International Journal of Science and Healthcare Research
Vol.9; Issue: 1; Jan.-March 2024
Website: ijshr.com
Case Report *ISSN: 2455-7587*

Effectiveness of Virtual Reality Therapy in Improving Balance in Stroke Patient: A Case Report

Ashok Ravi[1], Ramamoorthy Veyilmuthu[2], Parthiban Alagappan[3], Arul Uvaraj[4]

[1]Senior Physiotherapist, Dept of Physical Medicine & Rehabilitation (PMR), [2]Professor &HOD, [3]Senior Physiotherapist, [4] Physiotherapist, Department of PMR,
PSG Hospitals, Coimbatore, Tamil nadu, India

Corresponding Author: Ashok R

DOI: https://doi.org/10.52403/ijshr.20240122

ABSTRACT

Stroke affects approximately 15 million people worldwide every year and among those, between 55% and 75% of these survivors continue with motor deficits and reduce quality of life following the event. Balance impairment is a common consequence of a stroke, which can significantly hinder individual's participation in daily activities, social interactions, and leisure pursuits and their ability to return to work. Rehabilitation is vital for minimizing post-stroke sequelae and facilitating the recovery of patients. Virtual reality is that allows users to interact with a multisensory simulated environment and receive real-time feedback on performance. In this case report we presented a 50-year-old patient diagnosed as stroke had left hemiparesis and having difficulty in maintaining balance and walking and enrolled in physical rehabilitation for 6 weeks in that we incorporated virtual reality therapy to improve balance and quality of life. Where he had positive results and recovered well.

Keywords: Stroke, Balance impairment, Virtual Reality therapy, Physical rehabilitation

INTRODUCTION

It is estimated that stroke affects approximately 15 million people worldwide every year and among those, between 55% and 75% of these survivors continue with motor deficits and reduce quality of life following the event. Balance is the ability to maintain the line of gravity within the base of support with minimal postural sway.[1]The control of human balance is a comprehensive process relying on the integration of visual, vestibular and somatosensory inputs to the central nervous system. It is reported that about 83% of stroke survivors suffer from balance impairment. Balance impairment is characterized by short supporting time and differences between two sides of the body and slow walking speed, which may increase the risk of falls.[2] Fear of falling can contribute to a sedentary lifestyle and increased disability, which means lower quality of life.[3]Falling often leads to longer hospital stay, more medical and nursing costs, and economic losses directly or indirectly. Rehabilitation is vital for minimizing post-stroke sequelae and facilitating the recovery of patients[4].

Virtual Reality (VR) is defined as a computer-based technology that allows users to interact with a multisensory simulated environment and receive real-time feedback on performance. The interactive games are designed to provide the patient with real-life scenarios and activities relevant to daily living. There is modest evidence showing that neuroplasticity occurs after virtual reality (VR) training in stroke patients. VR as adjunctive therapy in neuro rehabilitation for arm motor recovery post stroke[5], it

improves primarily upper limb functional activity[6] and a secondary focus on gait, balance[7], global motor function, quality of life, and adverse events. It also creates a safe environment that can be easily manipulated to advance tasks as stroke patient's functional abilities progress. In addition, the technology provides diverse applications that can be tailored to the patient. The concept of VR is based on the neuroscience evidence of brain neuro-plasticity following injury.

CASE REPORT

A 50 years old male complains of difficulty in moving his left upper and lower limb came to our hospital was admitted in neurology ward. He was referred to physical rehabilitation, initial assessment was done and found had weakness left side and had difficulty in balance and walking. Balance examination was done using following scales Berg balance scale, Motor assessment scale in that we used balanced sitting, sitting to standing and walking component, and timed up and go test. After examination we found he had difficulty in maintain balance during functional activities.

We started with conventional physiotherapy exercises which include bed mobility exercise pelvic bridging, trunk rotation, and range of motion exercise. After getting informed consent from the patient, we explained about virtual reality therapy treatment in improving balance and quality of life. After his acceptance we initiated VR treatment program with 45-60 minutes/ session for 5-6days/ week up to 6 weeks along with regular conventional physiotherapy treatment. (figure:1-3) Rehametrics Neroathome virtual reality system is used for treatment with Xboxone kinect sensor. System has real time monitoring, which can monitor, muscle strength, posture, body balance, number of repetitions, energy expenditure. Benefits using VR is enhance recovery, integrated approach, treatment plan and exercises are user friendly, continuous monitoring and feedback, gamified exercises and rewards. VR treatment session which includes, sitting to standing transfer, anteroposterior static balance, lateral static balance, alternating coordination, bi-manual coordination, antero-posterior trunk control, dynamic balance, lateral displacement, unipodal balance were trained during the sessions.

Figure-1: Initial Treatment with assistance

Figure-2: Upper Limb training with assistance

Figure-3: Treatment session with supervision

OUTCOME MEASURES

The Berg Balance Scale (BBS)[8] is used to objectively determine a patient's ability or inability to safely balance during a series of predetermined tasks. It is a 14-item list with each item consisting of a five-point ordinal scale ranging from 0 to 4, with 0 indicating the lowest level of function and 4 the highest level of function. (Score of 56 indicates functional balance. A score of < 45 indicates individuals may be at greater risk of falling. A score of ≤49 indicates a risk of falls in individuals with stroke).

The Motor Assessment Scale (MAS)[9,10] is a performance-based scale used to assess level of impairment and everyday motor function in patients with stroke. The MAS is a brief and easily administered assessment of eight areas of motor function and one item related to muscle tone. Each item is scored on a scale from 0 to 6. 9 items to assess areas of motor function. Patients perform each task 3 times, only the best performance is recorded. (A score of 6 indicates optimal motor behavior. In this case report we used balance sitting, sitting to standing, walking component to assess balance and walking)

The Timed Up and Go test (TUG) is a simple test used to assess a person's mobility and requires both static and dynamic balance. It uses the time that a person takes to rise from a chair, walk three meters, turn around 180 degrees, walk back to the chair, and sit down while turning 180 degrees.

The outcome measures of Berg Balance score, MAS, TUG test results were reported in tables-1,2 &3, which shows Pre & Post test score of each outcome, and it gave good results with treatment as well as patient's quality of life with balance and gait.

TABLE – 1:

BERG BALANCE SCALE

ITEM DESCRIPTION	DAY 1	AFTER 6 WEEKS
Sitting to standing	1	3
Standing unsupported	1	4
Sitting unsupported	1	4
Standing to sitting	1	4
Transfers	1	4
Standing with eyes closed	0	4
Standing with feet together	0	4
Reaching forward with outstretched arm	0	4
Retrieving object from floor	0	4
Turning to look behind	1	4
Turning 360 degrees	1	4
Placing alternate foot on stool	0	2
Standing with one foot in front	0	1
Standing on one foot	0	1
Total	7	47

TABLE – 2:

MOTOR ASSESSMENT SCALE

DAY 1

MOVEMENT SCORING	0	1	2	3	4	5	6
Balanced sitting		1					
Sitting to standing		1					
Walking	2						

AFTER 6 WEEKS

MOVEMENT SCORING	0	1	2	3	4	5	6
Balanced sitting						5	
Sitting to standing						5	
Walking					4		

TABLE – 3:

Timed Up and Go Test (TUG)

Day	Seconds
Day 1	**30**
After six weeks	**13**

Risk for Falls :

High Risk (>14seconds):

None/low/moderate (<14seconds):

DISCUSSION

Stroke often results in impaired balance. Balance is essential for optimal functioning of the loco motor system and the performance of many activities of daily living. Accurate evaluation of balance is

important for prescribing appropriate mobility aids, determining the most effective treatment interventions, and identifying safe and unsafe activities after stroke. Because balance changes over time after stroke, it also is important to have a quantifiable measure that clinicians can use to monitor these changes and adjust treatment accordingly.

VR therapy for stroke recovery remains a promising application of the technology as it enables higher patient engagement compared to conventional therapy. Repetitive goal-oriented exercises with an increasing difficulty help a patient's brain build new neural pathways that stimulate the improvement of motor skills. A patient receives positive visual and audio reinforcement of the right actions in virtual reality training aimed at boosting their motivation. VR interventions also appear to be well suited for stroke rehabilitation, as they provide concurrent feedback, can be tailored to match the person's ability and can engage and motivate the person with stroke to achieve his or her therapy goals. In this case report we found our patient had significant improvement in maintaining balance and walking after using virtual reality treatment in rehabilitation.

Declaration by Authors

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Shumway-Cook A, Anson D, Haller S. Postural sway biofeedback: its effect on reestablishing stance stability in hemiplegic patients. *Arch Phys Med Rehabil* 1988; 69:395–400.
2. Forster A, Young J. Incidence and consequences of falls due to stroke: a systematic inquiry. *BMJ* 1995; 311:83–6. 10.1136/bmj.311.6997.83
3. 3.Schmid AA, Van Puymbroeck M, Altenburger PA, et al. Balance is associated with quality of life in chronic stroke. *Top Stroke Rehabil* 2013; 20:340–6. 10.1310/tsr2004-340
4. The World Health Report. (2002). World Health Organization. http://www.who.int/whr/2002/en/whr02_en.pdf?ua=1
5. Saposnik G, Levin M, Stroke Outcome Research Canada (SORCan) Working Group. Virtual reality in stroke rehabilitation: a meta-analysis and implications for clinicians. Stroke. 2011 May;42(5):1380-6.
6. Henderson A, Korner-Bitensky N, Levin M. Virtual reality in stroke rehabilitation: a systematic review of its effectiveness for upper limb motor recovery. Topics in stroke rehabilitation. 2007 Mar 1;14(2):52-6
7. Lee MM, Lee KJ, Song CH. Game-Based Virtual Reality Canoe Paddling Training to Improve Postural Balance and Upper Extremity Function: A Preliminary Randomized Controlled Study of 30 Patients with Subacute Stroke. *Med Sci Monit* 2018; 24:2590–8. 10.12659/MSM.906451
8. Wee JY, Bagg SD, Palepu A. The Berg balance scale as a predictor of length of stay and discharge destination in an acute stroke rehabilitation setting. Archives of physical medicine and rehabilitation. 1999 Apr 1;80(4):448-52.
9. Dean, C. M., Mackey, F. M. Motor assessment scale scores as a measure of rehabilitation outcome following stroke. Aust J Physiother. 1992; 38, 31-35.
10. Carr JH, Shepherd RB, Nordholm L, Lynne D. Investigation of a new motor assessment scale for stroke patients. Physical therapy. 1985 Feb 1;65(2):175-80.

How to cite this article: Ashok Ravi, Ramamoorthy Veyilmuthu, Parthiban Alagappan, Arul Uvaraj. Effectiveness of virtual reality therapy in improving balance in stroke patient: a case report. *International Journal of Science & Healthcare Research.* 2024; 9(1): 175-178. DOI: *10.52403/ijshr.20240122*

******