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A wearable biofeedback device to improve gait pattern in people with Parkinson's disease: a proof of concept study

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Background: The gait of people with PD is characterized by several disturbances, partially amendable by clinical rehabilitation approaches (1). Wearable biofeedback devices can be used in neurorehabilitation as valuable instruments to improve the effects of interventions (1).The purpose of this study was to verify the effectiveness, usability, and safety of a wearable biofeedback device in improving the gait patterns of people with Parkinson's Disease (2). The device extracts gait features in real-time and delivers a vibrotactile stimulus at the user's waist synchronously with specific gait phases.

Methods: Experimental procedures included a pre-training (pre-trn) and the post-training (post-trn) assessments and three training sessions to familiarize with the device. During the pre-trn and the post-trn assessments, a 10-meter walking test (10mWT) within a gait analysis laboratory and a two-minute walk test (2MWT) have been performed. Gait trials were executed with (bf) and without (no-bf) the biofeedback and gait performances were compared at various time points to evaluate the total effect (ΔTT; post-trn_Bf - pre-trn_no-Bf), training effect (ΔTE; post-trn_no-Bf - pre-trn_no-Bf), immediate effect before the training (ΔIE; pre-trn_Bf - pre-trn_no-Bf) and after the training (ΔIE; post-trn_Bf - post-trn_no-Bf). The vertical ground reaction force (vGRF), feet's kinematic and spatio-temporal gait parameters were analyzed.

Results: Preliminary results of one subject (Age=72 years; H&Y=3) showed improvements in gait speed (ΔTT=0.32 m/sec; ΔTE=0.25 m/sec), step length (ΔTT=0.26 m; ΔTE=0.13 m), feet's kinematic, and the vGRF during the 10mWT. The subject improved the distance walked (ΔTT=25.5 m; ΔTE=21.5 m) and decreased the double-support phase (ΔTT= -4%; ΔTE= -2.2%) during the 2MWT. Improvements in distance walked and cadence were detected at pre-trn and at post-trn as IE of the vibrotactile biofeedback.

Conclusions: A short training period using the vibrotactile stimulus seems to improve the gait pattern of the subject and the device seems to be usable and safe for the user.

References:

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