AIMS Neuroscience

AIMS Neuroscience, 12(3): 312–331.
DOI: 10.3934/Neuroscience.2025017
Received: 17 May 2025
Revised: 30 June 2025
Accepted: 09 July 2025
Published: 21 July 2025

https://www.aimspress.com/journal/neuroscience

Research article

Active and sham transcranial direct-current stimulation (tDCS) plus core stability on the knee kinematic and performance of the lower limb of the soccer players with dynamic knee valgus; two armed randomized clinical trial

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Supplementary

Table 1. CONSORT 2010 Checklist.

Section/Topic	Item No	Checklist item	Reported on page/section
Title and Abstract	1a	Identification as a randomised trial in the title	Title: Explicitly states "two armed randomized clinical trial" (Introduction, first line).
	1b	Structured summary of trial design, methods, results, and conclusions	Abstract
Introduction	2a	Scientific background and explanation of rationale	Introduction: Describes ACL injuries, dynamic knee valgus (DKV), tDCS, and core stability training as interventions, with supporting references [1–36].
	2b	Specific objectives or hypotheses	Last paragraph Introduction
Methods	3a	Description of trial design (such as parallel, factorial) including allocation ratio	Methods (Study Design): This study is a two-armed, double-blind, parallel-group RCT with a 1:1 allocation ratio (42 participants, 21 per group).
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	Not applicable
	4a	Eligibility criteria for participants	Methods (Participants, Table 1)
	4b	Settings and locations where the data were collected	Methods (Procedures): Recruitment from Sari Soccer Board, with assessments conducted at a sports facility in Sari, Iran.
	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	Methods (Interventions): Describes active tDCS (2 mA, 15 min, anode at $C_{3,4}$, cathode at FP1) and sham tDCS (30 s ramp-up/down), followed by core stability training (30 min, 3x/week, 8 weeks). Table 2 details exercise progression.
	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	Methods (Primary and Secondary Outcomes): Primary outcome: FPPA during single-leg landing (SLL) task, assessed via 2D video analysis at baseline and post-intervention. Secondary outcomes: Vertical jump height and 8-hop test time, with detailed assessment protocols.
	6b	Any changes to trial outcomes after the trial commenced, with reasons	Not applicable

7a	How sample size was determined	Methods (Sample Size Determination): Calculated using G*Power, expecting a large effect size (Cohen's d = 0.80), α = 0.05, power = 80%, resulting in 21 participants per group (N = 42).
7b	When applicable, explanation of any interim analyses and stopping guidelines	Not applicable
8a	Method used to generate the random allocation sequence	Methods (Randomization): Random Number Generator (RNG) implemented in Excel.
8b	Type of randomisation; details of any restriction (such as blocking and block size)	Methods (Randomization): Simple randomization was used without restrictions.
9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	Methods (Randomization): Allocation was concealed using sealed, opaque envelopes prepared by an independent researcher, opened only after baseline assessments.
10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	Methods (Randomization): An independent statistician generated the allocation sequence, an orthopedic specialist enrolled participants, and a physiotherapist assigned interventions.
11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	Methods (Study Design): Double-blind trial, with participants and researchers unaware of group assignments. Outcome assessors were blinded by coding video data and anonymizing participant identities during analysis.
11b	If relevant, description of the similarity of interventions	Methods (Interventions): Sham tDCS mimicked real tDCS with 30 s ramp-up/down to ensure similar tactile sensations, ensuring blinding.
12a	Statistical methods used to compare groups for primary and secondary outcomes	Methods (Statistical Analysis): Describes 2×2 mixed-model ANOVA (group × time) with Bonferroni-corrected post hoc tests, reporting mean ± SD, percentage change, and partial eta squared (ηp^2).
12b	Methods for additional	Not applicable

		analyses, such as subgroup analyses and adjusted analyses	
Results	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	Results: 42 participants randomized (21 per group), all received intended treatment and were analyzed for primary outcome (no exclusions).
	13b	For each group, losses and exclusions after randomisation, together with reasons	Results: No losses or exclusions reported.
	14a	Dates defining the periods of recruitment and follow-up	Results
	14b	Why the trial ended or was stopped	Not applicable; trial completed as planned.
	15	A table showing baseline demographic and clinical characteristics for each group	Results (Table 3): Reports baseline characteristics (age, height, weight, BMI, soccer experience) with p-values showing no significant differences.
	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	Results: All 42 participants (21 per group) included in analyses, conducted per original group assignments (intention-to-treat).
	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	Results (Table 4, Chart 1): Reports pre- and post-test means ± SD, percentage change, p-values, and ηp^2 for FPPA, vertical jump, and 8-hop test. 95% CIs for effect sizes added in Table 4.
	17b	For binary outcomes, presentation of both absolute and relative effect sizes	Not applicable
	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing	Not applicable

		pre-specified from exploratory	
	19	All important harms or unintended effects in each group	Results: No adverse events reported; monitored by medical staff during tDCS and exercise sessions.
Discussion	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	Discussion (Limitations and Future Directions)
	21	Generalisability (external validity, applicability) of the trial findings	Discussion (Limitations and Future Directions)
	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	Discussion (Clinical and Practical Implications)
Other Information	23	Registration number and name of trial registry	Methods (Code of Ethics): UMIN Clinical Trials Registry, UMIN000057181, registered March 1, 2025.
	24	Where the full trial protocol can be accessed, if available	Methods (Clinical Trial Registration): Available at UMIN Clinical Trials Registry (https://center6.umin.ac.jp/cgi-open-bin/ctr_e/ctr_view.cgi?recptno=R000065363).
	25	Sources of funding and other support (such as supply of drugs), role of funders	This study was not funded by any institution