Neuroimaging of brain reorganisation and therapy induced recovery in stroke patients using an MRI-compatible arm robot (MaRIA)

Summary / Zusammenfassung
Background: Despite increasing evidence that neurorehabilitation can promote clinical recovery, a better understanding of brain reorganisation following brain damage and therapy-induced recovery is necessary for the development of efficient rehabilitation strategies. Studies with functional magnetic resonance imaging (fMRI) in combination with MRI-compatible robots can provide a controlled and objective approach for measurements and can help to get insight into this area of research.

Aim: In this study MaRIA, an MRI-compatible arm robot, is used in patients with chronic stroke. The main goals of this project are 1) to reliably assess activation patterns in patients with different degrees of disability and 2) to evaluate the effect of robotic and conventional therapy at the brain level.

Methodology: In order to achieve the first goal, brain activation patterns are recorded with fMRI in patients with mild to severe motor impairments while performing active and passive arm movements with MaRIA. Differences in reorganisation patterns due to level of impairment are assessed and lesion characteristics are taken into account.

To assess the effect of arm therapy on brain activation, the moderately to severely affected patients are additionally trained either with ARMin, an arm therapy robot develop at the ETH Zurich, or with conventional therapy. These patients are participating in a total of three fMRI sessions (before therapy, at the end of therapy and 2 months later as follow-up).

Significance: The controlled assessment of brain activation using MaRIA will give insights into reorganisation patterns related to arm function in patients following stroke. Since the influence of degree of motor impairment and lesion characteristics on brain activation patterns is studied, detailed information will be generated for subsequent studies.

The longitudinal assessment of brain activation will provide important information about reorganisation patterns after training. It will give information about differences between different therapy forms and might help to assess potential benefits of the robot-induced therapy performed with the ARMin compared to the conventional therapy.

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