

Clinical Trial Protocol

Iranian Registry of Clinical Trials

01 Jul 2026

Comparison of the effectiveness of transcranial electrical stimulation of the cerebellum, parietal, anterior cingulate and primary motor cortex on adaptation to postural perturbations in healthy adults: Linear and nonlinear approaches

Protocol summary

Study aim

Comparison of the effectiveness of transcranial electrical stimulation of the cerebellum, parietal, anterior cingulate and primary motor cortex on adaptation to postural perturbations in healthy adults: Linear and nonlinear approaches

Design

A randomized, double-blinded, sham-controlled clinical trial with a parallel group design of 75 participants. For randomization, the "randomization.com" website algorithm will be used.

Settings and conduct

The study will be conducted in the rehabilitation school of TUMS. The participants will randomly be distributed to any of the intervention or control groups. After getting baseline information on the central pressure with a force plate, the participant will receive the transcranial direct current stimulation. After that, the measurer who is blind to the participant group will measure their response to perturbation (Achill vibration) with a force plate.

Participants/Inclusion and exclusion criteria

Not having a history of epilepsy Not having pacemaker
Not having skin infection Not having metal or implant in head
Not having sensory disorder Not having wound or scratch on the scalp
Not having cognitive disorder (Mini-Mental State Exam (MMSE) score more than or equal to 24)
Not having any history of severe neurologic or musculoskeletal disorders based on the participant's claim
Age: 18-40 Healthy people

Intervention groups

Intervention groups of this study will receive high-definition transcranial direct current stimulation over the cerebellum, primary motor cortex, posterior parietal cortex, and anterior cingulate cortex. The sham control group will receive the stimulation in a randomly selected montage.

Main outcome variables

The standard deviation of the displacement, the amplitude of displacement, the length of displacement, the Lyapunov exponent, the approximate entropy, and the correlation dimension of the center of pressure.

General information

Reason for update

Acronym

IRCT registration information

IRCT registration number: **IRCT20220819055745N1**

Registration date: **2022-11-15, 1401/08/24**

Registration timing: **prospective**

Last update: **2022-11-15, 1401/08/24**

Update count: **0**

Registration date

2022-11-15, 1401/08/24

Registrant information

Name

Nastaran bahadorani

Name of organization / entity

Country

Iran (Islamic Republic of)

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+98 21 6694 5185

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nbahadorani@razi.tums.ac.ir

Recruitment status

Recruitment complete

Funding source

Expected recruitment start date

2022-11-22, 1401/09/01

Expected recruitment end date

2023-01-21, 1401/11/01

Actual recruitment start date

empty

Actual recruitment end date

empty

Trial completion date

empty

Scientific title

Comparison of the effectiveness of transcranial electrical stimulation of the cerebellum, parietal, anterior cingulate and primary motor cortex on adaptation to postural perturbations in healthy adults: Linear and nonlinear approaches

Public title

Effect of transcranial direct current stimulation of different brain areas on postural adaptation

Purpose

Treatment

Inclusion/Exclusion criteria**Inclusion criteria:**

Healthy people Age 18-40 No history of sever neurologic or musculoskeletal disorders based on the participant's clam Not having cognitive disorder (Mini-Mental State Exam (MMSE) ≥ 24) No wound or scratch on the scalp No sensory disorder No metal or implant in head No skin infection No pacemaker No history of epilepsy

Exclusion criteria:

Taking any medication that influence balance, neural system or brain. Heavy bodily exertion before experiment Not willing to continue the study

Age

From **18 years** old to **40 years** old

Gender

Both

Phase

3

Groups that have been masked

- Participant
- Outcome assessor

Sample size

Target sample size: **75**

Randomization (investigator's opinion)

Randomized

Randomization description

Permuted Block Randomization method from the website randomization.com will be used for allocating participants to different groups. The size of each block will be 10. A secretary will announce the participant group via a sealed envelope for allocation concealment.

Blinding (investigator's opinion)

Double blinded

Blinding description

To blind participants, there will be a sham control group. To blind the assessor, the therapist that will set the device for stimulation will be different from the therapist who will assess and collect data.

Placebo

Not used

Assignment

Parallel

Other design features**Secondary Ids**

empty

Ethics committees**1****Ethics committee****Name of ethics committee**

Research ethics committees of school of nursing and midwifery and rehabilitation of Tehran universit

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Tehran university of medical science school of rehabilitation, Enghelab street

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6511111489

Approval date

2022-08-17, 1401/05/26

Ethics committee reference number

IR.TUMS.FNM.REC.1401.066

Health conditions studied**1****Description of health condition studied**

Postural adaptation

ICD-10 code**ICD-10 code description****Primary outcomes****1****Description**

Standard Deviation of Center of Pressure Displacement: This parameter comes from the second root of the sum of the square of the distance of each center of pressure from the average center of pressure divided by the number of the center of pressure in the anterior-posterior and lateral axis. The scale is in millimeter.

Timepoint

Before and after the intervention

Method of measurement

Force Plate

2**Description**

Range of Center of Pressure Displacement: The difference between the maximum and minimum center of pressure displacement in the anterior-posterior and lateral axis. The scale is in millimeters.

Timepoint

Before and after the intervention

Method of measurement

Force Plate

3

Description

Path Length of Center of Pressure Displacement: This parameter comes from the summation of the distance of every center of pressure point from the consecutive point in the anterior-posterior and lateral axis. The scale is in millimeters.

Timepoint

Before and after the intervention

Method of measurement

Force Plate

4

Description

Lyapunov Exponent: Lyapunov Exponent is used to define the system chaos. When consecutive points diverge (divergence) the system will become chaotic, which can be quantified by Lyapunov Exponent.

Timepoint

Before and after the intervention

Method of measurement

To calculate, the Rosenstein algorithm will be used in Chaos Data Analyzer Software.

5

Description

Approximate Entropy: Approximate Entropy is a scale for showing the complexity, regularity, and predictability of the center of pressure time series. In another word, Entropy gives a probability of the existence of a repeatable pattern with the length of m , the similarity of r , and delay of T .

Timepoint

Before and after the intervention

Method of measurement

To calculate, the Pincus algorithm will be used in Matlab Software.

6

Description

Correlation Dimension: Correlation Dimension is a scale that shows degrees of freedom or the dimensions of the time series of the center of pressure.

Timepoint

Before and after the intervention

Method of measurement

To calculate, the Grassberger and Procaccia algorithm will be used in Chaos Data Analyzer Software.

Secondary outcomes

empty

Intervention groups

1

Description

First intervention group: This group will receive Transcranial Direct Current Stimulation on posterior parietal cortex by Star Stim device. The amplitude will be 1 milliampere and the duration of stimulation will be 20 minutes.

Category

Rehabilitation

2

Description

Second intervention group: This group will receive Transcranial Direct Current Stimulation on cerebellum by Star Stim device. The amplitude will be 1 milliampere and the duration of stimulation will be 20 minutes.

Category

Rehabilitation

3

Description

Third intervention group: This group will receive Transcranial Direct Current Stimulation on primary motor cortex by Star Stim device. The amplitude will be 1 milliampere and the duration of stimulation will be 20 minutes.

Category

Rehabilitation

4

Description

Forth intervention group: This group will receive Transcranial Direct Current Stimulation on anterior cingulate cortex by Star Stim device. The amplitude will be 1 milliampere and the duration of stimulation will be 20 minutes.

Category

Rehabilitation

5

Description

Sham control group: Second intervention group: This group will receive Transcranial Direct Current Stimulation on any random cite from the intervention groups by Star Stim device. The amplitude will be 1 milliampere and will stop after ramp-up. The ramp-up time is 10 seconds.

Category

Rehabilitation

Recruitment centers

1

Recruitment center

Name of recruitment center

Tehran university of medical science rehabilitation

school

Full name of responsible person

Nastaran Bahadorani

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Sponsors / Funding sources

1

Sponsor

Name of organization / entity

Tehran University of Medical Sciences

Full name of responsible person

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6th floor of Research and Technology Vice-Chancellor,
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Grant name

Grant code / Reference number

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

Yes

Title of funding source

Tehran 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

Tehran University of Medical Sciences

Full name of responsible person

Nastaran Bahadorani

Position

MSc student

Latest degree

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Other areas of specialty/work

Physiotherapy

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Person responsible for updating data

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Sharing plan**Deidentified Individual Participant Data Set (IPD)**

Undecided - It is not yet known if there will be a plan to make this available

Study Protocol

Undecided - It is not yet known if there will be a plan to make this available

Statistical Analysis Plan

Undecided - It is not yet known if there will be a plan to make this available

Informed Consent Form

Undecided - It is not yet known if there will be a plan to make this available

Clinical Study Report

Undecided - It is not yet known if there will be a plan to make this available

Analytic Code

Undecided - It is not yet known if there will be a plan to make this available

Data Dictionary

Undecided - It is not yet known if there will be a plan to make this available