Functional gait training using an instrumented treadmill with visual context improves gait adaptability in the chronic phase after stroke: a proof of concept

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BACKGROUND AND AIM: After stroke, the ability to make step adjustments during walking, i.e. gait adaptability, is often reduced [1, 2], which contributes to increased risk of falling and elevated fall incidence [3]. The C-Mill is a novel instrumented treadmill with visual context presented by a projector [4], specifically designed to train this aspect of walking ability in a safe and controlled environment (Figure 1A). In this proof-of-concept study we examined the effect of C-Mill training on gait adaptability, as assessed with laboratory-based obstacle-avoidance tests under time pressure, as well as clinical indicators of walking ability. The former test was performed with and without a concurrent attention-demanding cognitive task to examine potential changes in attentional demands of gait adjustments.

METHODS: Sixteen community-dwelling persons in the chronic phase after stroke (54±11 yrs; time after stroke: 17±11 months) participated in the study. Participants underwent 10 1-hr C-Mill training sessions in 5-6 weeks. Pre and post intervention, instrumented obstacle-avoidance tests with and without a concurrent auditory Stroop task [5] were conducted to examine the effect of C-Mill training on gait adaptability (i.e. obstacle-avoidance success rates) and the associated attentional demands. In addition, Berg Balance Scale (BBS), 10m walking test (10MWT), Timed Up and Go test (TUG) and the subtask obstacle course of the Emory Functional Ambulation Profile (EFAP) were assessed.

RESULTS: The ability to avoid obstacles under time pressure improved after C-Mill training, as evidenced by an increase in obstacle-avoidance success rates (from 57±18% pre intervention to 80±18% post intervention; p<0.001). Also, BBS, 10MWT, TUG and EFAP all improved significantly (p<0.05) (Figure 1B).

CONCLUSION: C-Mill therapy fully complies with evidence-based ingredients for effective gait training in that it allows for task-specific, repetitive, intensive gait training with feedback on performance (e.g. [6]). The results of this study indicate that C-Mill training is a promising therapeutic means for improving gait adaptability and clinical indicators of walking ability in the chronic phase after stroke. We currently examine whether or not these improvements are accompanied by meaningful changes in the attentional demands of gait adjustments.

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REFERENCES:


Figure 1. (A) Functional C-Mill training with visual context, e.g. stepping targets, presented by a projector. (B) Timed walking test, i.e.: 10MWT (10 meter walking test), TUG (TimedUp and Go) and EFAP (Emory Functional Ambulation Profile – Obstacle course) before (■) and after (●) C-Mill training. Error bars: ± 2 SD. * Significant difference, p<0.05.