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Title:

How can rhythmic haptic cueing using wearable haptic devices help gait rehabilitation for stroke survivors: a longitudinal pilot study

Submission For:

Abstract submission for Presentations.

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Themes:

- Assisted Technologies
- Long-term Conditions
- Technology in the Future
- Wearable Devices and Mobile apps

Three Learning Outcomes for attendees:

1. How can wearable haptic devices be useful for rehabilitation in various neurological conditions such as stroke
2. How can biological entrainment be helpful for gait rehabilitation of stroke survivors or other neurological conditions
3. How can the above techniques bring long-term benefits in rehabilitation

Abstract:

Stroke is one of the leading causes for long-term adult disabilities. More than half of all stroke survivors depend on others for everyday activities after they are discharged from hospital. One of the conditions a stroke survivor may experience is *hemiparetic gait*. Typical characteristics of hemiparetic gait are: reduced speed, increased step variability, spatial and temporal asymmetry. These, in turn, lead to joint pain, bone degeneration, higher risk of falls, and fracture. To improve health and daily activities, rehabilitation, and physiotherapy is an integral part of the recovery plan. Rehabilitation is commonly performed in a clinical setting however this kind of long-term care is expensive. Therefore, reliable in-house rehabilitation techniques are highly desirable. In addition, there is evidence in the literature to suggest home-based rehabilitation is often more beneficial to the patients.

Numerous studies have shown rhythmic cueing as a promising technique for post-stroke gait rehabilitation. Auditory rhythmic cueing has shown improvement in gait patterns. Specifically, auditory cueing can assist with improvements in temporal and spatial symmetry, along with increases in walking speed, step and stride length. However, auditory cueing may be obstructive in an outdoor setting while trying to listen for alerts or having a conversation with others.

In such settings, haptic (touch based) cueing can be highly effective as means of covert, unobstructive rhythmic cueing. Recent studies have shown promising results for rhythmic haptic cueing using wearable haptic devices for post-stroke gait rehabilitation with improvement in temporal symmetry, increase in stride length and walking speed. This could improve confidence, independence and overall quality of life for the stroke survivors, with implications for reduction of costs associated with care and rehabilitation. Long-term benefits are yet to be determined empirically. Therefore, a longitudinal, in-the-wild pilot study, has been conducted with a single brain trauma survivor, providing rhythmic haptic

cueing using a wearable haptic device. Gait characteristics have been analysed by comparing before and after in-lab measurements from a two-week intervention. This study aims to provide insights into potential long-term benefits of rhythmic haptic cueing for a range of neurological conditions affecting gait.

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