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Effect of virtual reality based rehabilitation on balance in stroke patient's: An evidence based study

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Abstract
Virtual Reality is used in the field of rehabilitation/physical therapy to improve Patient's functional abilities. Stroke is one of the most common case of physical disability and early, intensive and repetitive rehabilitation exercises are crucial to the recovery of stroke survivors. Game based rehabilitation system have been proposed to motivate patient during rehabilitation exercises, generally these systems work on the principle of providing the patients with an interactive uses interface and implementing different task-oriented scenarios.so, Among these VR based (Virtual Reality) Technology is a novel Adjunctive therapy that could be Applied in neurorehabilitation. VR-based therapy thus has the potential to be useful tool for balance and gait training for stroke Rehabilitation.

Keywords: stroke, VR game, neurorehabilitation, balance

Introduction
Stroke is one of the leading cause of death and disability and has been described as a worldwide epidemic (Fligin 2014) The effect of stroke may include sensory, motor, and cognitive Impairments as well as a reduced ability to Perform selfcare and Participate in social and Community based activities (Miller 2010) while most recovery is thought to be made in the first few weeks after stroke, patient may make improvements on functional tasks. many months after having a stroke (Teasell 2014), many stroke survivors report long-term disability and reduced quality of life (Patel 2006, Starm 2004) [1] one study reported that since stroke patients experience hemiplegia, they become isolated in their daily lives from family members and society as well as experiencing a loss of independence, >50% of stroke patients had depression. So, most of the patient's experienced depression have not only has an Adverse effect on Appetite and sleep but it's also affect the rehabilitation.2-4Balance disorder due to deficit in multiple mechanisms are frequently encountered in patients with stroke. Balance is an important predictor of outcome in stroke rehabilitation. Virtual reality has been demonstrated to be effective in the rehabilitation of stroke patient's, whose physical and recreational activities are limited.5 so, various studies have proposed this type of Training have positive improvements in the UE function, Balance, gait and daily living movements of stroke patients have been reported.6-9 VR home video games using consoles such as the Sony Play station 2 or Nintendo Wii- fit have been widely used since the mid- 2000s. In recent years, training using the X-box Kinect has been employed as a VR training Programme. The training programme involve playing a VR game in which players move their bodies in front of the game screen by and 48 of their joint position's and motions are tracked via the Kinect sensors10. key concept related to VR are Immersion and Presence.

VR may be Advantageous as it offers several features, such as goal-oriented tasks and repetition, shown to be important in neurological rehabilitation (Langhorne 2011 Veer beek 2014) [11-12] VR may have the potential to provide an enriched environment in which people with stroke can problem solve and master new skills. VR tasks have been described as more interesting and enjoyable by children and Adults thereby encouraging higher numbers of repetition (Lewis 2012)

Methodology
The articles were taken from journal of Physical therapy science, stroke journal of the American heart Association, Elsevier, Cochrane library, medicine Journal. These articles were taken with reference to explain the stroke and effectiveness of VR on stroke patients.

Table 1

Author	Subjects/Sample Design	Protocol	Outcome	Result	Level of Evidence
Nara Kim, YuHYuNg Park (2015) [13]	RCT (n = 20) community-based VR treadmill training (CVRTT) group or the control group.	Conventional physical therapy for 60 min/day, 5 days/week, for 4 weeks. Additionally, the CVRTT group underwent community-based virtual reality scene exposure combined with	anteroposterior, mediolateral, and total postural sway path lengths and speed, which were recorded using the Balancia Software on a Wii	The postural sway speed and anteroposterior and total postural sway path lengths were significantly decreased in the CVRTT group. the use of CVRTT for effectively improving balance in	1b -B

		treadmill training for 30 min/day, 3 days/week, for 4-week control group underwent conventional physical therapy, including muscle strengthening, balance training, and indoor and outdoor gait training, for 30 min/day, 3 days/week, for 4 weeks.	Fit™ balance board.	stroke patients. Moreover, we determined that a CVRTT program for stroke patients is both feasible and suitable.	
2.Kim *et al*. 22(2009) [14]	RCT (double-blind: patients And rater) 24SG (12 patients): conventional therapy + VRCG(12patients): conventional therapy only	4 weeks (4 sessions/week; 40 min).SG:40minofconventional therapy+30min of VR CG: 40 min of conventional therapy	Assessment at the Beginning and end of the intervention Balance (computerised dynamic posturography and Berg Balance Scale) —Gait (10-minwalk test: kinematic variables; and Modified Motor Assessment scale)	Statistically significant Differences between groups; greater improvements in balance in The SG (higher score on theBerg Balance Scale and Dynamic balance test)— The SG shows statistically significant improvements in cadence, step length, step time, velocity, and Modified Motor	1b-A
Yang *et al*. (2011) [15]	RCT 14 SG (7 patients): balance Training with treadmill + VR CG (7 patients): balance Training with treadmill only.	3 weeks (3 sessions/week; 40 min)	Static and dynamic Balance (computed Dynamic posturography platform) No. of steps of the paretic LL Contact area of the Paretic foot during Quiet stance Contact Area of the paretic Foot during sit-to-stand transfer -Contact area of the Paretic foot during Level walking	Assessment Scale scores — Dynamic balance improvement was positively correlated with velocity and cadence. Training had no positive Effect on static balance — Statistically significant Differences between groups, with improvements in dynamic balance in the SG (centre of gravity displacements) during gait and sit-to-stand transfers. Contact area of the paretic foot during gait and transfer also improved in this group.	1b-A
Cho *et al*. (2012) [16]	RCT 22 SG: (11 patients): conventional therapy + VR CC (11 patients): conventional therapy only	6 weeks (5 sessions/week; 1h) Note: the SG has trained With VR in sessions of 30 min, 3 sessions/week for 6 weeks. —	Assessment of static Balance with eyes open and closed (computed dynamic posturography) Assessment of dynamic balance (Berg Balance Scale and Timed Up and Go test)	No significant improvements In static balance in any group There were statistically significant differences between groups In dynamic balance; the SG achieve higher scores on The Berg Balance Scale and Timed Up and Go tests.	2b-B
Cho *et al*. 37(2013) [17]	RCT 14SG (7patients): conventional therapy + Treadmill gait training with VR projection (real-world Video recording during gait) SG (7patients): conventional therapy + treadmill gait training without VR projection.	Conventional therapy was applied for 6 weeks (3 sessions/week;45 min) — Treadmill therapy with and without VR was applied for 6 weeks (3 sessions/week; 30 min)	Dynamic balance (Berg Balance Scale And Timed Up and Go test) — Gait Kinetic variables (parameters obtained With the treadmill.	Statistically significant Improvements in the Study variables in both groups —Statistically significant differences between groups in dynamic balance, cadence, and gait velocity; the SG displayed higher scores.	1b-A
Rajaratnam *et al*. (2013) [18]	RCT Acute stroke control group: n=9, Experimental group: n=10	control groups underwent 60 minutes of conventional rehabilitation experimental groups underwent 40 minutes of convention rehabilitation and 20 minutes of self directed virtual reality balanced rehabilitation.	1) FRT 2) TUG 3) BBS 4) COP sway 5) Modified Barthel Index (MBI)	Both the control and experimental group showed significant improvements in the TUG (2) and the MBI (5) post-intervention. There were significant improvements in FRT (1) post-intervention in only the experimental group	1b-C
Marco Tramontano [19]	RCT 50 (EG- 25) and (CG-25)	Wii group performed 12 sessions of 20 minutes each of balance training performed with Wii Fit, 3 times a week for four weeks, control group added to standard physiotherapy 20 minutes of balance therapy 3 times/week for 4 weeks	(Berg Balance Scale-BBS), (Barthel Index-BI), (10-meters walking test) (Functional Ambulation Category),	balance training performed with video game-based therapy performed with Wii Fit and in add-on to the conventional therapy was found to be effective for improving balance and for reducing disability in patients affected by subacute stroke.	1C-c

Conclusion

It can be concluded that there is strong evidence supporting the improvement in dynamic balance than in static balance. There is little evidence suggesting improvement in static balance using VR and according to Yang (2011) [15] no improvement was seen in static balance. Significant improvement was observed in TUGT, FRT and BBS scale along with the velocity and cadence which suggests strong evidence supporting the use of VR to train dynamic balance. VR based rehabilitation along with conventional therapy not only improve balance but also postural sway speed and gait velocity.

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Conflict of Interest

There was no personal or institutional conflict of interest for this study.

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