Clinical Trial Protocol
Iranian Registry of Clinical Trials

17 Sep 2026

Efficacy of transcranial direct and alternating stimulation of the prefrontal cortex on cognitive functions and symptoms in schizophrenic patients: A double-blind randomized clinical trial with the control group

Protocol summary

Study aim
Evaluation of direct and alternating electrical stimulation of brain on cognitive functions and symptoms in people with schizophrenia

Design
A double-blind, randomized clinical trial with a control group on 114 patients. Random allocation software will be used for randomization.

Settings and conduct
In the first phase, 54 eligible patients with schizophrenia will be randomly assigned into two groups of 27 and in the second phase, another 60 patients will be randomly assigned into three groups of 20. This clinical trial is double-blind and the patient and the outcome assessor are not aware of the type of intervention. The study site will be Fatemi Hospital in Ardabil.

Participants/Inclusion and exclusion criteria
Inclusion: Diagnosis of schizophrenia based on DSM V, Being 18-50 years old, Required written informed consent signed by patients' guardian, Exclusion: Pregnancy, The existence of metal implants in the body, History of neurological diseases

Intervention groups
In the first phase, patients will be randomly assigned into two groups. The first group will receive three conditions of tDCS (2 mA, 3 mA, and sham) and the second group will receive three conditions of tACS (8 Hz, 40 Hz, and sham) in three sessions of 20 minutes with an interval of three days. the anodic electrode is placed over the F3 and the cathode electrode is placed over the right shoulder. In the second phase, another 60 patients will be randomly assigned into three groups with active tDCS, active tACS, and sham, and by the results of the first phase, the stimulation will be performed for 10 consecutive days in two sessions of 20 minutes per day, with an interval of 20 minutes. Sham stimulation is as same as active stimulation, except that there will be no current and the device will turn off after one minute.

Main outcome variables
cognitive functions؛ Symptoms of schizophrenia

General information

Reason for update

Acronym

IRCT registration information
IRCT registration number: **IRCT20210622051675N1**
Registration date: **2021-08-30, 1400/06/08**
Registration timing: **prospective**

Last update: **2021-08-30, 1400/06/08**
Update count: **0**

Registration date
2021-08-30, 1400/06/08

Registrant information

Name
Samaneh Aziziaram

Name of organization / entity

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Iran (Islamic Republic of)

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Recruitment status
Recruitment complete

Funding source

Expected recruitment start date
2021-09-06, 1400/06/15

Expected recruitment end date
2022-03-21, 1401/01/01

Actual recruitment start date
empty

Actual recruitment end date
empty
Trial completion date
empty

Scientific title
Efficacy of transcranial direct and alternating stimulation of the prefrontal cortex on cognitive functions and symptoms in schizophrenic patients: A double-blind randomized clinical trial with the control group

Public title
Direct and alternating electrical stimulation of the brain in schizophrenia disorder
Purpose
Treatment
Inclusion/Exclusion criteria
Inclusion criteria:
Diagnosis of schizophrenia based on DSM V Being 18-50 years old Required written informed consent signed by patients' guardian
Exclusion criteria:
History of neurological diseases such as seizures, strokes, or cerebrovascular diseases The existence of metal implants in the body Pregnancy
Age
From **18 years** old to **50 years** old
Gender
Both

Phase
N/A
Groups that have been masked

- Participant
- Outcome assessor
- Data analyser

Sample size
Target sample size: **114**
Randomization (investigator's opinion)
Randomized
Randomization description
In this study, we will use the Restricted Randomization method of block randomization and in each phase, we will have 6 blocks. Generation of random sequences via the blocking method will be done by Random Allocation software. To conceal, we use Allocation Concealment, which refers to the method used to perform a random sequence on study participants, so that the assigned group is not identified before the individual is assigned. Also, non-transparent envelopes sealed with random sequences will be used, that in this method each random sequence is recorded on a card and the cards are placed in the envelope in order. In order to maintain a random sequence, the envelopes are numbered in the same way on the outer surface. Finally, the lids of the envelopes are glued and placed inside a box, respectively. At the beginning of the registration, according to the order of entry of the eligible participants, one of the envelopes will be opened in order and the assigned group of the participant will be revealed.
Blinding (investigator's opinion)
Double blinded
Blinding description
The executive specialist of electrical brain stimulation will be aware of the research topic and will perform therapeutic interventions. He codes the patients and refers them to a psychologist to check the patient's mental state and record the relevant criteria based on the same code. The patients will be tested in the same condition in the Neurotherapy room and the electrodes of the device will be connected to them, but they will not be aware of the type of stimulation. The experimenter who assesses outcome measures will be independent from the one who applied intervention and will be blind to stimulation condition. This method of double-blinding is based on previous works in the field of transcranial electrical stimulation (Gandinga et al., 2006). Accordingly, this study will be a double-blind study.
Placebo
Used
Assignment
Parallel
Other design features
This design has two phases. In the phase 1 there are 2 groups and each receive 3 interventions (including a placebo condition) in a crossover design. Phase two includes 3 groups each of which receives one intervention in a parallel group design

Secondary Ids

empty

Ethics committees

1

Ethics committee
Name of ethics committee
Ethics Committee of Ardabil University of Medical Sciences
Street address
End of University Street, Ardabil University of Medical Sciences
City
Ardabil
Province
Ardabil
Postal code
56189-85991
Approval date
2021-03-01, 1399/12/11
Ethics committee reference number
IR.ARUMS.REC.1400.043

Health conditions studied

1

Description of health condition studied
schizophrenia
ICD-10 code
F20
ICD-10 code description

Schizophrenia

Primary outcomes

1

Description
Executive function
Timepoint
In the first phase, each session during stimulation, and in the second phase, at the beginning of the study, 10, 30 and 90 days after the intervention
Method of measurement
Cambridge Neuropsychological Test Automated Battery (CANTAB)

2

Description
Working memory
Timepoint
In the first phase, each session during stimulation, and in the second phase, at the beginning of the study, 10, 30, and 90 days after the intervention
Method of measurement
Cambridge Neuropsychological Test Automated Battery (CANTAB)

3

Description
Emotional recognition
Timepoint
In the first phase, each session during stimulation, and in the second phase, at the beginning of the study, 10, 30, and 90 days after the intervention
Method of measurement
Cambridge Neuropsychological Test Automated Battery (CANTAB)

4

Description
Cognitive flexibility
Timepoint
In the first phase, each session during stimulation, and in the second phase, at the beginning of the study, 10, 30, and 90 days after the intervention
Method of measurement
Cambridge Neuropsychological Test Automated Battery (CANTAB)

5

Description
Severity of schizophrenia
Timepoint
In the second phase, at the beginning of the study, 10, 30, and 90 days after the intervention
Method of measurement
Positive and Negative Syndrome Scale (PANSS)

6

Description
Depression
Timepoint
In the second phase, at the beginning of the study, 10, 30, and 90 days after the intervention
Method of measurement
Beck Depression Inventory-II (BDI-II)

7

Description
Negative and positive affection
Timepoint
In the first phase, before and after each session
Method of measurement
Positive and Negative Affect Scale (PANAS)

8

Description
Psychotic symptoms
Timepoint
In the second phase, at the beginning of the study, 10, 30, and 90 days after the intervention
Method of measurement
Psychotic Symptom Rating Scales

Secondary outcomes

empty

Intervention groups

1

Description
First intervention group: Three conditions of tDCS (2 mA, 3 mA, and sham) are applied using an anodic electrode over the F3 and cathode electrode over the right shoulder, crosswise, in three sessions, each session for 20 minutes with an interval of three days.
Category
Treatment - Devices

2

Description
Second intervention group: Three tACS conditions (8 Hz, 40 Hz, and sham) are applied using an anodic electrode over the F3 and cathode electrode over the right shoulder, crosswise, in three sessions, each for 20 minutes with an interval of three days.
Category
Treatment - Devices

3

Description
Third intervention group: According to the results of the first phase, transcranial electrical stimulation is applied for 10 consecutive days, with direct electric current, in

two twenty-minute sessions per day, with an interval of 20 minutes.

Category

Treatment - Devices

4

Description

Fourth intervention group: According to the results of the first phase, transcranial electrical stimulation is applied for 10 consecutive days, with alternating current, in two sessions of twenty minutes per day, with an interval of 20 minutes.

Category

Treatment - Devices

5

Description

Control group: In this group, participants receive sham electrical stimulation with the same actual stimulation protocol for 10 days, while the current generator increases the current to 2 mA in 30 seconds, and then gradually over a period of 30 seconds, the current reaches zero.

Category

Placebo

Recruitment centers

1

Recruitment center

Name of recruitment center

Department of Psychiatry, Fatemi Hospital

Full name of responsible person

Dr. Anita Azarkolah

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Sponsors / Funding sources

1

Sponsor

Name of organization / entity

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Full name of responsible person

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Grant name

Grant code / Reference number

Is the source of funding the same sponsor organization/entity?

No

Title of funding source

Ardabil University of Medical Sciences

Proportion provided by this source

100

Public or private sector

Public

Domestic or foreign origin

Domestic

Category of foreign source of funding

empty

Country of origin

Type of organization providing the funding

Academic

Person responsible for general inquiries

Contact

Name of organization / entity

Ardabil University of Medical Sciences

Full name of responsible person

Anita Azarkolah

Position

Assistant Professor

Latest degree

Specialist

Other areas of specialty/work

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Sharing plan

Deidentified Individual Participant Data Set (IPD)
No - There is not a plan to make this available
Justification/reason for indecision/not sharing IPD
Due to the confidentiality of the participant's personal characteristics
Study Protocol
Yes - There is a plan to make this available
Statistical Analysis Plan
Yes - There is a plan to make this available
Informed Consent Form
Yes - There is a plan to make this available
Clinical Study Report
Yes - There is a plan to make this available
Analytic Code
Yes - There is a plan to make this available
Data Dictionary
No - There is not a plan to make this available
Title and more details about the data/document
All collected data for the primary outcome measures only after anonymizing
When the data will become available and for how long
Starting 12 months after publication
To whom data/document is available
Researchers working in academic and scientific institutions
Under which criteria data/document could be used
To raise the level of knowledge about the treatment of schizophrenia
From where data/document is obtainable
Raw data and documents generated for this study are available from the corresponding authors and institution on reasonable request.
What processes are involved for a request to access data/document
A formal request from person/institutions should be sent to the corresponding authers and corresponding institutions via email (for international users) and mail (for national users).
Comments