Clinical Trial Protocol
Iranian Registry of Clinical Trials

22 Nov 2026

Investigation of the Effects of Transcranial Direct Current Stimulation on Athletic Performance: A Comparison Between Primary Motor Cortex and Dorsolateral Prefrontal Cortex

Protocol summary

Study aim
Determining the effect of transcranial direct current stimulation on the motor cortex compared to the dorsolateral prefrontal cortex on athlete performance

Design
The clinical trial has a single group crossover, double-blind, and randomized design on 17 subjects. The rand function of Excel software was used for randomization.

Settings and conduct
In the first session, participants' age, height, weight, body mass index, duration of exercise experience, and average daily and weekly exercise time will be recorded. After a 10-minute warm-up, the 1-RM will be measured using a knee extension machine. In sessions 2 to 4 (intervention sessions), following warm-up and measurement of maximum voluntary contraction (MVC) using a dynamometer, tDCS stimulation will be randomly applied—either real stimulation over the primary motor cortex or the dorsolateral prefrontal cortex, or sham stimulation. MVC will then be measured again. Participants will then be asked to repeat lifting a weight equal to 30–40% of their 1-RM until failure. The number of completed repetitions will be recorded as muscular endurance. Finally, perceived exertion will be assessed using the Borg RPE 6–20 scale. Both participants and assessors will be blinded to the type of intervention, making this a double-blind study.

Participants/Inclusion and exclusion criteria
Inclusion criteria: Men aged 18 to 30 with at least 6 months of resistance training experience and right-dominant leg. Exclusion criteria: Musculoskeletal disorders in the lower extremities, steroid hormone injections in the past 3 years, and creatine supplementation in the past 1 month.

Intervention groups
Motor cortex stimulation؛ dorsolateral prefrontal cortex stimulation؛ non-realistic stimulation

Main outcome variables
Rate of perceived exertion; maximum voluntary contraction; muscular endurance

General information

Reason for update

Acronym

IRCT registration information
IRCT registration number: **IRCT20250430065545N1**
Registration date: **2025-08-14, 1404/05/23**
Registration timing: **registered_while_recruiting**

Last update: **2025-08-14, 1404/05/23**
Update count: **0**

Registration date
2025-08-14, 1404/05/23

Registrant information

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Recruitment status
Recruitment complete

Funding source

Expected recruitment start date
2025-05-22, 1404/03/01

Expected recruitment end date
2025-11-22, 1404/09/01

Actual recruitment start date
empty

Actual recruitment end date
empty
Trial completion date
empty

Scientific title
Investigation of the Effects of Transcranial Direct Current Stimulation on Athletic Performance: A Comparison Between Primary Motor Cortex and Dorsolateral Prefrontal Cortex

Public title
Effects of Transcranial Direct Current Stimulation on Athletic Performance
Purpose
Other
Inclusion/Exclusion criteria
Inclusion criteria:
At least 6 months of experience in resistance training Right feet dominant
Exclusion criteria:
History of musculoskeletal injury in lumbar, hip, or knee Use of hormonal injection such as steroids in the last 3 months Use of creatine supplement in the last 1 month
Age
From **18 years** old to **30 years** old
Gender
Male

Phase
N/A
Groups that have been masked

- Participant
- Outcome assessor

Sample size
Target sample size: **17**
Randomization (investigator's opinion)
N/A
Randomization description
Blinding (investigator's opinion)
Double blinded
Blinding description
Participant: On one of the intervention days, transcranial direct current stimulation is applied in a non-realistic manner and the participant is unaware of the method of application of the stimulation. Evaluator: The person evaluating the consequences of the intervention is unaware of the type and location of transcranial direct current stimulation applied to the subjects.
Placebo
Used
Assignment
Crossover
Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee
Name of ethics committee
Ethics committee of isfahan University of Medical Sciences
Street address
Unit 3, Mah Complex, Pega Alley, Khwarizmi 1st Street, Ghadir Boulevard, Sepahan Shahr, Isfahan
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Approval date
2025-04-30, 1404/02/10
Ethics committee reference number
IR.MUI.REC.1404.006

Health conditions studied

1

Description of health condition studied
Strength, muscular endurance, and perceived exertion in strength athletes
ICD-10 code
ICD-10 code description

Primary outcomes

1

Description
Maximum Voluntary Contraction (MVC): Maximum isometric force produced by the quadriceps femoris muscle. Muscular Endurance: Maximum number of correct repetitions of knee extension exercise with a specific load (30-40% of 1-RM) until complete exhaustion. Rate of Perceived Exertion (RPE): Subjective assessment of an individual's perceived level of difficulty and strain associated with the physical activity performed.
Timepoint
Before and immediately after each intervention session (anodal tDCS over M1, anodal tDCS over DLPFC, and sham tDCS).
Method of measurement
Maximum Voluntary Contraction (MVC): Using a handheld dynamometer, while the subject is seated on a knee extension machine with the knee flexed at a 90-degree angle. The subject is instructed to extend the knee with maximal effort for 5 seconds. This process is repeated 3 times with a one-minute rest interval, and the highest value is recorded.Muscular Endurance: Using a leg extension machine. Subjects are asked to lift a weight equivalent to 30-40% of their 1-RM until they can no longer perform additional repetitions. The number of completed repetitions is recorded.Rate of Perceived Exertion (RPE): Using the Borg's RPE scale (ranging from 6 to 20), reported by the subject after the muscular

endurance test.

Secondary outcomes

empty

Intervention groups

1

Description

Intervention Group 1: Primary Motor Cortex (M1) Stimulation:Anodal transcranial direct current stimulation (tDCS) over the primary motor cortex (M1).Stimulation parameters: Current intensity of 2 mA for 20 minutes. The anode electrode will be placed over the M1 region (according to the 10-20 EEG system), and the cathode (return) electrode will be placed over the contralateral supraorbital region.Intervention Group 2: Dorsolateral Prefrontal Cortex (DLPFC) Stimulation:Anodal transcranial direct current stimulation (tDCS) over the dorsolateral prefrontal cortex (DLPFC).Stimulation parameters: Current intensity of 2 mA for 20 minutes. The anode electrode will be placed over the DLPFC region, and the cathode (return) electrode will be placed over the contralateral supraorbital region.Intervention Group 3: Sham Stimulation:Sham transcranial direct current stimulation (tDCS).Stimulation parameters: Electrode placement will be similar to one of the active conditions (e.g., M1 or DLPFC, randomly). The current will be applied for a short duration (30 seconds) and then turned off, while the device remains on, to allow the participant to experience the initial sensation of stimulation; however, active stimulation will not continue throughout the 20-minute duration.This study is a randomized, double-blind, crossover clinical trial. Each participant will receive all three intervention conditions (M1 stimulation, DLPFC stimulation, and Sham stimulation) in separate sessions and in a randomized order. A washout period of 2 days will be observed between each intervention session.

Category

Rehabilitation

Recruitment centers

1

Recruitment center

Name of recruitment center
Rhino Sport Club

Full name of responsible person
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Sponsors / Funding sources

1

Sponsor

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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
Esfahan 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
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MSc Student

Latest degree
Bachelor

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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
Yes - There is 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
No - There is not a plan to make this available

Clinical Study Report
Yes - There is 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

Title and more details about the data/document
The complete study protocol (research proposal) including objectives, methodology, inclusion/exclusion criteria, interventions, outcome measures, and statistical methods also The final clinical study report including the main results and findings of the research, which will be published as scientific article(s) in peer-reviewed journals, as well as the final project report submitted to the university.

When the data will become available and for how long
For Study Protocol: From the time of final registration of the trial with the Iranian Registry of Clinical Trials (IRCT), throughout the study duration, and permanently after study completion. For Clinical Study Report: After publication of the article in scientific journals and submission of the final report to the university.

To whom data/document is available
For Study Protocol: Researchers, students, and other individuals interested in the study topic. For Clinical Study Report: The scientific community, researchers, students and the general public.

Under which criteria data/document could be used
For Study Protocol: For research, educational purposes, and to understand the methodological details of the study. Use of content is permitted with appropriate citation. For Clinical Study Report: For scientific, research, educational, and informational purposes. Use of results for systematic reviews and meta-analyses is permitted with appropriate citation.

From where data/document is obtainable
For Study Protocol: Through the Iranian Registry of Clinical Trials (IRCT) website (after final registration) or by contacting the principal investigator (Dr. Navid Taheri, email: n_taheri@rehab.mui.ac.ir). For Clinical Study Report:Through scientific journal databases (after

publication) or by contacting the principal investigator.

What processes are involved for a request to access data/document

For Study Protocol (if requested directly): Requests will be sent via email to the principal investigator. After review, the protocol will be provided to the requester.

For Clinical Study Report (if requested directly before public release): Requests will be sent via email to the principal investigator. Once the report/article is prepared and before public release, the request can be considered.

Comments