The flow of information during mental simulation

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Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Structural brain disorders
Study type	Observational invasive

Summary

ID

NL-OMON37599

Source
ToetsingOnline

Brief title
Mental simulation

Condition

- Structural brain disorders

Synonym
epilepsy

Research involving
Human

Sponsors and support

Primary sponsor: Academisch Medisch Centrum
Source(s) of monetary or material Support: Brain and Cognition programma

Intervention

Keyword: connectivity, electrocorticography, mental simulation

Outcome measures

Primary outcome

In this study we measure both the behavioural responses (reaction-time and hand orientation distribution) as well as the electrophysiological signals from the ECoG electrodes. During the interference protocol, we investigate the influence of local cortical stimulation on task performance. All results will be presented as cortical maps showing the active areas and their interactions. This will provide a cortical network model for mental simulation. Finally, the effects of resection on the performance of the task will be used as a proof of the models predictive potential.

Secondary outcome

n.a.

Study description

Background summary

The motor system does not only enable us to make movements, it also allows us to make mental simulations of movements without actually executing them. Mental simulation of movements has been implicated to play a key role in a number of cognitive processes such as the preparation and execution of movements, understanding the intention of other people*s movements and semantic processing of action words (Gallese & Lakoff, 2005; Wolpert & Ghahramani, 2000). When the ability to simulate movements is hampered, this may have severe adverse effects on everyday life.
Although mental simulations play a crucial role in our everyday lives, its neuronal underpinnings have not been elucidated in great detail. Previous studies have indicated the fronto-parietal circuitry as the neuronal substrate for mental simulations. But the exact time course of the interactions between

the different subregions of the underlying neuronal network -in other words, the flow of information- remains unclear.
This information is especially relevant for patients that undergo brain surgery. Deficits in mental imagery may underlie hitherto unexplained postoperative complaints of lack of concentration, reduced executive performance or impaired thinking. If we can identify the essential nodes of the underlying network, this information can be taken into consideration in resections of neural tissue.

Gallese, V., & Lakoff, G. (2005). The Brain*s concepts: the role of the Sensory-motor system in conceptual knowledge. Cognitive neuropsychology, 22(3), 455-79.

Wolpert, D M, & Ghahramani, Z. (2000). Computational principles of movement neuroscience. Nature neuroscience, 3 Suppl(november), 1212-7

Study objective

The main objective of this study is to characterize the flow of information in the fronto-parietal network during the simulation of movements using intracranial EEG recordings. In the characterization we will pinpoint the neuronal (sub)regions of the underlying neuronal network and map their interactions. Critical nodes of the network will be identified using cortical stimulation during the task. The architecture and location of this network can have consequences for neurosurgical strategies, especially in brain resections for epilepsy, to avoid postoperative impairments. Therefore, a second objective of this study is the development of a protocol to localize essential nodes in the network for the simulation of movement.

Study design

This core of this study is the recording of intercranial EEG signals (ECoG) while the subject is engaged in a mental simulation task. The design of the experiment therefore is as follows:

1. Before the implantation, the patient will perform one session of the mental simulations task and the control task This will take 20 minutes.

2. After the implantation of the ECoG electrodes the patient will remain in the hospital for one week. During this week the patient will perform the mental simuation task 3 times. On the last session, we will apply cortical stimulation to identify the nodes that are essential for performing the task. In total, this will take 3x 20

minutes.

3. To assess the effect of the resection of the task, the patient will be tested three times after the resection (48h, 1 week and 6 weeks post-resection). On these occasions the patient will again perform the mental simulations task and the control task. This will take 3x 20 minutes in total.

Study burden and risks

The proposed methods do not differ substantially from those used for tests that are currently performed on these subjects as part of their clinical investigations (language, spatial orientation, short-term memory tasks, etc.).
It is possible that the subject has an epileptic seizure during the course of the experiment. In the case of a seizure, the medical staff at the IEMU, who are specialized do deal with such situations, will take over immediately. Epileptic seizure are common in these patients and are in fact used to locate the source of the epilepsy.
The main burden for the subjects is that he/she may be exhausted by the amount of testing. Therefore we only test the subject three times during the hospitalication. There will be an independant nurse that monitors whether the subject is not exhausted. The subject will only perform the task when both the subject and the independent nurse indicate that the subject is fit enough to participate.
To minimize the burden of the pre- and post-surgical testing we will test the subject at times when they already have to be at the UMC Utrecht for a clinical appointment. Therefore the subject does not need to travel to the UMC Utrecht on a separate occasion for the purpose of the study.
We think that patients may benefit from the study. Mental simulation may be disturbed in dyspraxia or execution disorders that may be a sequel of brain surgery but cannot be predicted from current tests. Electrocortical stimulation interfering with a task is a powerful predictor of the critical role of a brain area in the execution of that task, and the subsequent loss of ability to perform the task after resection of that area.
Therefore, this study may yield information that improves the post-surgical functional outcome of the patient. The protocol may become part of the standard repertoire of clinical tests that are currently performed on the ECoG patients to predict and minimize the adverse effects of the resection.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adolescents (12-15 years)
Adolescents (16-17 years)
Adults (18-64 years)
Children (2-11 years)
Elderly (65 years and older)

Inclusion criteria

Patients aged at least 8 years with medically intractable epilepsy who undergo chronic invasive EEG monitoring as part of a presurgical evaluation for epilepsy surgery. Preoperative mental simulation test performance should be within normal limits.

Exclusion criteria

Not being able to perform the test.

Study design

Design

Study type: Observational invasive

Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	24-08-2012
Enrollment:	10
Type:	Actual

Ethics review

Approved WMO

Date:	04-07-2012
Application type:	First submission
Review commission:	METC Universitair Medisch Centrum Utrecht (Utrecht)

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	NL39200.041.11