Investigating an adaptive target biofeedback paradigm to reduce gait asymmetry in older adults post-stroke

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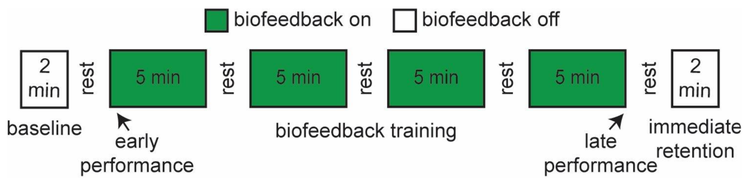
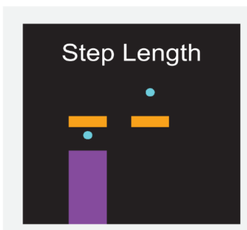
Introduction

- Stroke is one of the most common causes of long-term disability in the United States and can present with debilitating motor impairment.
- Asymmetric walking patterns due to hemiparesis are energetically costly and impair walking performance. For this reason, gait asymmetry is an important target of clinical gait training and post stroke rehabilitation research.
- Visual gait biofeedback training is an effective, well-studied way to alter walking patterns in people with chronic stroke. However, there exists large methodological variability between studies with discrepancies in feedback target and feedback structure.
- **Objective**: to determine the utility of a novel, adaptive target biofeedback paradigm to reduce step length asymmetry after stroke and explore its use as a standardized methodology.

Methods



Biofeedback Paradigm



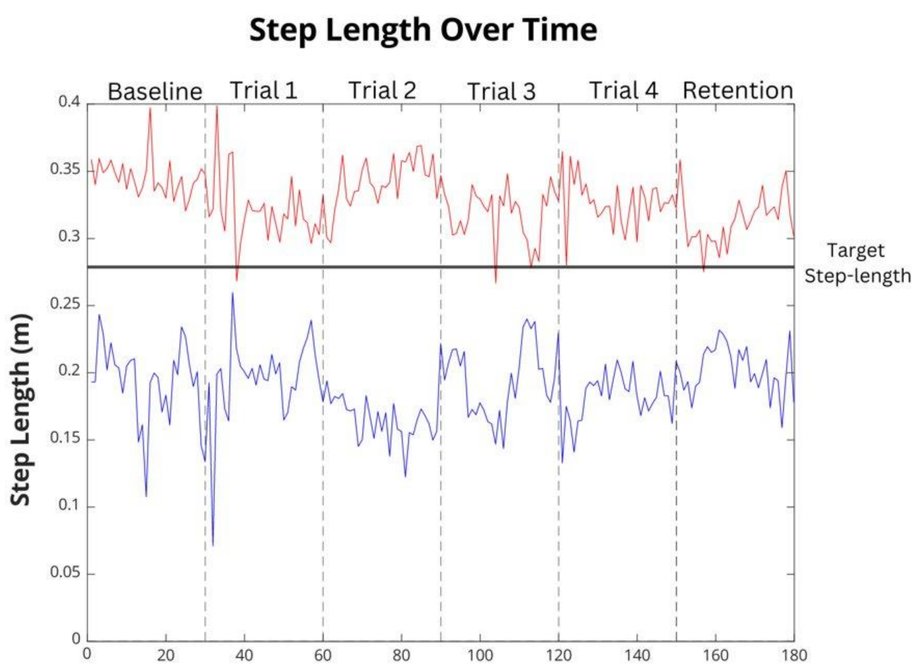
Step length asymmetry

$$\frac{(SL_{longer} - SL_{shorter})}{(SL_{longer} + SL_{shorter})}$$

SL = step length

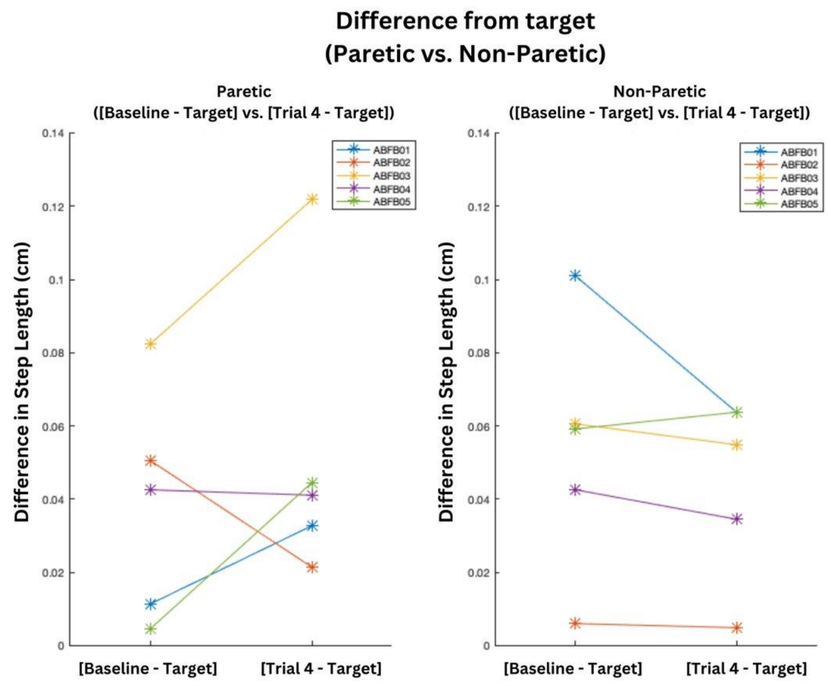
- At the start of the experiment, the targets were large and easy to achieve.
- If the participant consistently hit the target zones, the targets would adapt, moving toward the predicted step length value.
- The final target was set as a function of each individual's predicted pre-morbid step length that was established based on height, body mass, age, leg length, and gait speed.

Figure 1



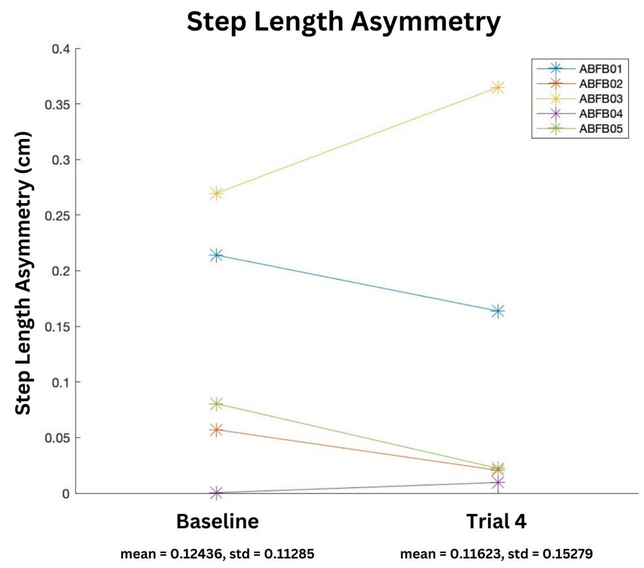
*Participant ABFB2

Figure 2



At baseline, the mean target error was 0.038 +/- 0.031cm and 0.054 +/- 0.034cm on the paretic and non-paretic lower extremities, respectively. This increased to 0.052 +/- 0.044 on the paretic limb and decreased to 0.04 +/- 0.03 on the non-paretic limb during the last trial, with significant inter-participant variability.

Results



- Biofeedback driven decrease in the step length asymmetry in 3 out of the 5 participants.
- One participant did not change, and one participant exaggerated their step length asymmetry.

Conclusion

- **This work provides preliminary evidence that it is feasible for people with chronic stroke to use real-time gait biofeedback with adaptive feedback targets to change their step length asymmetry within a single session of training.**
- Further biofeedback training should be explored to determine the feasibility and efficacy of this paradigm as a standardized approach.

References

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2. Bonilla Yanez, M., Kettlety, S.A., Finley, J.M. et al. Gait speed and individual characteristics are related to specific gait metrics in neurotypical adults. Sci Rep 13, 8069 (2023)

Acknowledgments

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