Anti-Gravity Treadmill Training Improves Walking in a Person with Severe Multiple Sclerosis

Jonathan Melbourn, DPT1,2, T. Bradley Willingham, MS3, Kevin K. McCully3, PhD, Deborah Backus, PT, PhD, FACRM1,2
(1) The Crawford Research Institute; (2) The Eula C. and Andrew C. Carlos MS Rehabilitation & Wellness Program; (3) Department of Kinesiology, University of Georgia, Athens, GA

BACKGROUND
The vast majority of people with multiple sclerosis (MS) experience a combination of motor and sensory impairments including weakness, decreased balance, and fatigue that ultimately lead to walking dysfunction. Recent evidence also suggests that skeletal muscle function, specifically muscle oxidative capacity, is also impaired in people with MS (PwMS), which could be related to walking dysfunction as well. Exercise and rehabilitation interventions have been shown to improve walking function as well as motor impairments such as strength and balance in PwMS. However, few studies have evaluated exercise mediated adaptations to skeletal muscle function and the contribution of skeletal muscle plasticity to these improvements. Understanding the underlying mechanisms of walking dysfunction and the relationship between impairments and changes in walking function after training would provide valuable insights into the design of interventions for improving walking in PwMS.

Overground gait training is one way to improve walking function in PwMS, but presents limitations for people greater walking disability. Body-weight supported treadmill training (BWSTT) that utilizes lower body positive pressure technology to unweight the lower extremities. This approach may provide the safety, task-specificity, repetition, feedback, body-weight support (BWS) needed to improve walking for PwMS and higher levels of disability. Training in the anti-gravity treadmill has been shown to improve balance and walking in people with stroke, Parkinson’s disease, and cerebral palsy but has not yet been examined in PwMS.

The purpose of this case report is to present data demonstrating changes in walking function, strength, balance, fatigue, and muscle-related impairment in one person with moderate MS who participated in a pilot study examining the efficacy of anti-gravity treadmill training.

METHODS
The participant was a 56 year-old female diagnosed with relapsing remitting MS with an Expanded Disability Status Score (EDSS) of 6.5. Participant was not on any medication except Vitamin D3, was medically stable, willing to remain consistent with pre-intervention exercise and medication regimen, and did not exhibit any cardiovascular, neurological, or orthopedic comorbidities.

The Intervention was designed and overseen by a trained physical therapist and consisted of 24-minutes of walking (2 min-warm-up, 20 minutes of the intervention, and 2 minute cool down) on the AlterG Anti-Gravity Treadmill (AlterG Inc., Freemont, CA) (Figure 1), 2-times per week for 16 sessions. Cinematic visual feedback of her gait was provided via 3 cameras placed anteriorly, posteriorly, and laterally. A trained physical therapist or exercise specialist gave verbal cueing for improved gait mechanics (e.g. increased heel strike or hip flexion). If gait mechanics were adequate, the trainer increased speed or decreased body-weight support (BWS0) to challenge the participant and progress toward real-world walking conditions.

The following outcome measures were collected by trained evaluators pre and post the 16 session intervention:

- Walking Speed: Timed 25-Step Walk Test (T25FWT)21
- Lower Extremity Strength: Hand-Held Dynamometry22
- Balance Confidence: Activities Balance Confidence Scale (ABC)23
- Perceived Fatigue: Modified Fatigue Impact Scale (MFIS)24
- Near-Infrared Spectroscopy (NIRS)25

Muscle oxidative capacity increased by 47.90% (Figure 8) and muscle endurance increased by 8.10% at 2Hz, 8.40% at 4Hz, and 31.20% at 6Hz (Figure 9).

REFERENCES

ACKNOWLEDGEMENTS: This research was funded by the Eula C. and Andrew C. Carlos MS Rehabilitation and Wellness Program at Shepherd Center.