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Is occipital cortex neuromodulation with tDCS efficient for migraine prophylaxis? A meta-analysis of randomized controlled trials

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Introduction

Migraine is a neurological condition characterized by recurrent episodes of unilateral, pulsating pain, typically of moderate to severe intensity, being the second leading cause of disability worldwide, surpassed only by lower back pain, especially in young women. Transcranial direct current stimulation (tDCS) is considered an effective and well-tolerated non-pharmacological option for treating several neuropsychiatric diseases, with increasing evidence for management of migraines. In this context, the occipital cortex (visual cortex) has been used as a stimulation target for prophylactic treatment of migraine, with initial studies of efficacy for both excitatory and inhibitory stimulation protocols.

Objective

To investigate, through a systematic review and meta-analysis, the efficacy of tDCS targeting occipital cortex in patients for preventing migraines attacks.

Methods

Following PRISMA guidelines and PICO, a search was conducted in PubMed, Embase, Cochrane, Web of Science, PsycInfo, and Scopus databases using the descriptors "tDCS" and "Migraine" to identify studies investigating the effects of therapy in adults with migraine. Randomized controlled trials (RCTs) of migraine patients undergoing tDCS targeting the occipital cortex and reporting outcomes of frequency, intensity, duration, or medication use were included. Data screening was performed on the Rayyan platform by two independent authors, and data extraction was carried out using Excel by two other authors. Statistical analysis was performed using R software, and data were combined using the standardized mean difference (95% CI).

Results

A total of 2,600 records were imported from the databases. After removing duplicates, 1,160 records were screened, and 10 (N = 322) were included with an average follow-up of 80 days. A significant reduction was found in the number of migraine days (SMD -0.41; 95% CI: -0.72 to -0.10; p=0.0094; I2=24.4%), pain intensity (SMD -0.98; 95% CI: -1.87 to -0.09; p=0.0307; I2=84.4%), and pain duration (SMD -0.83; 95% CI: -1.40 to -0.27; p=0.0038; I2=60.9%). However, no significant difference was observed in abortive medication use (SMD -0.73; 95% CI: -1.47 to 0.01; p = 0.0519; I2=84.1%). Two studies reported reduction in migraine frequency after tDCS, and one study reported reduction in overall headache days.Combined stimulation of M1 and the occipital cortex resulted in reduced migraine parameters. Occipital stimulation does not demonstrate significant superiority over sham in reducing disability or improving patients' overall quality of life. No serious adverse events due to the stimulation were reported.

Conclusion

tDCS is effective in the treatment of prophylactic migraine in patients. Although no significant reduction in abortive medication use was observed, the favorable results in key clinical outcomes reinforce tDCS as a promising and safe non-pharmacological therapeutic alternative for migraine management.

Keywords:
Neuromodulation
Migraine
Headache
Noninvasive brain stimulation
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