

The Impact of Whole Body Vibration Therapy on Spasticity and Disability of the Patients with Post-Stroke Hemiplegia

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ABSTRACT

Calf muscle spasticity leading spastic movement disorders during walking is the major complex functional problem in post stroke hemiplegia. And a recent RCT suggests that Whole Body Vibration (WBV) therapy of 40 hz/4 mm amplitude for 5 minutes totally 12 sessions improves walking speed in the long term and may be a complementary therapy in gait rehabilitation. Nevertheless, a 2015 systematic review and meta-analysis concludes that WBV training had no beneficial effects in muscle strength.

Keywords: Hemiplegia; Supraspinal discharges; Rehabilitation; Homogeneous

DESCRIPTION

Spasticity; a consequence of post stroke hemiplegia is a velocity dependent increase in tonic stretch reflexes and tendon jerks because of abnormal supraspinal discharges. It has many components associated with qualitative changes in muscle mechanical properties. Calf muscle spasticity leading spastic movement disorders during walking is the major complex functional problem in poststroke hemiplegia. A recent RCT by Alp et al. [1] suggests the Whole Body Vibration (WBV) therapy of 40 hz/4 mm amplitude for 5 minutes/session, (3 times a week for 4 weeks) improves walking speed and may be a complementary therapy in gait rehabilitation. The study indicates the long-term therapeutic effect of the WBV therapy intervention group which is also positively correlated with improvement in ankle spasticity.

with a clear dosing schedule still maintains its singularity for long-term clinical benefits about WBV training when compared to sham therapy in post stroke walking performance.

Nevertheless, a 2015 systematic review and meta-analysis concludes that WBV training had no beneficial effects in muscle strength, (isometric knee flexion and extension) and balance in people with stroke and effects on mobility and gait performance remain inconclusive [2]. Another review has highlighted a bit more encouraging results as neuromuscular and mobility responses to WBV therapy when compared to sham therapy in these patient population but it is also considered that there are

serious discrepancies among interventions due to differences of parameters (frequency, duration, type of exercise, patient characteristics) and there is no solid evidence confirming the beneficial effects of WBV therapy among people with stroke compared with either other types of physical activities or sham therapy in order to make a conclusion about WBV [3]. Therefore it is decided that evidence is insufficient about WBV in such an empirical approach in post stroke rehabilitation.

Even so, there is a considerable increase in studies that examined the effects of WBV on functional impairments and muscle spasticity among this patient population. An 2019 systematic review has found only a weak evidence for a positive effect of short term therapeutic effect on calf muscle spasticity, walking, balance and postural control. It is still emphasized that there is not a clear consensus yet about optimal WBV dosing and duration in treating patients with neurological disorders [4].

DISCUSSION

This commentary and mini review on the basis of the trial by Alp et al. [1] is written for incentive purposes and to indicate that there are promising new studies on individual basis highlighting different benefits and short term solid effects about WBV since 2018. In one of the studies, WBV was applied at 30 Hz (4-8 mm amplitude) for 5 min on the hamstrings, gastrocnemius, and soleus muscles in a sitting position [5]. Spasticity was assessed by The F-wave parameters, Modified Ashworth Scale score, and passive range of motion. All of these

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parameters improved significantly after the WBV and remained below the baseline levels even after 20 min. Another important finding is that, unaffected limb had no such changes in these parameters. Yeo-reum et al. [6] also aimed to find the appropriate stimulus frequency for improving ankle joint spasticity. Individuals had half squat position on the vibration platform and were exposed to 4 different frequencies; 0,10,20,30 hz. Findings of this study show that the frequency of more than 20 Hz was effective in improving the ambulatory ability in patients with chronic stroke in the short-term, but unfortunately higher frequencies were not studied. Another recent study aimed to investigate the acute effect of Whole-Body Vibration (WBV) on the components of spastic hypertonia and intramuscular blood perfusion among individuals with chronic stroke [7]. Patients were exposed 5 minutes to WBV (30 Hz, 1.5 mm) or no vibration. The results revealed a significant inhibition of the H/M ratio after 3 to 5 minutes bilaterally. WBV had an acute effect on modulating spastic muscle blood perfusion, physiology and hyperreflexia in people with chronic stroke.

Stimulating muscle spindles and alpha motor neurons by WBV therapy arises as a promising treatment modality by modifying these physical properties. It is hypothesized to mimic the effects of physical exercise as a strength and proprioception training leading to normalization of the muscle tone [1]. The transmission of vibrations and oscillations to the human body can produce physiological changes by stimulating mechanoreceptors, muscle spindles, and vestibular system, [8,9] leading to neuroplasticity changes in somatosensory cortex and thalamus [10,11].

CONCLUSION

Anyhow, this type of complementary therapy must go beyond to be empirical and more studies of good quality with homogeneous parameters and larger patient populations are needed to make a clear consensus about its efficacy in the short and the long-term.

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