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Cortical Activation Pattern after Long-term Gait Training with Wearable Hip-assist Robot in Elderly

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Objective
The purpose of this study was to investigate the effect of the long-term gait training with wearable hip-assist robot on cortical activation pattern during walking in elderly persons.

Methods
Seven elderly persons (mean age, 74±6.24, 3 males) participated. A wearable type hip-assist robot, Gait Enhancing Mechatronic System (GEMS, Samsung Electronics Co., Ltd., Korea), was used. Participants received over ground gait training with GEMS in various environments, 24 sessions for consecutive 8 weeks. Cerebral oxygenation was measured by oxyhemoglobin (OxyHb) concentration using the 49 channels of functional near infrared spectroscopy (fNIRS) imaging system (NIRScout, NIRx Medical Technology, LLC, Germany) covering bilateral prefrontal cortices (PFC), premotor cortices (PMC), supplemental motor areas (SMA), and lower limb sensorimotor cortices (SMC). Cortical activation was assessed at pre- and post-intervention, and at 4 weeks follow-up time points.

Results
After completion of 24 gait training sessions with GEMS, we observed less OxyHb concentration over bilateral SMCs, SMAs, and PMCs in the late period of gait, between 31 and 60 seconds after initiating walking task ($p<.05$). These changes were maintained until 4 weeks after the cessation of training ($p<.05$). Conclusion
The long-term intensive gait training in elderly persons with GEMS demonstrated decreased activity of specific cortical regions related with gait which might represent increased efficiency of cortical neural resources during walking.

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