The cortical control of cycling exercise in stroke patients: an fNIRS study.

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Abstract

Stroke survivors suffering from deficits in motor control typically have limited functional abilities, which could result in poor quality of life. Cycling exercise is a common training paradigm for restoring locomotion rhythm in patients. The provision of speed feedback has been used to facilitate the learning of controlled cycling performance and the neuromuscular control of the affected leg. However, the central mechanism for motor relearning of active and passive pedaling motions in stroke patients has not been investigated as extensively. The aim of this study was to measure the cortical activation patterns during active cycling with and without speed feedback and during power-assisted (passive) cycling in stroke patients. A frequency-domain near-infrared spectroscopy (FD-NIRS) system was used to detect the hemodynamic changes resulting from neuronal activity during the pedaling exercise from the bilateral sensorimotor cortices (SMCs), supplementary motor areas (SMAs), and premotor cortices (PMCs). The variation in cycling speed and the level of symmetry of muscle activation of bilateral rectus femoris were used to evaluate cycling performance. The results showed that passive cycling had a similar cortical activation pattern to that observed during active cycling without feedback but with a smaller intensity of the SMC of the unaffected hemisphere. Enhanced PMC activation of the unaffected side with improved cycling performance was observed during active cycling with feedback, with respect to that observed without feedback. This suggests that the speed feedback enhanced the PMC activation and improved cycling performance in stroke patients.

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KEYWORDS: brain activation; cycling; near-infrared spectroscopy; rehabilitation; stroke

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