Rehabot: Robot that Assists in Parkinsonian Gait Rehabilitation Fatin Sharafana Mohd Haniff, Joe Yee Tan, Justin Tze Hai Ang, James Chen Yong Kah. *Gerontechnology* 25(s)

Background Parkinson's Disease (PD) is the fastest growing neurological disorder in the world, and it is projected that by 2040 there would be 12 million people with PD globally [1]. In Singapore, PD is the second most common neurodegenerative disease in Singapore with about 3 in every 1,000 individuals over 50 years and above having PD [2]. With PD rapidly increasing locally and globally, driven in part by an ageing population, this trend is expected to accelerate the progression and prevalence of gait impairments, including reduced stride length, slowness, postural instability, and freezing of gait. Conventional gait rehabilitation, though effective, faces limitations due to manpower constraints, low training frequency, and the need for physiotherapist supervision. As the number of individuals with PD increases, there is an urgent need for accessible, high-frequency, and cost-effective gait rehabilitation solutions that support patients both in clinical and home environments. **Methodology** Here, we develop a semi-autonomous robot, Rehabot with an integrated visual, verbal and rhythmic cueing system designed to provide guided gait training through visual cues, metronome-based rhythmic cues, and real-time verbal feedback via a simple three-button control interface supporting independent use (Figure 1). Such cueing strategies are known to improve stride length, walking speed, and turning performance [3]. A 10-week two-phase pilot, single-arm, repeated-measures clinical feasibility trial involving 14 individuals with PD from rehabilitation centers across Singapore were subsequently conducted with Rehabot (Figure 2). The study was conducted in two phases: Phase 1 capturing natural rehabilitation progression and Phase 2 evaluating immediate responses across four test conditions (baseline, physiotherapist-cued, Rehabot-visual only-cued, and Rehabot-visual+rhythmic-cued). **Results and Discussion** Wilcoxon and repeated-measures analyses showed immediate improvements in gait speed, stride length, and turning time when using Rehabot cueing, with effects comparable to physiotherapist-provided cues. Participant surveys demonstrated high acceptability, comfort (mean 4.4/5), and overall positive experience (4.6/5), with many reporting perceived gait improvements and willingness to recommend the device. Patients with pronounced bradykinesia, hypokinesia, postural instability, or frequent freezing episodes showed the strongest improvements with robot-assisted cueing. **Conclusion** The results provided evidence that robot-assisted cueing with Rehabot could provide an effective and acceptable rehabilitation modality for individuals with PD, offering immediate enhancements in gait parameters similar to therapist-delivered cues. Rehabot demonstrated strong potential as a scalable tool to augment rehabilitation capacity, support independent at-home training, and reduce reliance on healthcare manpower. Anticipated outcomes include the refinement of robot-assisted cueing protocols, identification of responder patient profiles, and groundwork for larger multi-centre trials evaluating long-term effects and integration into clinical practice.

Figure 1: Overview of Rehabot's Function and Features

Figure 2: Patient Conducting Gait Rehabilitation with cues from Rehabot

References

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Affiliation: Department of Biomedical Engineering, National University of Singapore
Email: biekahj@nus.edu.sg