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VIRTUAL REALITY PROGRAM FOR STROKE REHABILITATION - A REVIEW

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ABSTRACT Stroke is one of the leading causes for disability worldwide . Motor function deficits due to stroke affects the patient's mobility and contribute to overall quality of life. Neurorehabilitation training is the most effective way to reduce motor impairments in stroke patients. Conventional rehabilitation found to provide modest and sometimes delayed effects. This systematic review focuses on the impact of Virtual Reality Program on motor rehabilitation of stroke patients. The studies suggested that virtual reality is relatively recent approach that may enable practice of functional tasks at higher dosage than traditional therapies. From this review of literature , it can be concluded that Virtual Reality is effective in improving motor functions following stroke. Use of Virtual Reality as an adjunct to conventional therapy resulted in greater motor gains than conventional therapy alone . The studies included in this review show optimal level of evidence and grade of recommendations , but further studies with larger sample sizes are needed to draw more reliable conclusion.

KEYWORDS :

INTRODUCTION

Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause, cerebral infarction, intracerebral haemorrhage (ICH), and subarachnoid haemorrhage (SAH), and is a major cause of disability and death worldwide. [1] Stroke affects about 17 million people per year worldwide, with an increasing rate every year.[2] Stroke survivors often suffer from physical and mental disabilities, heavily impacting their quality of life. Five years after the first stroke, nearly 66% of patients exhibit different degrees of disability and only 34% are functionally independent in their activities of daily living.[3] Stroke is a disorder associated with long term disability and is more common in older people.[4] The symptoms of stroke such as cognitive, motor and emotional sequelae often impact on a person's level of independence and quality of life.[5] The purpose of neurological rehabilitations is to promote a rapid recovery from the manifold post-stroke deficits and the attainment of a lifestyle, as close as possible to the premorbid state.[6]

Motor dysfunction is the most prevalent impairment, with 9 out of 10 stroke survivors suffering from some form of upper limb motor disability. [11] Thus, there is a strong need for rehabilitative approaches enhancing motor recovery for stroke patients.[12] To maximize neural, motor and functional recovery, training needs to be long lasting, challenging, repetitive, task-specific, motivating, salient, and intensive. [13] Further approaches include strength training, trunk restraint, somatosensory training, constraint-induced movement therapy, bilateral arm training, coordination of reach to grasp, mirror training, action observation and neuromuscular electrical stimulation. [14]

Virtual Reality is a relatively recent approach that may enable simulated practice of functional at a higher dosage than traditional therapies (Demain 2013; Kwakkel 2004; Merians 2002)[25]. It is a computer technology that simulates real-life learning while providing augmented feedback and a high intensity of massed practiced tasks [26] .VR can be differentiated into immersive and nonimmersive gaming systems. Immersive systems enable players to move an avatar in a simulated environment. Nonimmersive systems often focus on arm or leg movements in simulated 3D environments [27] . Virtual reality immersion techniques are based on the conjunct use of a computer-generated three-dimensional graphical environments (Riva, 2003; Oujamaa et al., 2009) and visual, auditory, or haptic devices[28,29].

REVIEW OF LITERATURE

Turolla et al.,(2013) did a research on 367 patients divided into two groups to compare the effectiveness of virtual reality program combined with conventional therapies to conventional therapy alone and concluded that association of virtual reality based rehabilitation with traditional restorative approaches improve the effectiveness of restoring upper limb functions.[31] Hatem et al.,(2016) conducted a multiple systematic review also concluded that virtual reality is one of the approach recommended as adjuvant therapy in improving upper limb motor functions.[39] Association of VR with traditional restorative approaches improves the effectiveness of rehabilitation of motor functions and ADL capacities compared with conventional rehabilitation alone [42,43].

In a study done by Perez Marcos et al.,(2017), the feasibility of training intensity in chronic stroke patient using embodied virtual reality system is investigated over 10 stroke patient with upper extremity paresis .It was concluded that task specific virtual reality training may be beneficial for functional recovery in chronic stage of stroke.[32] Another study done by Schuster-Amft C. et al.,(2015) to evaluate feasibility and neurophysiological changes after virtual reality based training of upper limb movements concluded that it is feasible ,safe and intense and were related to changed cortical activation patterns.[36]

A review done by Maureen K. Holden et al., (2005), on Virtual Reality for motor rehabilitation. He compared motor learning in real environment than in virtual environment. As a result people with disabilities appear capable of motor learning within virtual environment.[33]

In a study done by Calabrò R S et al., (2015), on the role of virtual reality in improving Motor performance revealed by EEG, it was concluded that robotic based rehabilitation combined with Virtual Reality in chronic hemiparesis induced an improvement in gait and balance.[34] Another study done by Jang et al., (2005), to investigate the effects of Virtual Reality on cortical reorganisation and motor recovery Virtual reality induces neuroplastic changes associated with motor recovery.[35]

According to the study done by Krichevets et al.,(1995) on virtual reality and computer gaming as a means of movement rehabilitation , it was stated that because of playful aspect of the training ,subjects tends to be more motivated in VR settings than in conventional rehabilitation settings. It also improve patient motivation and confidence through reinforcement and immediate feedback , and positivity through achievement and social interaction.[41]

Various studies concluded that novel demonstration of VR induces neuroplastic changes and associated motor recovery in stroke patients allows for mass practice and provide training in environments that are sometimes impractical to create in natural world .[36,46,49,50]

VR technology can be used to produce an environment in which intensity of practice and feedback on performance can be manipulated to provide tailored motor training (Merians et al, 2002). (48)

CONCLUSION

Based on sufficient amount of evidence, it can be concluded that virtual reality program for stroke rehabilitation is effective in improving motor functions by increasing subject interest and rate of participation, which influences brain reorganization and increases neural plasticity and eventually fastens functional recovery. Use of virtual reality as an adjunct to conventional therapy, resulted in significantly greater motor gains than conventional therapy alone. VR is advantageous as it offers goal oriented task, repetition and training in complex environments that are impractical to create in the natural world shown to be important in neurological rehabilitation.

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