A longitudinal rehabilitation case study for hemiparetic gait using outdoor rhythmic haptic cueing via a wearable device

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Title:

A longitudinal rehabilitation case study for hemiparetic gait using outdoor rhythmic haptic cueing via a wearable device

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Abstract:

Introduction
Improvement of gait is a high priority for hemiparetic stroke survivors. Auditory rhythmic cueing is a proven method for improving gait via entrainment but use is limited outside the lab. The lack of use in outdoor settings seems to reflect the problem that auditory cueing can be distracting and isolating out of doors, where survivors typically need to remain safe, aware of the environment. In such settings, haptic cueing offers an unobtrusive, invisible, sociable, safe alternative.

Research Question
Existing studies have demonstrated improvements in temporal symmetry, increase in stride length and walking speed by means of post-stroke gait rehabilitation using wearable haptic devices in the lab. However, previous studies have been limited to laboratory settings and have focused on short-term improvements. By contrast, we present the first case study on the self-managed use of wearable haptics for gait rehabilitation via entrainment in outdoor settings, and the first findings from applying this technique over a number of days.

Methods
A longitudinal pilot study was conducted with a single hemiparetic participant providing rhythmic haptic cueing using a wearable haptic device for a two-week period. The participant was asked to walk in synchrony to the haptic rhythm at a suitable outdoor setting for a minimum of 10 minutes each day. Gait data was measured before and after the two-week intervention using lab-based IMU sensors.

Results
On comparing before and after gait characteristics, preliminary results showed substantial improvement in temporal symmetry and walking speed.

Conclusions
There is implications for potential long-term benefits for stroke survivors in gait rehabilitation using rhythmic haptic cueing. Improvements in temporal symmetry, increase in stride length and walking speed could improve confidence, independence and overall

quality of life for stroke survivors, with implications for reduction of costs associated with care and rehabilitation.

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