTRACT

The use of Virtual Reality (VR) is widely disseminated in the health area, improving the prognosis of many pathologies, this tool is capable of creating environments that promote the rehabilitation and recovery of motor and cognitive functions. This study aims to analyze the use of VR in motor rehabilitation and postural balance in neurological patients with motor deficit. This is a qualitative systematic literature review, using the SciELO (Scientific Electronic Library Online) and Research Gate databases, in the period between August and September 2024. The analysis of several tools and environments involving VR and used in the treatment of pathologies such as Parkinson's Disease (PD), Cerebral Vascular Accident (CVA) and Cerebral Palsy (CP), which observes neurological damage with alteration in movement and postural balance, was valid in the recovery and promotion of balance and postural control by stimulating muscular and neurological responses. They simulate realities in controlled environments, reducing risks and motivating the performance of exercises. Among the most used consoles are the XBOX 360 Kinect and the Nintendo Wii, both of which have a satisfactory cost/benefit ratio for use by various professionals and specialized rehabilitation clinics. It is then perceived that the use of VR presents itself as an innovative and revolutionary tool, stimulating its use in clinical rehabilitation and the elaboration of increasingly specific treatment protocols for each pathology and neurological conditions.

Keywords: Virtual Reality. Motor function. Postural Balance.

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INTRODUCTION

The use of Virtual Reality (VR) is widely disseminated in all areas, including health, in which technological advancement and the spread of the electronics industry have developed tools that can progressively improve the quality of life of many patients and even improve the prognosis of many realities that before the advent of virtual reality, It was unlikely, either in teaching or in practice. Concomitantly, the search for treatment with fewer side effects, dependence, and toxicity is a challenge, especially for complex pathologies, such as Parkinson's Disease (PD), in which the side effects of the drugs involve effects on the gastrointestinal tract and the cardiovascular system, in addition to the results of prolonged use of the drug that can bring signs of involuntary movements of contortion and dependence (Rodrigues; Campos, 2006).

According to Cardoso et al. (2006), the environments are created with the purpose of rehabilitating people with disabilities and aims to recover motor capacity and cognitive functions, a therapy aimed at patients who have brain damage, traumatic brain injuries, cerebral palsy, in the prevention of accidents, surgeries, etc. In this way, this technology serves to create a "new reality" for the user, provoking their immersion, interaction and complete involvement in a three-dimensional world, these three concepts are important in the perception of the use of this type of tool in the rehabilitation of neurological patients with motor deficit, since the patient's relationship with this environment promotes positive neurological responses and that show the progress of rehabilitation for the user, family and team of professionals related to the case (Lima et al, 2017).

Among the advantages observed in the use of this technology, it is noteworthy that this type of therapy has several positive points that cover several possibilities of application, whether cognitive, motor and/or behavioral, which can be performed in real situations without risk to patients, performing simulations and actions that would not be noticeable in the real world, being of fundamental importance in the rehabilitation of neurological patients. In Brazil, the diverse number of studies related to this therapy is remarkable, however, they are specific works in each niche (Nunes et al., 2011), in the neurological area, we can see works related to Parkinson's Disease (Mendes, 2012), Cerebral Vascular Accident (CVA) (Pompeu et al, 2014), cerebral palsy (Moreira, 2012), among others, which show the effects that this type of technology can bring to patients. (Lima et al, 2017)

In Parkinson's disease, for example, there is the death of the dopaminergic neurons of the substantia nigra, responsible for the fluidity and coordination of movement, as well as balance, in addition to this, other diseases are also accompanied by dysfunctions and important sequelae of motor function and balance by other pathophysiological processes in

the cerebral and cerebellar hemispheres, when not accompanied and treated, the progression of these pathologies leads to physical impairment and dependence in the performance of daily activities, resulting in a decrease in the quality of life of the patient and the family sphere (Santana et al.2014). Thus, in several studies related to this pathology, the improvement of motor and cognitive skills was observed using rehabilitation with games that involve virtual reality, showing a possibility of non-drug treatment in symptomatic patients, especially in the rehabilitation of gait and balance (Fritsch et al, 2018). Although some research results related to VR in the treatment of stroke are not significant (Meireles et al, 2022), in most studies they reported results in addition to motor improvement and postural correction, cognitive and memory development, cardiopulmonary endurance, gait, and the response to various stimuli that VR could provide using the interaction of visual and mechanical stimuli. (Lima et al, 2017)

In this article, an analysis of these studies related to the effects generated in the rehabilitation of neurological patients with motor deficit will be carried out, highlighting the characteristics of virtual reality and its advantages, what were the methods used, the motor response of these patients and the limitations in this area. In this sense, the objective of this article is to establish, according to the literature, the use of Virtual Reality in motor rehabilitation and postural balance of neurological patients who presented motor deficit, in order to integrate this technological tool as a non-pharmacological physiotherapeutic treatment method. As more specific objectives, it is intended to establish the importance of virtual reality in the context of non-drug treatments; define the environments and tools used for neurological treatments; to elucidate the advantages of using virtual reality in the treatment of neurological patients and to discuss the results of studies related to the theme.

METHODOLOGY

This is a systematic literature review that will be collected and evaluated the qualitative data pertaining to the theme (Costa, Toledo, 2016). For the elaboration of this review, research stages were carried out, such as: Debate on the theme and refined elaboration of the idea, choice of articles and studies related to the case, using the SciELO (Scientific Electronic Library Online) and Research Gate databases, categorization of the themes according to specific objectives, evaluation of the information and presentation of the results.

RESULTS AND DISCUSSION

During the conduct of this study, the various tools and environments used in the treatment of neurodegenerative pathologies mentioned in the text were analyzed, which contributed to the improvement of movement and postural balance in patients with neurological damage. In Parkinson's disease, for example, a neurodegenerative condition that impacts the dopaminergic neurons of the basal ganglia, studies that employed the XBOX 360 Kinect consoles (Mendes et al., 2015) and the Nintendo Wii (Mendes, 2012) were examined. Both technologies offer a variety of games and environments that can be adapted and developed to facilitate the performance of repetitive physical movements and provide the feedback necessary for motor rehabilitation, in addition to being cheaper and easier to use technologies (Mendes et al., 2015).

In this context, the Xbox 360 Kinect console, characterized by the absence of the need for manual controls and the use of a motion recognition system through the built-in camera that captures three-dimensional images, provides a more immersive interaction experience when compared to others (Chang, Chen, & Huang, 2011). The Nintendo Wii, on the other hand, requires manual control to carry out activities in the games. However, studies have shown improvements in the performance of functions compromised during the execution of games specific to both platforms. It was possible to perceive from the improvement of physical conditioning, balance, gait, amplitude and fluidity of movements, to the improvement in displacement and weight bearing and postural adjustments. It was possible to perceive with the use of these consoles that the visual elements present stimulated participation in addition to promoting the cognitive development of patients, particularly for those games with progressive levels of difficulty (Mendes et al., 2015; Silva; Iwabe – Marchese, 2014).

In stroke, the loss of motor function and postural balance usually comes from ischemic or hemorrhagic disorders with the impairment of the areas of the precentral gyrus, responsible for the primary motor cortex (LOUIS et al, 2018). Here, the most used console of choice is the Nintendo Wii, in the studies carried out by Souza et al (2012), they showed an improvement in the speed of movement, agility and muscle strength of the upper limbs when associated with conventional treatment. Although there is still an insufficient number of studies to define the exact effectiveness of the Wii, this technology promotes well-being and works on the movements of day-to-day tasks of patients with stroke sequelae. This response stems from a cortical reorganization cited by Júnior and Silva (2012), in which the repetitive and induced performance of movements by virtual reality technology would result

in a neuroplasticity mechanism in which the information transmitted through the performance of the patient would lead to improved motor control.

Studies have also shown the use of virtual reality in cases of Cerebral Palsy (CP), which is caused by a traumatic brain injury or fetal malformation, can cause limitations in movement and permanent postural disorders accompanied by sensory and/or cognitive changes (Silva; Iwabe-Marchese, 2013; Rosebaum et al, 2007). Although the changes for this condition are permanent, the use of the Nintendo Wii stimulated balance and postural control, and the muscular response of CP patients, revealing that the VR used in these cases is one of the most promising non-pharmacological mechanisms that can be used in the treatment, especially associated with physiotherapy (Lima et al, 2017).

It is evident that virtual reality has the ability to motivate participation in treatment and provide resources for patients to experience different environments that put them in challenges compared to reality in an individualized way, thus allowing them to enjoy a better quality of real life (Cardoso et al., 2004), training them cognitively and physically to perform activities that were previously challenging (Koeniget et al, 2009), in addition to contributing to future studies, using the observation of the data acquired and stored during the performance of the activities, both to maintain the performance of the activities by the multidisciplinary team (Pompeu; Pompeu, 2011), as well as in the development of new environments that explore more activities that challenge patients (Dores et al, 2012).

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