Promoting brain-computer interface technology for stroke rehabilitation.

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Introduction: Electroencephalographic (EEG)-based BCI (Brain Computer Interface) technology operated via motor imagery (MI) appears a unique option to promote motor recovery after stroke. With the aim of developing a specific BCI system for stroke rehabilitation of the upper limb we performed an extensive neurophysiological screening of 21 stroke patients consecutively enrolled from a rehabilitation clinic. A subgroup of patients underwent a one-month BCI training with a system developed specifically and installed in the rehabilitation hospital ward.

Methods: EEG and Transcranial Magnetic Stimulation (TMS) data were collected from 21 monolateral stroke patients during MI of simple hand movements. Stroke impairment was assessed by means of clinical and functional scales. In a subgroup of 6 patients, clinical and neurophysiological measurements were repeated after a one-month MI-based BCI training and compared to a control group.

Results: All patients were able to perform MI of affected hand (AH) as revealed by the EEG desynchronization of the alpha and beta rhythms over the ipsilesional scalp electrodes and by the increase in motor evoked potential measured with TMS. During the BCI training, stroke patients were able to control the movement of a visual representation of their own AH by MI.

Conclusions: The preliminary results of the BCI training with stroke patients are encouraging: it has been shown that EEG features related to the MI task can be collected from the affected hemisphere of stroke patients and successfully adopted to control a BCI system.

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