Research Article

Impact of Virtual Reality on Hand Grip Functional Activity in Stroke Patients

Velmurugan G[1], Gladies Kamalam S[2]*, Manivannan S[3], Dinesh Dharmalingam[4] and Mrudula J Pawar[5]

[1]*Associate Professor, Department of Physiotherapy, Mahatma Gandhi Medical College and Research Institute, Pondicherry.*

[2] *Associate Professor, Department of Physiotherapy, KMCT College of Allied Health Sciences, Calicut, Kerala.*

[3]*Principal, Aparampar Swami Physiotherapy College, Nanded, Maharashtra*

[4]*Consultant Physiotherapist, Spectrum Physio Centre, Bangalore.*

[5]*Lecturer in Physiotherapy, Akash Institute of Physiotherapy and Akash hospital, Devanahalli, Bangalore.*

*Corresponding Author: Gladies Kamalam S, Associate Professor, Department of Physiotherapy, KMCT College of Health Sciences, India.

Abstract

Background: Stroke is common cause of motor disability. Recovery of hand function such as gipping activity is poor with few stroke survivors. Virtual reality therapy can provide enhanced feedback to promote hand functions in stroke conditions.

Aim: This study is done to find out the effect of virtual reality on improving grip function of stroke patients.

Methodology: 10 stroke patients with difficulty in gipping activities received virtual reality therapy for 4 weeks, 5 sessions/week. Hand dynamometer was used as outcome measure to measure the grip strength.

Statistical tool: Independent t test was used.

Conclusion: Significant difference in grip strength was seen after Virtual reality therapy at $p < 0.01$

Keywords: Stroke; Virtual Reality (VR) Therapy; Virtual Reality Exercise Program (VREP); Hand Dynamometer

Introduction

Stroke can be the consequence of brain injury either ischaemic or haemorrhagic, resulting in chronic disruption of sequenced neuromuscular functions. Declined motor activities, compromised sensory reception, poor cognitive orientation led to an imbalance in motor functions in stroke patients, that necessitates involving timely recovery activities following stroke. To improve the kinesthetic and aesthetic integration that involves technology basis of rehabilitation, a virtual reality-based exercise program (VREP) - outlook is considered to be the best tool. The paralyzed upper limb component of the patients is influenced by VREP to impact learning motor functions that enhance activities of daily living [1]. Audio-visual feedback, and improvement in proprioceptive elements in a virtual reality environment, is enabled into customized exercise training programs, in VERP [2].

Methodology

10 patients, between the age 50- 60 years, diagnosed to have left MCA stroke (Brunnstorm re- covery stage 3) with three months duration by the neurophysician were selected specifically to fulfil the purpose of this research. The patient's had the ability to extend the wrist at least 15º and the finger for 10º from the full flexion, allowing to engage in perform functional activities. These patients cooperated well by following the precise instructions. It was ensured that any therapeutic approach was not sought by the patients to facilitate upper limb function during this research regime. The study was approved by the Ethical Committee of a private physiotherapy college in Kerala and was conducted in the out-patient department of the college.

Study Design and Sampling

Quasi experimental study with purposive sampling method.

Assessment

The outcome measure was based on the measures of hand-held dynamometer [3,4]. The change in the score of the test at baseline and after completion of treatment were recorded.

Regime

Each session of 45 minutes was executed for four weeks, five times per week. The changes in upper extremity function were analysed after a period of four weeks.

Data analysis

Independent t test was used. The mean pretest and posttest scores were analysed, at $p < 0.01$, using SPSS version 21.

Pre-test mean	Post-test mean	Mean difference
2.545	4.525	1.98

Table: Represents the prestest, posttest means and the mean difference in hand grip.
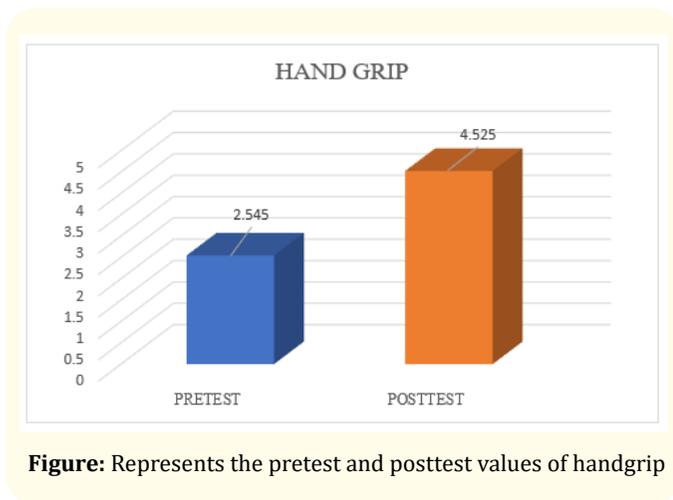
Figure: Represents the pretest and posttest values of handgrip

Results

The results indicate that a significant improvement in the post test measures recorded using the hand-held dynamometer, when compared to the mean of pretest scores added with the mean difference.

Discussion

Virtual Reality therapy is specifically designed to provide relaxation, sense of accomplishment, and happiness that stimulates the patients to provide their best during rehabilitation. Wide usage of this training has shown marked improvements in bringing about better motor recovery in chronic post stroke injury [5]. Steady raise in the upper limb joint range, sensory improvement, endurance of the muscle, declined pain, precise functional enablement has been proven to be the highlights of VR training, markedly in stroke rehabilitation.

Literature suggests that various VR programs have been successful in improving the fi developed and implemented for the lower limbs as well as the upper limbs, and their effects are being tested. This has further proved to be a burden less therapy in terms of cost and safety of rehabilitation focussing to improve balance, ascent - decent of stairs, power of the ankle muscles, movement range and velocity of gait.

A virtual reality environment is created indoors, concentrating on ADL activities on both upper and lower limb, that makes this VR concept, the beneficial one [6]. Studies by Broeren., et al. show that the VR improved overall dexterity, power of prehension, and stability along affected site [7]. This is clearly evident through the post-test mean scores (4.525), and the mean difference (1.98) obtained, as an initiative executed in patients who are in post stoke phase of 3 months.

Pronounced effects were documeneted by Jang., et al. VR training with IREX system on cortical reorganization and arm motor function in participants with chronic stroke moderate impairment [8]. Lee reported that VR using video games resulted in improvement in the muscle strength of the upper extremities and performance of ADL [1,9].

After 4 weeks of VREP therapy, there were significant differences in upper extremity motor function and performance of ADL between the initial and final assessment.

Conclusion

Rehabilitation training with VREP is positively impactive and clinically applicable therapeutic strategy to witness a functional recovery in stroke patients.

Limitations

Duration of the study was short and follow up was not ensured.

Recommendation

The study can be done on Anterior cerebral artery stroke and Posterior cerebral artery stroke.

Conflict of Interest

None.

Source of Fund

Self.

Bibliography

1. Kyoung-Hee Lee. "Effects of a virtual reality-based exercise program on functional recovery in stroke patients: part 1". *Journal of Physical Therapy Science* 27.6 (2015): 1637.

2. Saposnik G., *et al.* "Effectiveness of virtual reality using Wii gaming technology in stroke rehabilitation a pilot randomized clinical trial and proof of principle". *Stroke* 41 (2010): 1477-1484.

3. Aguiar LT., *et al.* "Dynamometry for the measurement of grip, pinch, and trunk muscles strength in subjects with subacute stroke: reliability and different number of trials". *Brazilian Journal of Physical Therapy* 20.5 (2016): 395-404.

4. Bohannon and Richard. "Adequacy of hand-grip dynamometry for characterizing upper limb strength after stroke". *Isokinetics and Exercise Science* 12 (2004): 263-265.

5. Antonio Vinicius Soares., *et al.* "The use of Virtual Reality for upper limb rehabilitation of hemiparetic stroke patients". (2014): 309-317.

6. Ehab Mohamed Abd El-Kafy., *et al.* "The Effect of Virtual Reality Based Therapy on Improving Upper limb functions in Individuals with stroke". *Frontiers in Aging Neuroscience* (2021): 02.

7. Broeren Jurgen., *et al.* "Haptic virtual rehabilitation in stroke: Transferring research into clinical practice". *Physical Therapy Reviews* 14 (2009): 322-335.

8. Jang Sung., *et al.* "Cortical Reorganization and Associated Functional Motor Recovery After Virtual Reality in Patients with Chronic Stroke: An Experimenter-Blind Preliminary Study". *Archives of Physical Medicine and Rehabilitation* 86 (2005): 2218-23.

9. Reneh Karamians., *et al.* "Effectiveness of virtual Reality and Gaming based Interventions for Upper Extremity Rehabilitation Poststroke: A Meta analysis". *Archives of Physical Medicine and Rehabilitation* 101.5 (2020): 885.