A feasibility study of fMRI-neurofeedback in Parkinson*s disease

Published: 15-05-2023
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Primary objective: Identify feasibility of basal-ganglia regions as NF targets in PD patients
Secondary objective: Document short-term changes in brain resting-state activation

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Movement disorders (incl parkinsonism)
Study type	Observational invasive

Summary

ID

NL-OMON53752

Source
ToetsingOnline

Brief title
Brain self-regulation for Parkinson*s

Condition

- Movement disorders (incl parkinsonism)

Synonym
Parkinson's disease, Shaking palsy

Research involving
Human

Sponsors and support

Primary sponsor: Universiteit Maastricht
Source(s) of monetary or material Support: ZonMW

Intervention

Keyword: Feasibility, Neurofeedback, Real-time, Self-regulation

Outcome measures

Primary outcome

The region of interest fMRI data will be analysed with the appropriate parametric tests for activation and general linear model analysis will be performed as implemented in the Brainvoyager software. This will assess neurofeedback performance and changes in brain activation over time.

Secondary outcome

Correlational analysis will be performed on demographic and clinical data (MoCA score) to assess association with neurofeedback performance.

Study description

Background summary

Parkinson*s disease (PD) is associated with progressive neurodegeneration of dopaminergic neurons of the substantia nigra. It is characterized by both motor and non-motor systems and affects predominantly people over 60. Although motor symptoms, which include the classic triad of limb tremor, limb rigidity and slowness of movement, can be treated with dopaminergic drugs, some patients have insufficient clinical responses, and for many treatment effects de-crease over time. Furthermore, non-motor symptoms are difficult to manage in many patients.

This feasibility study aims to investigate and develop a new protocol for a non-invasive treat-ment modality for PD, based on self-regulation of brain circuits with neurofeedback (NF). Neurofeedback entails training of self-regulation of brain regions or networks via real-time feedback of neural signals, for example obtained by functional MRI (fMRI). NF enables patients to develop personal strategies that are most effective in self-regulating brain areas and net-works associated with mental imagery. Thereby, it can provide an individually tailored inter-vention(Esmail & Linden, 2014; Johnston et al., 2010; Linden, 2014). NF is a highly sustainable form of non-invasive neuromodulation because, once learnt, the self-regulation strategies can be applied by patients whenever needed to overcome disease symptomology. The PI*s group has shown proof-of-concept of fMRI-neurofeedback in Parkinson*s disease (PD) (Subrama-nian et al., 2011; 2016) but target selection has so far been

rather generic, such as activation level of the supplementary motor area (SMA). Our aim with this feasibility study is to evaluate a new neurofeedback protocol that entails upregulation training of specific parts of the basal ganglia, the subcortical circuit that is primarily affected by PD and also targeted by deep brain stimulation, the most successful (but invasive) neuromodulation treatment developed for PD thus far. We therefore want to investigate whether patients with PD can learn self-regulation of basal ganglia activation with fMRI-neurofeedback.

Study objective

Primary objective: Identify feasibility of basal-ganglia regions as NF targets in PD patients
Secondary objective: Document short-term changes in brain resting-state activation

Study design

This is single-group feasibility study of PD patients receiving NF training using SMA and basal ganglia as target areas. NF training will be delivered in up to three sessions, modelled on our previous work (Mehler et al., 2019). Following initial contact with patients through one of the collaborating clinical teams, a suitably qualified member of the study team will provide patients with information about the study and a date for the screening session is scheduled (at the earliest 7 days after participants received the study information). At the start of the screening session consent is taken. Subsequently, the screening assessment is performed to determine inclusion and exclusion criteria.

Study participants will then be invited for up to three further separate visits for fMRI-NF sessions in approximately weekly intervals. At the last NF session, a post-training assessment will be conducted.

Intervention

The fMRI neurofeedback (NF) sessions will include anatomical scans, an fMRI localizer (inactive bar thermometer shown whilst patients move the dominant hand, alternating with rest periods) and neurofeedback runs during which participants see an active thermometer on a screen and are instructed to upregulate activation in brain regions, alternating with rest periods. These regions are assigned according to the NF condition, either SMA or basal ganglia, and further individualized using the localizer measurement. Success of this upregulation is signaled by the level of the thermometer. Participants will receive some guidance from the investigator as to potential mental strategies, for example mental imagery of swimming or playing a musical instrument. If necessary, auditive cueing can be provided. Localization and

neurofeedback training will be performed with TurboBrainVoyager (BrainInnovation B.V., Maastricht, The Netherlands). The principle of neurofeedback training is that participants optimize the strategies for self-regulation themselves. After each run, patients will be debriefed about their strategy. Before the first and after the final fMRI-NF run we will also acquire a resting state scan to determine any connectivity changes in the patients* brain.

Study burden and risks

The overall time commitment (excluding travel) will be appr. 2.5 hours. Patients will be compensated for their time (10¤ / hour) and travel costs. Expected benefits are creation of a feeling of control as well as an interesting methodological paradigm. There are no known safety issues arising from fMRI-neurofeedback over and above general MRI safety requirements (for which strict guidelines implemented at Scannexus will be followed). The risk of adverse effects of the fMRI-neurofeedback procedure on patients* wellbeing is minimal and will be monitored through debriefing.

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

- Diagnosis of Parkinson*s disease according to MDS clinical diagnostic criteria (Postuma et al., 2015).
- Disease stage 1-3 according to the Hoehn and Yahr Scale

Exclusion criteria

- Exclusion criteria for MRI (e.g., cardiac pacemaker, certain metallic implants)
- History of psychotic disorder, bipolar disorder, or psychotic depression
- Current use of illegal drugs (any in the last four weeks)
- Current excessive alcohol consumption that interferes with daily functioning
- Advanced cognitive impairment (MoCA <24) or dementia

Study design

Design

Study type: Observational invasive

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

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	01-06-2023
Enrollment:	12
Type:	Actual

Ethics review

Approved WMO Date:	15-05-2023
Application type:	First submission
Review commission:	METC academisch ziekenhuis Maastricht/Universiteit Maastricht, METC azM/UM (Maastricht)

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	NL82024.068.22