Transcranial Magnetic Stimulation Mapping using the Pseudorandom Walk Method to Measure Training-Induced Plasticity

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Primary objective: To acquire motor maps of the BR and the MD muscles by using the pseudorandom walk method and assess their change after long-term motor learning.
Secondary objectives: Compute muscle synergies from the motor maps and assess their...

Ethical review	Approved WMO
Status	Pending
Health condition type	Other condition
Study type	Interventional

Summary

ID

NL-OMON50874

Source
ToetsingOnline

Brief title
TMS motor mapping

Condition

- Other condition
- Central nervous system vascular disorders

Synonym
CVA, Stroke

Health condition

Brain plasticity in healthy participants

Research involving
Human

Sponsors and support

Primary sponsor: Erasmus MC, Universitair Medisch Centrum Rotterdam
Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: Plasticity, Transcranial Magnetic Stimulation

Outcome measures

Primary outcome

Motor learning: Accuracy on the motor task.

Motor maps: The area, volume, and centre of gravity of the muscle cortical representations for the MD and the BR muscles. Potential change will serve as a measure of cortical plasticity after motor learning.

MEP-amplitude ratio: Measure for brain excitability. The height of the MEP amplitudes will be measured at a constant stimulation intensity.

Secondary outcome

Muscle synergies: The extent to which the motor maps overlap.

Intermanual transfer: Potential change in the motor maps of the hemisphere that is not undergoing the intervention.

Study description

Background summary

Stroke is a leading cause of long-term disability. Functional recovery involves both spontaneous recovery and motor learning. The latter relies on the ability of the primary motor cortex (M1) to functionally reorganize and adapt the existing muscle synergies. Muscle areas on the M1 can be measured by applying Transcranial Magnetic Stimulation (TMS) over the motor cortex while simultaneously measuring the amplitudes of the motor evoked potentials (MEPs) in the Electromyography (EMG) signal of the target muscle. A recently developed mapping technique, the pseudorandom walk method, significantly reduces time needed to perform TMS mapping without sacrificing the reliability of the measurements. Due to this faster technique, it is now possible to map several muscles at once, which was not viable before with the traditional mapping method. To investigate the movement control of the upper-limb we focus on the proximal Medial Deltoid (MD) and the distal Brachioradialis (BR) muscles. These muscles have not been mapped yet using the pseudorandom walk method. Furthermore, motor learning studies mostly remain focused on the effects of short-term training. Thus, the goal of this experiment is to use the pseudorandom walk method to map the two muscles of interest and measure their change after a long-term motor learning task. We will compare the obtained motor maps, the mean MEPs measured at the hotspot, the overlap in the cortical representations, and the potential for interhemispheric transfer before and after the period of the motor learning.

Study objective

Primary objective: To acquire motor maps of the BR and the MD muscles by using the pseudorandom walk method and assess their change after long-term motor learning.
Secondary objectives: Compute muscle synergies from the motor maps and assess their change. Investigate potential changes on the contralateral motor maps of the side of the body that will not undergo any motor learning.

Study design

Crossover intervention study

Intervention

Motor learning of a complex upper-limb motor task - throwing of darts

Study burden and risks

Healthy participants will visit the Erasmus MC on 2 days for a total of 2 hours per visit. There is a 6-week period in between the two sessions. In this time, half of the participants will go through a motor learning of a complex motor

task at home. All the materials will be provided. These participants will be asked to keep a diary of their performance. In this study, the safety measures are applied as described in recent brain stimulation reviews. There are no serious risks associated with this study. The minimal risks associated with the discharge of the TMS coil at higher intensity levels are the loud sounds and a temporary discomfort in the muscles on the head.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

Healthy
Aged 18-55 years
Right-handed

Exclusion criteria

History of neurological or psychiatric disorders
Implants or metal parts in the head
Use of psychoactive drugs in the last month
Pregnancy

Study design

Design

Study type:	Interventional
Intervention model:	Crossover
Allocation:	Randomized controlled trial
Masking:	Open (masking not used)

Primary purpose: Diagnostic

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	15-03-2021
Enrollment:	60
Type:	Anticipated

Ethics review

Approved WMO Date:	23-03-2021
Application type:	First submission
Review commission:	METC Erasmus MC, Universitair Medisch Centrum Rotterdam (Rotterdam)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL75865.078.20