Effects of virtual reality training on mobility and physical function in stroke

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Abstract

Stroke is a common disabling condition which declines the functional and mobility level. The purpose of the case series was to determine the effect of virtual reality training on sensorimotor function and mobility level in stroke patients. Ten male (40-60 year) patients of stroke (08 Infarction, 02 Haemorrhagic) were selected from Physiotherapy department of Pakistan Railway Hospital, Rawalpindi. The additional virtual reality training (15-20 minutes) was provided 03 days per week for 06weeks along with task oriented training. All patients were assessed through Fugl-Meyer Assessment-Lower Extremity (FMA-LE) and Timed Get Up and Go Test (TUG) at baseline and after 06 weeks of training. The results showed that there was significant improvement in mobility level of stroke patients. It is concluded that combination of task oriented and virtual reality training considerably improves the physical performance and mobility level in stroke patients.

Keywords: Exer-Gaming, Fugl-Meyer Assessment, Stroke, Timed Up & Go Test, Virtual reality training.

Introduction

Stroke is a sudden onset of neurological deficits due to compromised blood supply to the brain.[1] Approximately 15 million people suffer from stroke worldwide and 250 per 100,000 in Pakistan annually. The younger population is more affected in Pakistan as compared to western countries.[2] The stroke disability causes deficits in physical function, gait performance and mobility level.[3] Since last two decades, multiple rehabilitation approaches are designed and developed to improve the functional status of stroke patients. The key component is repetition in such approaches while patients have no incentive to engage themselves in specific task activities. They lose concentration on exercise and movement pattern due to decreased motivational level.[4] Exer-gaming through virtual reality training was recently incorporated for neurological rehabilitation of stroke patients to improve the activity level.[5] In virtual reality training patients to perform specific task like walking, picking, jumping and throwing in computer generated environment. The specific equipment for virtual reality training is very expensive and literature has shown that commercially available video gaming consoles like Xbox can be used for training and physical rehabilitation of stroke patients.[3] The exer-gaming through Xbox Kinect has shown to improve the mobility, functional level and activities of daily life. These also engage the patients by enhancing the concentration and interest in playing such games.[6] Exer-gaming is a valuable addition in stroke rehabilitation; this is cost effective regarding the time and finance.[7] This case series was planned to determine the effect of task oriented training with virtual reality training on mobility and physical performance of stroke patients.

Case Series

In this study 10 male patients were included from February-August 2016 at Physiotherapy department of Pakistan Railway Hospital, Rawalpindi. The age bracket was 40-60 years (mean age 50.20 ± 7.67 years), type of stroke (08 infarction, 02 haemorrhagic), chronic stroke (> 03 months) and right (8) and left (2) hemiplegia. The written informed consent was taken from all participants. The assessment included Fugl-Meyer Assessment-Lower-Extremity (FMA-LE) and Timed Get Up and Go Test (TUG) were taken at baseline and after 06 weeks of exer-gaming training.

Rehabilitation Regimes

The task oriented training was provided including the Balance training (Standing with eye open/close, tandem standing, standing on different surface, internal and external perturbations) and gait training (stepping, reaching activities, marked gait training, sit to stand practice, equal weight distribution and parallel bar training). The specific games were introduced and explained to patients. The additional 15 minutes of Xbox exer-gaming practice was provided to all patients. The games included the 20,000 water leaks, river rush and reflex ridge was selected for patients. While playing these games the patient has to move right/left, forward/backward and move the upper extremity to manage the tasks of games. It provides an enriched environment to improve mobility thorough active involvement of patients. The first session was orientation and details were explained to the

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Table-1: Show the FMA-LE and TUG test pre and post comparison.

Patient	Age (Year)	Pre FMA-LE	Post FMA-LE	Pre TUG (Seconds)	Post TUG (Seconds)
1	48.00	12	22	25.54	13.24
2	56.00	20	25	16.91	9.35
3	36.00	14	22	32.76	13.29
4	62.00	15	24	30.23	14.33
5	50.00	16	28	24.07	11.34
6	38.00	15	26	20.14	10.22
7	56.00	18	26	15.41	9.28
8	61.00	13	24	19.40	9.23
9	55.00	15	25	16.42	8.56
10	40.00	15	26	22.49	11.36
Mean	50.20 year	15.3	24.8	22.30 sec	10.02 sec

FMA-LE: Fugl-Meyer Assessment-Lower-Extremity, TUG: Timed Up & Go.

participants. The games have different activities include plugging of hole through limb and moving in different directions while avoiding an obstacle. The objective was to improve the physical performance and mobility level of stroke patients through these activities. The detailed score of each patient as well as the overall mean value is presented in (Table-1). All patients demonstrated significant improvement in FMA-LE score as a result of training except for patient 2 and 7.The patient number 1, 3, 4 and 10 were still lacking in complete speed and mobility in TUG score. The results show the significant improvement in mean value of FMA-LE after training from 15.30 to 24.80. The overall TUG score also reduced from 22.30 to 11.02 seconds (Table-1).

Discussion

The findings conclude that there was significant improvement in sensorimotor function of lower limbs and mobility level in stroke patients through virtual reality training. The findings of the present study confirm the results of an earlier study conducted by Sin and Lee in 2013. They studied 40 stroke patients with mean onset 07 month for 06 weeks of VR training and reported increase score of FMA-LE.[6] The findings of the current study are fairly consistent with previous studies in literature which reports that the virtual reality training is an effective protocol to enhance the mobility and physical function of stroke patients.[8]

The current study found the significant improvement in mobility level through TUG in VRT group after 06 weeks of training. A systematic review having 15 trials with 341 stroke patients concluded that the virtual reality training was an effective treatment option in balance and mobility of stroke patients. This type of training is a good addition and has positive impact on motivation of patients towards the physical function.[9]

The systemic review findings are also highlighting the potential use of virtual reality training in physical function and mobility level. The key findings of the study include the improved balance, gait speed and mobility level in stroke patients. They also suggest that VR is a promising method to improve the gait of patients with stroke.[8] Similarly, Malik and Zafar reported in their case report that virtual reality through exer-gaming has a significant effect in enhancing the mobility in chronic stroke.[10]

Conclusion

The case series suggests that virtual reality training with task oriented training is effective in improving the physical performance and mobility level of stroke patients. The findings recommend 06 weeks of training to improve the functional and mobility level of stroke patients.

Recommendations

Further Studies with larger sample size and more specific protocols are needed to evaluate the effects of virtual reality training on balance and functional status after stroke.

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