

Rehabilitation of Neurological Disorders Using Body Weight Supported Treadmill Training - A Brief Review

Dr. Meetu Nagpal

Assistant Professor, College of Physiotherapy, Pt. B. D.S., University of Health Sciences, Rohtak,
Haryana-124001

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ABSTRACT

Treadmill walking with the help of body weight support or without body weight support through a harness connected to an overhead support system, is a method of rehabilitating locomotor impairments in patients suffering from various disorders which affect normal gait/locomotion and is becoming increasingly popular. Body weight supported treadmill training (BWSTT) is a recent therapeutic training / technique that is being used for rehabilitation of patients with neurological walking disorders such as stroke, spinal cord injuries and cerebral palsy and Parkinson's disease. Further research to be carried out for establishing a definitive treatment protocol for BWSTT in these disease states

Key words: Body weight supported treadmill training, stroke, spinal cord injuries, cerebral palsy.

INTRODUCTION

There are many ailments that lead to an impaired ability to walk and are the primary factors leading to long-term disability. These ailments primarily include Stroke, Spinal cord injury (both complete and incomplete forms), Cerebral palsy, Parkinson's disease etc. Body weight supported treadmill training (BWSTT) is a recent therapeutic training / technique that is being used for rehabilitation of patients with walking disorders.^{1,2}

Description of the technique

Treadmill walking with the help of body weight support or without body weight support through a harness connected to an overhead support system, is a method of rehabilitating locomotor impairments in patients suffering from various disorders which affect normal gait/locomotion and is becoming increasingly popular. Treadmill walking encourages patient to take more number of steps in each training intervention and encourages patients to undergo task-specific practice. The basic advantage of treadmill training over ground walking training is that in treadmill training higher number of gait cycles can be practiced and that too with higher speed. A study in 2003 by Hesse, reported that post stroke patients can complete up to 1000 steps in a treadmill training session as compared with only 50 to 100 steps during conventional physiotherapy. Walking speed of treadmill, percentage of body weight support and the percentage of assistance provided by the physical therapist, all these factors can be customized in order to provide the desired training intensity to patients.¹⁻³

Mechanism by which BWSTT works

Treadmill training has shown significant improvement in locomotion in various neurological disorders such as stroke, spinal cord injuries (SCI) and cerebral palsy (CP). Body weight supported treadmill training (BWSTT), is a method of task-oriented gait

training using an overhead suspension system and harness to support a percentage of the patient's body weight as the patient is walking on a treadmill. BWSTT helps to reduce the weight from the lower extremities symmetrically as the patient tries to walk, thereby it is now a popular modality for neuro-rehabilitation of gait. BWSTT addresses the problem of gait limitations at various levels of the International Classification of Functioning, Disability and Health (ICF). BWSTT is based on current motor learning theories that promote neuroplasticity by concentrating on active involvement in task performance over time.⁴

BWSTT in various disease forms

Mehrholz J et al (2017) in a systematic review study done on treadmill training given to stroke patients with or without body weight support through a harness in order to improve their walking ability have concluded that grossly there is no significant difference between the independent walking ability of post stroke patients who are trained by treadmill training, with or without body weight support and patients who are not receiving treadmill training. But the authors have concluded that short term improvement may be seen in walking speed and endurance of patients undergoing treadmill training. Also, post stroke patients who can walk at start of treatment are expected to benefit maximum from treadmill training with concern to walking speed endurance. This review did not investigate whether the improvements in walking speed and endurance may have long term beneficial effects. The authors have concluded that further research needs to be carried out to find out the effect of different frequencies or intensities (in terms of speed increments and inclination) of treadmill training. Also, future trials should be conducted on people who are already ambulatory and patients who are unable to walk should be excluded.¹

Sharan D et al (2016) in a study conducted on cerebral palsy patients concluded that

BWSTT was effective in improving the gait and locomotor parameters in persons with CP when compared with the patients who were not given this training. The study had many limitations including the various adjustments (overhead system, handrails and counterweights) were done manually. Dynamic Gait Index (DGI), Physician Rating Scale (PRS) and Functional Mobility Scale (FMS) were the only parameters used for gait assessment and other outcome measures of gait, quality of life and functional outcomes were not investigated. The authors also suggested that further research should be carried out with a larger sample size and a long-time follow-up and by using improved design of BWSTT device.⁴

In a recent study conducted on patients with Parkinson's disease (PD) by Berra E et al (2019), it has been concluded that BWSTT and conventional rehabilitation treatment are both effective in improving motor functions and gait parameters in PD. But, gait parameters were effected more by BWSTT. This observation suggests that BWSTT treatment may be the treatment of choice in comparison to conventional treatment for gait training in PD patients who have postural instability, balance problems and orthostatic hypotension. This study also had limitations owing to small sample size and lack of outcome measures evaluating the effect of BWSTT on balance and orthostatic hypotension.⁵

BWSTT has also been proven to be useful for patients with spinal cord injury. BWSTT can be helpful for locomotor training as well as musculoskeletal changes such as modifying osteoporosis. The training can trigger central pattern generators (CPGs) in the spinal cord which can stimulate the afferents as there is a lack of utilization of afferent inputs after SCI. beneficial effects of BWSTT on the function of incomplete SCI has been proven by many studies as it might help in recovering ability to walk with the gait training. In recent study by Semary and Daker (2019), it has been concluded that BWSTT is beneficial in

improving quality of life and walking speed in patients with incomplete SCI. The study also had limitations owing to small sample size and proper blinding was not done in the study. The authors have suggested that future study should be done evaluating the biomechanical outcomes of BWSTT.

CONCLUSION

Body weight supported treadmill training (BWSTT) is a recent therapeutic training / technique that is being used for rehabilitation of patients with walking disorders.^{1,2} Studies have been conducted till date investigating the effect of BWSTT in various neurological disorders including Stroke, Spinal cord injury (both complete and incomplete forms), Cerebral palsy and Parkinson's disease. They have concluded that BWSTT is beneficial in terms of improvement of walking ability and functional outcomes of these patients. But, owing to limitations in these studies there is need for further research to be carried out for establishing a definitive treatment protocol for BWSTT in these disease states.

Declaration by Authors

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