

Effects of a Single Session Reactive Step Training Intervention in the Geriatric Population: A Feasibility and Safety Study

Mowder-Tinney JJ., Bonino S., Fay J., Bennett L., Charles G., DeBarr A., Gallina C., Garbeck J., Longo L., Papponetti S., Rose C., Tretowicz A.

Introduction

On average, 33% of people older than 65 experience a fall each year and many are recurrent. Conventional physical therapy interventions have been proven to require at least 50 hours of training to decrease fall risk. Recent studies indicate a single session of repeated slip training, involving 24 slips or trips, cuts annual fall risk for older adults by 50%. However, the majority of studies lack translation into the clinical setting. The purpose of this study was to assess the feasibility and safety of implementing a one session step training program in a clinic environment to improve walking ability and decrease risk and fear of falls in older adults.

Subjects

Fourteen healthy older adults over the age of sixty-five participated in this study. Participants were excluded if they had a condition that affected their ability to walk.

Materials/Methods

A convenience sample was screened using a health status questionnaire. Outcome measures included the Activities-Specific Balance Confidence Scale, Four Square Step Test, reactive stepping portion of MiniBest, 10 Meter Walk Test, and speed adjustment setting of a virtual reality treadmill. Single session reactive step training was performed using a reactive step trainer (Figure 1) two weeks following pretesting. A standardized protocol was designed which is summarized in Figure 2. Feasibility was determined through identification of themes from responses to questions immediately post intervention, and semi-structured interviews five months later, which explored participants' experiences of the intervention and reports of falls.

Figure 1. Reactive Step Trainer



Figure 2. Standardized Protocol

Pre-Intervention

- Orientation video of harness and reactive step trainer
- Progression of perturbations (ankle strategy → step strategy) to familiarize (~5 minutes)
- Baseline vital signs established

Intervention

- Slips and trips randomly administered for 4 sets of 2 minutes each, with rest periods in-between (total session time ~30 minutes)
- Force was determined sufficient when a reactive step was elicited
- Vital signs monitored throughout

Post-Intervention

- Open ended questions immediately followed the intervention
- 3-question follow-up interviews conducted 5 months post-intervention
- Vital signs reassessed to ensure return to baseline

Results

The average number of slips and trips that were elicited during the intervention is shown in Figure 3. The average distance that the reactive step trainer was pushed to elicit a stepping reaction is shown in Figure 4. There was only one minor adverse event of bruising. Participants perceived the intervention was challenging but beneficial, stepping backwards was more difficult, and the harness created a sense of security. In the 5 month follow up, participants reported no falls while walking, felt they had increased awareness of their capability to step, better reaction when losing their balance and would participate in the intervention again. Examples of questions and participant responses are shown in Figure 5.

Figure 3. Average Trips and Slips

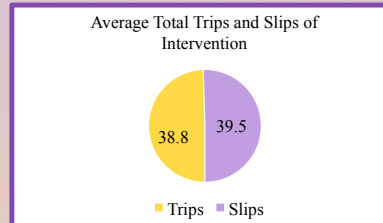
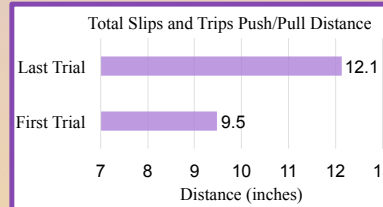


Figure 4. Average Push/Pull Distance



Conclusions

Overall, participants responded positively, noted the intervention was beneficial and reported no adverse events. The majority of previous studies have been completed in laboratories with expensive equipment, offering clinicians little ability to implement findings in clinical practice. This study was performed in a clinic setting, using equipment that can be easily acquired. The major limitation of this study included a small, homogeneous sample of convenience. In conclusion, it is feasible for clinicians to implement this intervention in clinical practice with the geriatric population.

Clinical Relevance

Reactive step training is a safe, practical intervention that patients can tolerate and therapists can reasonably implement to decrease risk of falls.

Figure 5. Questions and Answers

"Interesting to pay attention to what to do when you fall"

"Better understanding of how to prevent another fall"

What did you think of the training?

What was your favorite part of the training?

"The opportunity to experience falling and the reaction without danger of falls/getting hurt"

"Challenging yourself in a new way"

"Very much so. When I was about to fall or lose my balance I have used the strategies I learned in your study in order to regain my balance"

Do you feel the balance training had an impact?

Would you do the training again?

"Yes, I would recommend that people do this to make the connection in the brain so you don't have to think about it when you start to fall, you can just take that step to save you from losing your balance."

References

- Parijat P, Lockhart TE. Effects of moveable platform training in preventing slip-induced falls in older adults. *Ann Biomed Eng*. May 2012;40(5):1111-1121.
- Pai YC and et al. Perturbation training can reduce community-dwelling older adults' annual fall risk: a randomized controlled trial. *J Gerontol A Biol Sci Med Sci*. December 2014;69(12):1586-1594.
- McCrumb C and et al. A systematic review of gait perturbation paradigms for improving reactive stepping responses and falls risk among healthy older adults. *European Review of Aging and Physical Activity*. 2017;14:3.
- Papadimitriou A, Perry M. A systematic review of the effects of perturbation training on preventing falls. *New Zealand Journal of Physiotherapy*. 2017;45(1):31-49.
- Yang F and et al. Generalization of treadmill-slip training to prevent a fall following a sudden (novel) slip in over-ground walking. *J Biomech*. January 2013;46(1):63-69.

Acknowledgements

Acknowledgements to Chris Greene, Adam Krahmer, and Agape Physical Therapy for the use of their treadmill during data collection.

