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Functional imaging-based targeting of transcranial magnetic stimulation for treatment-resistant depression

Submission date	Recruitment status	[X] Prospectively registered
14/07/2023	No longer recruiting	[ ] Protocol
Registration date	**Overall study status**	[ ] Statistical analysis plan
14/08/2023	Ongoing	[ ] Results
Last Edited	**Condition category**	[ ] Individual participant data
22/01/2025	Mental and Behavioural Disorders	[ ] Record updated in last year

Plain English summary of protocol

Background and study aims
The symptoms of depression can vary, but the cardinal features are persistent low mood and/or inability to feel pleasure. Transcranial magnetic stimulation (TMS) is a noninvasive procedure that uses magnetic fields to stimulate nerve cells in the brain to improve symptoms of depression. TMS is typically used when other depression treatments haven't been effective. The present randomized study aims to test whether a new targeting method of repetitive transcranial magnetic stimulation (rTMS) improves outcomes in depression.

Who can participate?
Patients whose doctors have referred them to the Helsinki University Central Hospital for rTMS for major depressive disorder (MDD) are asked to participate.

What does the study involve?
The study involves a 2-hour visit to Aalto University Advanced Magnetic Imaging Centre for magnetic resonance imaging (MRI). This is followed by a 2-hour meeting with a psychiatrist including an interview and definition of dose and targets for the treatment. A nurse delivers the treatment to each side of the forehead. S/he or the patient does not know whether the targeting is based on individual brain imaging or on average measures. Treatment visits take about 30 min 3-5 times a week up to 25 visits.

What are the possible benefits and risks of participating?
Possible benefits of the study include improved outcomes of rTMS treatment. Risks include uncomfortable stimulation site sensations and mild tiredness after treatment.

Where is the study run from?
HYKS Psykiatriakeskus, Helsinki (Finland)

When is the study starting and how long is it expected to run for?
September 2022 to May 2026

Who is funding the study?
1. Academy of Finland (Research Council of Finland), Helsinki and Uusimaa Hospital District (Finland)
2. Finnish Cultural Foundation (Suomen Kulttuurirahasto) (Finland)
3. Jalmari and Rauha Ahokas Foundation (Jalmari ja Rauha Ahokkaan Säätiö) (Finland)

Who is the main contact?
Dr Tuukka Raij, tuukka.raij@hus.fi

Contact information

Type(s)
Principal investigator

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Additional identifiers

Protocol serial number
HUS/12135/2022

Study information

Scientific Title
Comparison of Helsinki individual targeting and regular targeting in TMS treatment of depression

Acronym
HIT2

Study objectives
Functional imaging-based targeting results in better outcome than regular scalp measure-based targeting

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 31/05/2023, HUS regional medical research ethics committee (HUS Keskuskirjaamo, Helsinki, PO Box 200, Finland; +358403594618; eettiset.toimikunnat@hus.fi), ref: HUS/12135/2022

Study design
Interventional double-blind randomized controlled trial

Primary study design
Interventional

Study type(s)
Efficacy

Health condition(s) or problem(s) studied
Major depressive disorder, resistant to at least two antidepressants

Interventions
Current interventions as of 22/01/2025:
Targeting is alternated every 5th treatment session between:
1. Targeting based on group average of functional imaging
2. Targeting based on individual functional imaging
The order of the targeting is randomized 1:1 according to a list for randomization. The patient and the research nurse who delivers treatment are blind to the treatment arm. Repetitive theta burst stimulation is delivered at 120% (or the nearest tolerated intensity) of the motor threshold up to five times a week for a total of 25 treatment visits.

Previous interventions:
Targeting is alternated every 5th treatment session between:
1. Regular targeting method based on scalp metrics
2. Individual targeting based on functional imaging
The order of the targeting is randomized 1:1 according to a list for randomization. The patient and the research nurse who delivers treatment are blind to the treatment arm. Repetitive theta burst stimulation is delivered at 110% (or the nearest tolerated intensity) of the motor threshold up to five times a week for a total of 25 treatment visits.

Intervention Type
Device

Phase
Not Applicable

Drug/device/biological/vaccine name(s)
Transcranial magnetic stimulation

Primary outcome(s)
Depressive symptoms measured using the Beck's Depression Inventory-21 (BDI) at baseline, before 6th, 11th, 16th, and 21th and after 25th treatment visit

Key secondary outcome(s))

Depressive symptom reduction measured using a subjective Visual Analogue Scale (VAS) at baseline, before 6th, 11th, 16th, 21th and after 25th treatment visit

Completion date
31/05/2026

Eligibility

Key inclusion criteria
1. Diagnosis of major depressive disorder (DSM-IV) as the principal diagnosis
2. Patient Health Questionnaire-9 score >14
3. Inability to tolerate antidepressant medication or unresponsiveness to minimum of two trials of more than 60 days with adequate dose of antidepressant
4. No change in antidepressive medication within four weeks prior to treatment

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 years

Upper age limit
67 years

Sex
All

Key exclusion criteria
1. Previous rTMS treatment
2. Borderline personality features exceeding 7 points in McLean Screening Instrument for Borderline Personality Disorder, or other somatic or psychiatric conditions that likely interfere with recovery from depression with TMS (an unstable severe medical illness, substantial neurological illness, chronic pain, psychotic disorder or current psychotic symptoms, substance abuse or dependency within last 3 months, >2 mg lorazepine equivalents benzodiazepine use daily or any anticonvulsant, or lifetime history of non-response to an adequate course—ie, a minimum of eight treatments—of electroconvulsive therapy)
3. Safety risks including active suicidality, pregnancy, magnetic metal or leads in the upper body, or history of seizures

Date of first enrolment
01/02/2025

Date of final enrolment

31/12/2025

Locations

Countries of recruitment
Finland

Study participating centre
HYKS Psykiatriakeskus
Välskärinkatu 12
Helsinki
Finland
PL590, 00029 HUS

Sponsor information

Organisation
Hospital District of Helsinki and Uusimaa

ROR
https://ror.org/020cpqb94

Funder(s)

Funder type
University/education

Funder Name
Academy of Finland

Alternative Name(s)
Academy of Finland, Suomen Akatemia, Finlands Akademi, AKA

Funding Body Type
Government organisation

Funding Body Subtype
Research institutes and centers

Location
Finland

Funder Name
Suomen Kulttuurirahasto

Alternative Name(s)
Finnish Cultural Foundation, SKR

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

Location
Finland

Funder Name
Jalmari ja Rauha Ahokkaan Säätiö

Alternative Name(s)
Jalmari and Rauha Ahokas Foundation

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

Location
Finland

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated during and/or analysed during the current study are not expected to be made publicly available due to the need to protect privacy of the participants. New researchers may however join the research group and use the data for scientific purposes.

IPD sharing plan summary
Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	version 3 version 4	19/05/2023	11/08/2023	No	Yes

Participant information sheet	Study website	17/12/2024	22/01/2025	No	Yes
Study website		11/11/2025	11/11/2025	No	Yes