ORIGINAL ARTICLE

Comparison of exergaming and vestibular training on gaze stability, balance, and gait performance of older adults: A single blind randomized control trial

Syeda Amna Bukhari,[1] Misbah Ghous,[2] Poshmal Butt,[3] Sania Khawar Kiyani,[4] Aroosa Tariq[5]

Abstract

Objective: To compare the effects of exergaming and vestibular training on gaze stability, balance and gait performance of older adults.

Method: The single-blind randomised controlled trial was conducted from August to October 2020 at the Doctor Raza Clinic, Swabi, Pakistan, and comprised individuals of both genders aged 60-75 years. The subjects were randomised into two groups using the sealed envelope method. Group 1 received exergaming, while group 2 received vestibular training 3 days a week for 6 weeks. The outcomes measures were dynamic gait index, time up and go test and non-instrumented dynamic visual acuity test. Data was analysed using SPSS 21.

Results: Of the 24 subjects, 12(50%) were in each of the two groups. Overall, there were 16(66%) males and 8(33%) females with a mean age of 66.3±4.36 years. Intra-group improvement was significant compared to the baseline ($p<0.05$) in both the differences, but inter-group differences across all parameters were non-significant ($p>0.05$).

Conclusion: Both exergaming and vestibular training has similar effects on gaze stability, balance, and gait performance among the older adults.

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Introduction

The global adult population age 65 years and above is expected to increase to 2 billion by the year 2050.[1] In Pakistan, by 2025, the total number of individuals aged 60 years and above is expected to rise from 12.13 million to 17.53 million. A good quality and longevity of life are considered important for the older adults.[1] A decrease in muscle strength, balance and vestibular functions are the characteristics of aging that can lead to falls and may result in compromised quality of life (QOL) among older adults. The decline in the functions starts around age 40 and reaches up to maximum in individuals aged 80 years and above.[2-4] Age itself is a strong risk factor for impaired balance. According to a recent survey, 30-50% of individuals aged >60 years have trouble in maintaining balance due to physical, neurological, vestibular, sensory, visual and somatosensory deterioration.[5] The most common consequences of aging include decline in overall muscle strength, osteoporosis, cognitive functions, orthostatic hypotension, diabetes, arthritis and depression due to fall or fear of it.[6,7] Mostly, older adults suffer from cardiovascular diseases, diabetic neuropathy, disorders of the central nervous system (CNS), metabolic disorders, diseases of the peripheral and central vestibular system, metabolic diseases and age-related degeneration of the macula.[8-10] The most usual complaints are dizziness, loss of balance and gaze instability that lead to higher risks of falls in older adults. There are many causes of imbalance and falls in older adults, but vestibular degeneration due to aging is the most frequent one.[11] Vestibular rehabilitation is an exercise-based programme that aims at improving balance and gait. It has proved to be effective in reducing symptoms, like vertigo, dizziness, falls or fear of falls, motion sensitivity and imbalance. Three types of vestibular exercises have been used; gaze stability exercises (GSEs) habituation exercises (HEs) and balance training exercises (BTEs).[12,13] Clinical evidence suggests that these exercises can lead to long-term changes in the symptoms. Virtual reality training (VRT), or exergaming through Nintendo Wii fit, has become famous for rehabilitation of older adults. It provides a real-life environment which has motivated people, especially older adults, and is used for rehabilitation for balance and gait in them.[14,15] Patients are trained by playing different video games according to need of individual patients. Participating in regular training sessions outside the homes can be challenging for the elderly, and it is hard to motivate oneself to exercise regularly alone at home. Regular physical activity is important both for physical and psychological health and it is an integral part of many rehabilitation therapies. In addition, many elderly suffer

[1,3]Department of Physiotherapy, Pakistan Railway General Hospital, Rawalpindi, [2,4,5]Riphah College of Rehabilitation and Allied Health Sciences, Islamabad, Pakistan.

Correspondence: Misbah Ghous. Email: drmisbahghous@gmail.com

from loneliness, and making social interaction within exergames is very important. The current study was conducted to compare and determine the effects of exergaming and vestibular training on gaze stability, balance and gait performance of older adults.

Subject and Methods

The single-blind randomised controlled trial was conducted from August to October 2020 at the Doctor Raza Clinic (DRC), Swabi, Pakistan. After approval from the ethics committee of Riphah College of Rehabilitation and Allied Health Sciences, Riphah International University, Islamabad, and DRC, Swabi, the sample size was calculated using Open-Epi calculator.[16] After getting the study registered with Clinical Trials.gov Identifier: NCT04414462, the sample was raised using non-probability sampling technique. Those included were individuals of both genders aged 60-75 years having score of 21-40 on the Berg Balance Scale[17] and a difference of >2 lines between static and dynamic visual acuity readings on the non-instrumented dynamic visual equity (DVA) test. Individuals were excluded if they had acute musculoskeletal pain, cardiovascular disease, uncontrolled blood pressure (BP, uncontrolled blood glucose, neurological problems, like Parkinson's disease, stroke and multiple sclerosis, and cervical spondylosis and other cervical diseases.

After taking informed consent from the subjects, they were randomised into two groups using the sealed envelope method. Patients were blinded to the intervention. Group 1 received exergaming, while group 2 received vestibular training for 45 minutes per day, 3 days a week for 6 weeks. Group 1 was exposed to target shooting, soccer heading, table tilt, tight rope tension and snowboard slalom, while group 2 received HEs, wobble board exercises, single-leg stance, double-leg stance and tandem walk. Assessment of gaze stability, balance and gait performance was done at baseline as well as on 3rd and 6th weeks. Dynamic gait index (DGI) was used to assess the ability of the patients to maintain walking balance while responding to different task demands through various dynamic conditions. It is a useful 8-item test in individuals with vestibular and balance problems and those at risk of falls. Its total score is 24.[18] The time up and go test (TUG) was used to measure balance and risk of fall. Those who took >12 sec were considered at risk of fall.[19] DVA is an objective tool to assess severity of gaze stability in a clinical setting.[20]

Data was analysed using SPSS 21. Shapiro Wilk test was used to check data normality. Subsequently, non-parametric tests were applied for measuring the differences. Mann Whitney U test was applied for inter-group differences, and Friedman and Wilcoxon sign rank tests were used for intra-group analysis. P<0.05 was considered statistically significant.

Results

Of the 24 subjects, 12(50%) were in each of the two groups at baseline (Figure). Overall, there were 16(66%) males and 8(33%) females with a mean age of 66.3±4.36

Table-1: Inter-group analysis for DGI, TUG and DVA.

Variables	Groups	Mean Rank	Median (IQ)	Z-value	P-value
DGI at baseline	Exergaming	10.13	12.5(4)	-1.669	0.95
	Vestibular training	14.88	14(2.75)		
DGI at 3rd week	Exergaming	12.46	16(4.75)	-0.29	0.977
	Vestibular training	12.54	16(2.75)		
DGI at 6th week	Exergaming	13.83	20(3.75)	-1.382	0.167
	Vestibular Training	10.00	19(2)		
TUG at baseline	Exergaming	12.00	12.5(5.5)	-0.355	0.723
	Vestibular Training	13.00	13(1.5)		
TUG at 3rd week	Exergaming	11.13	11(4.5)	-0.969	0.333
	Vestibular Training	13.88	12(1.75)		
TUG at 6thweek	Exergaming	10.71	9(3.75)	-0.983	0.325
	Vestibular Training	13.41	9(2)		
DVA at Baseline	Exergaming	13.00	3(0)	-0.604	0.546
	Vestibular training	12.00	3(0)		
DVA at 3rd	Exergaming	11.67	3(0.75)	0.693	0.488
	Vestibular training	10.18	2(0)		
DVA at 6th week	Vestibular training	13.67	2.5(1)	1.459	0.144
	Exergaming	11.67	3(0.75)	0.693	0.488

DGI: Dynamic gait index, DVA: Dynamic visual acuity, TUG: Time up and Go test, IQR: Interquartile range.

Table-2: Intra-group analysis for DGI, TUG and DVA.

Groups	Variables	Median (IQ)	P-value
Exergaming Group	DGI at Baseline	12.5(4)	<0.001***
	DGI at 3rd week	16.0(4.75)	
	DGI at 6th week	20.0(3.75)	
	TUG at Baseline	12.5(5.5)	<0.001***
	TUG at 3rd week	11.5(4.5)	
	TUG at 6th week	9(3.75)	
	DVA at Baseline	3(0)	<0.001***
	DVA at 3rd week	3(0)	
	DVA at 6th week	2.5(1)	
Vestibular Group	DGI at Baseline	14(2.75)	<0.001***
	DGI at 3rd week	16(2.75)	
	DGI at 6th week	19(2)	
	TUG at Baseline	13(1.5)	<0.001***
	TUG at 3rd week	12(1.75)	
	TUG at 6th week	9(2)	
	DVA at Baseline	3(0)	<0.001***
	DVA at 3rd week	3(0.75)	
	DVA at 6th week	2(0)	

DGI: Dynamic gait index, DVA: Dynamic visual acuity, TUG: Time up & Go test, IQR: Interquartile range.

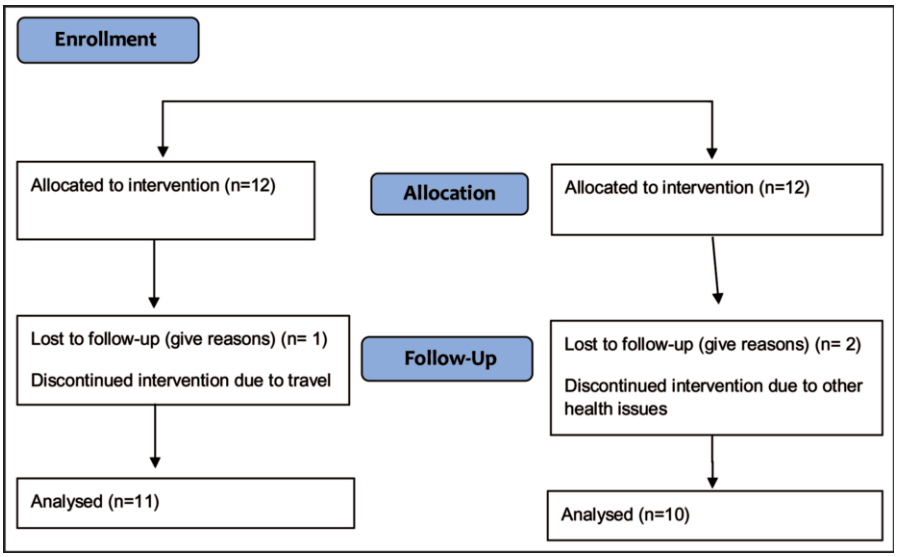

Figure: Study flow diagram.

years. Major co-morbidities included controlled hypertension 6(25%), controlled diabetes 4(16.6%), osteoarthiritis 5(21%), gout 2(8.3%), hypertension and diabetes 3(12.5%), osteoarthritis and diabetes 2(8.3%), while 2(8.3%) had no co-morbidity.

Inter-group differences across all parameters were non-significant between the two groups ($p>0.05$) (Table-1). Intra-group improvement was significant compared to the baseline in both the groups ($p<0.05$) (Table-2).

Discussion

Exergaming allows the participants to interact with a virtual environment and participants perform different games while Vestibular training involves different types of physical exercises that are performed by the participants.[21] Results showed that between groups all parameters improved equally $P>0.05$, indicating that both interventions are equally effective, which supports the current study. Franco et al, conducted a study to find balance, gaze and gait stability in exergaming and vestibular training group. The result of the study concluded that both groups improved equally when assessed on DGI, TUG, DVA and berg balance scale, which is in favour of this study. Dynamic gait index and DVA tests were used to assess the gaze stability, and balance of older adults and within group analysis showed improvements from baseline to 6th week, however no significant difference was noted between the effects of both groups ($P>0.05$), which supports this study. A study conducted by Dara Meldrum et al, in which one group performed exergaming and the other group performed vestibular training showed that both groups improved equally.[22] Previous study showed improvements in gaze stability in the participants of both groups when assessed through DVA test which is in the favor of this study.[23,24] Another study compared exergaming group with traditional vestibular training showed that the dynamic balance improved significantly in exergaming group only.[25] Small number of population, long term follows up and non-instrumented DVA test were the limitations of the current study. A large sample size, a long term follows up and instrumented DVA test is recommended for future studies.

Conclusion

Exergaming and vestibular training were found to have similar effect on gaze stability, balance and gait performance of older adults.

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Conflict of Interest: None.

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