The Effect of Overhead Support System on Reactive Stepping Behavior in Older Adults

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Background:

- Reactive stepping is an example of an automatic response to maintain balance and prevent a fall. [1]
- When eliciting reactive stepping in a clinical environment, therapists often use patient safety.
- However, it is unknown whether thesequipment such as gait belts and/or overhead harness systems to ensure e safety mechanisms alter the characteristics of the stepping response.

Objective:

- The purpose of this case series of 3 older adults was to describe the differences in stepping parameters during a clinical assessment of reactive stepping performed while individuals were either in a mobile overhead harness system or assisted by a physical therapist using a gait belt.

Methods:

- Three female community ambulators (Ages: 59-64 years) were included.
- Flexibility, strength, fall risk, community ambulation, and balance confidence were assessed.
- Protective steps were randomly evoked in the anterior, lateral, and posterior directions using the mini-BESTest (Balance Evaluation Systems Test© 2005-2012) compensatory stepping method.[2]
- Twenty-four total trials. 12 in a mobile overhead harness (Figure 2-A), 12 assisted by a PT using a gait belt.
- The number of reactive steps; first step length, height, latency, and duration (Figure 2-C,D); and behavioral responses (Figure 2-E) were determined.
- Footprint (Figure 2-B) and video analysis (Dartfish™) was used to describe differences in stepping parameters, trials were averaged, and paired t-tests were calculated for each individual ($\alpha = 0.05$) (Figure 1).
- In addition to performing paired t-tests, any novel stepping characteristics were documented.

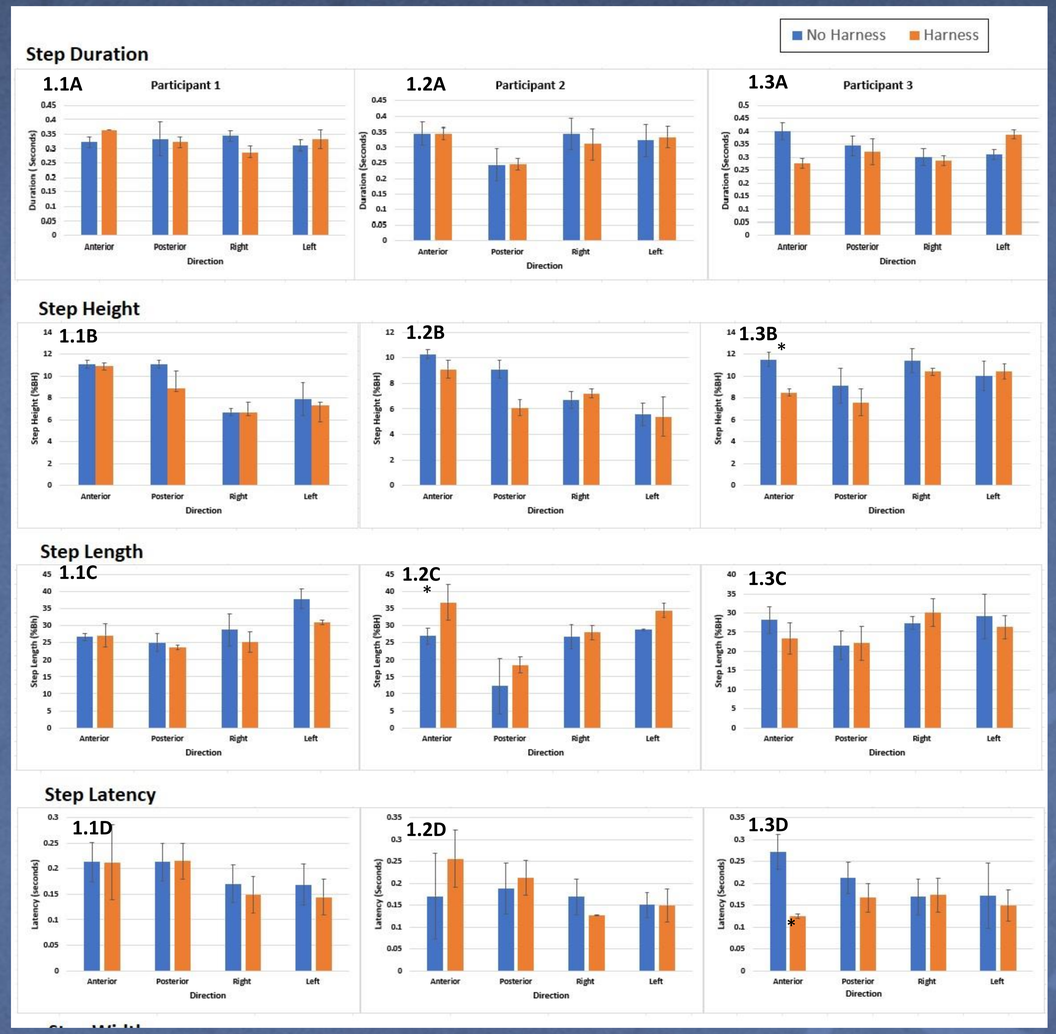

Figure 1.

Step height, length, duration, and latency for participants 1,2 and 3 were measured in the anterior, posterior, right, and left directions while using the mobile overhead harness and assistance by a physical therapist holding a gait belt. Asterisks indicate statistically significant change with a p-value of <0.05. Left, middle, and right columns show results for participants 1, 2, and 3 respectively.

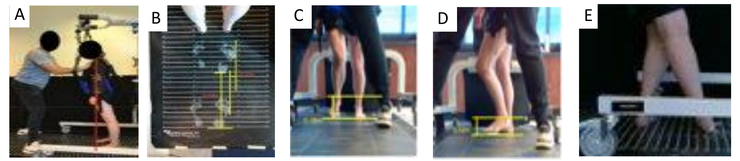

Figure 2.

2-A Set up of the mobile overhead harness system with a plumb line to align the shoulders over the toes based on the Mini-BESTest (Balance Evaluation Systems Test© 2005-2012) compensatory stepping method.

2-B Measurements of step length and width were gathered using images of talcum powder footprints on the black mat and Dartfish software.

2-C Measurements of step height in the anterior direction. Anterior and posterior direction used lateral malleoli marker for reference.

2-D Measurement of step height in the left lateral direction. Lateral malleoli marker used for reference.

2-E Behavioral Strategy. Crossover step performed by participant 3.

Results:

- The AVE number of steps per trial and the percent of trials performed requiring 1 step for participant 1, 2, and 3 were 1.2 (83%), 2.4 (33%) and 1.5 (67%).
- Participant 1 had no significant changes (Figure 1.1 A-D).
- Participant 2 had significant increase in anterior and left lateral step length (p=0.027, p=0.036), and reduced posterior step height (p=0.046) when utilizing the overhead harness system (Figure 1.2 A-D). When perturbed posteriorly, participant 2 demonstrated grabbed the examiner's arms or the harness straps during 100% of posterior trials. Participant 2 turned towards the wall in 33% of trials without the mobile overhead harness and 25% of trials with the mobile overhead harness system.
- Participant 3 showed significant decrease in forward step length and height (p=0.033, p=0.006), decreased forward latency (p=0.023), and increased left step duration (p=0.019) with use of an overhead harness system. Participant 3 also performed multiple cross over steps with the overhead harness system (Figure 1.3 A-D).
- Overall trend in decreased step height when participants used the mobile overhead harness system (Figure 1.1 B, 1.2 B, 1.3 B).

Conclusion & Clinical Relevance:

- Reactive stepping may result in reduced step height and change in step length with assistance from a mobile overhead harness system versus physical therapist holding a gait belt.
- Environmental factors that may have influenced stepping response included set-up next to the wall and sense of restraint from harness system.

References:

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