Study Title: Neurofeedback for Stroke Rehabilitation

NCT: 03775915

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Sponsor: The University of Oxford

Protocol summary – 10th June 2021

Summary of Study Design

Real-time neurofeedback aims to alter brain activation patterns through online feedback of ongoing brain activity using magnetic resonance imagining (MRI). Stroke survivors will be randomised to receive 3 sessions of real or sham neurofeedback. This study aims to investigate whether: 1) stroke survivors can maintain alterations in brain activity after the feedback is removed, 2) neurofeedback training leads to improvements in movement of the hand and arm, 3) neurofeedback training leads to changes in brain structure and function, 4) variability in response across people can be understood.

The training will consist of 3 real time functional MRI (rtFMRI) training sessions. Baseline measures will be taken prior to the start of the first session and post-training measures will be taken after the final training session.

Primary and Secondary Endpoints/Outcome Measures

The primary outcome measures are a change in motor function in the neurofeedback group compared to the control group and changes in brain activity during neurofeedback. These outcome measures will address whether the neural plasticity brought about by the neurofeedback can lead to subsequent behavioural improvements.

The secondary outcome measures will be performance on visuo-motor tasks (visually cued grip force), motor impairment and measures of change in brain structure and function.

Study Participants

Patients who have had a stroke more than 6 months previously, that has affected their motor function of their upper limb.

Inclusion Criteria:

- Participant is willing and able to give informed consent for participation in the study.
- Participant can understand verbal and written instructions in English.

- Male or Female, aged > 18 years
- Patient will have had symptomatic stroke that has affected the upper limb of one side of their body
- Patients must have some residual movement in their affected limb.

Exclusion Criteria:

- Contraindications to MRI, such as a pacemaker, metallic implants or aneurysm clips
- Inability to provide informed consent
- Inability to actively participate in the research procedures

Study Procedures

Written informed consent will be taken at the start of the first session by an experimenter trained in good clinical practice (GCP). A number of baseline measures of motor and neural function will then be performed. These tests will then be followed by the training sessions where participants will receive real or sham neurofeedback while performing a motor skill with their affected hand. Following the training sessions, the post-test session will repeat the motor and neural measures performed during baseline.

Number of Participants

The sample size (n=30) was selected to ensure there was sufficient data given issues in data quality or participant retention. In most FMRI studies it is recommended that there be at minimum 12 participants in each group (e.g., sham vs. treatment) (Desmond & Glover, 2002).

Analysis of Endpoints

MR analysis will be performed using a common approach, using the FMRIB Software Library. EEG analysis will be performed similarly using a common approach using EEGlab software for Matlab.

Statistical analysis of derived data will be performed using SPSS Statistics for Mac and MATLAB/R. Behavioural (e.g., Jebsen Taylor test, Action Research Arm Test) and EEG outcome measures will be assessed across sessions using a mixed-ANOVA (or linear mixed model as appropriate) with group (real *vs* sham) as a between-subjects variable and session as a within-subjects variable. Behavioural outcomes will also be correlated with neurological changes over training.