Abstract

Brain Computer Interface training for patients with severe upper limb paresis after stroke

A pilot randomized controlled trial

Introduction
Brain Computer Interfaces (BCI) pair brain activity with visual and / or motor feedback. They may provide sorely needed training alternatives for patients with severely impaired upper limb after stroke, where treatment choices are limited and unsatisfactory. Studies where the effectiveness of BCI training with patients in the subacute phase after stroke is examined are scarce.

Objectives
We want to examine if BCI based training is more effective in improving upper limb (UL) motor function than conventional therapy in the subacute phase after stroke. Furthermore, we want to explore which patients benefit, and how patients and therapists experience this type of training.

Patients and methods
This is a pilot RCT. Forty patients with stroke and severe UL paresis (< 13 on Action Research Arm Test) will be included and randomized to either BCI training as part of their rehabilitation or standard UL rehabilitation. BCI training will be conducted with the RecoveriX system (g.tec, Austria). The RecoveriX system comprises EEG, functional electrical stimulation and visual feedback from virtual hands on a screen. The system is calibrated according to patients' brain activity. Only when a defined accuracy in imaging wrist and hand movements is reached, functional electrical stimulation is initiated to move the hands. The patients will undergo targeted 12 treatment sessions during the course of 3-4 weeks. Outcome measures: UL motor function will be assessed with Action Research Arm Test (ARAT) and Fugl Meyer Motor Assessment. Interviews will be conducted with patients and therapists to explore their experience with regard to effect and user-friendliness. Data on cortico-spinal tract integrity derived from transcranial magnetic stimulation and patient-related data will be used as predictors in a regression analysis.

Discussion
In the subacute phase, most plasticity and potential for recovery can be expected. Stimulating task-oriented training with many repetitions can improve motor function. However, it is very challenging to provide suitable active training for patients who hardly can move their affected upper limb. A system that creates a closed loop between intention, output and feedback may represent a promising treatment option for patients with severe upper limb paresis after stroke.

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