Motor recovery after stroke: the role of overground exoskeletons in shaping brain plasticity

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The use of neurorobotic devices into gait rehabilitative programs, including Ekso, is reported to increase the engagement and motivation of the patients while actively performing a task, and to shape the sensory-motor plasticity (SMP) and its balance between the primary motor areas (M1), and the fronto-parietal network (FPN) connectivity, thus contributing to successful gait rehabilitation [1]. Aim of our study was to assess whether Ekso would foster the recovery of deteriorated FPN connectivity and SMP patterns involved in limb coordination during walking [2] in a sample of patients with hemiparesis due to stroke. To this end, we enrolled ten patients who underwent Ekso training (24 sessions) and were evaluated about gait performance, FPN connectivity, and SMP pattern. Esko significantly increased gait performance index as revealed by surface EMG ($p=0.01$) and the deterioration of prefrontal-SMA and SMA-centroparietal connectivity (both $p=0.02$), and rebalanced the equilibrium between the SMP patterns of the two M1-leg areas ($p=0.03$). Moreover, the baseline plasticity and FPN connectivity were the most important factors in using Ekso fruitfully ($r=0.9$, $p=0.03$). Even though our findings need to be confirmed by future research further addressing the safety and effectively use of Ekso, our small cohort study provides new cues supporting the role of powered exoskeletons in rehabilitation protocols for persons with stroke.

References

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[2] Vaney et al. (2012). Robotic-assisted step training (Lokomat) not superior to equal intensity of over-ground rehabilitation in patients with multiple sclerosis. Neurorehabil Neural Repair 26:212–221.

Keywords