

Chronic Hiccups Treatment by Transcranial Direct Current Stimulation

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Abstract

Chronic hiccups are often dismissed as a benign annoyance but can significantly impact an individual's quality of life and may be indicative of underlying neurological or psychological conditions. In our research, we aimed to explore the efficacy of non-invasive neuromodulation techniques, particularly transcranial direct current stimulation (tDCS), in improving symptoms of persistent hiccups.

Our study presents the case of a 77-year-old individual suffering from persistent hiccups for twelve months. Following the protocol outlined in Shiozawa., *et al.* [1], we administered anodal tDCS at 2 mA, with the anode over F3 and cathode over F4 for thirty minutes daily from Monday to Friday over a three-week period. Despite following Shiozawa., *et al.* [1] procedures, our results did not indicate a significant reduction in symptoms. During the intervention, the patient began a pharmacological treatment with Trankimazin (Alprazolam), which provided temporary relief from hiccups, but these returned when the patient experienced a situation with high emotional distress, suggesting a potential emotional component to the condition. This finding underscores the complex interplay between neurological and psychological factors in the manifestation of hiccups and highlights the need for a multimodal approach to its treatment. Our study contributes valuable insights into the potential of tDCS for neurological disorders and the integration of psychological interventions alongside neuromodulation techniques. We propose that future research should explore the combined effects of psychological therapy and tDCS in addressing conditions with both neurological and emotional components.

Keywords: Chronic Hiccups; Transcranial Direct Current Stimulation (tDCS); Persistent Hiccups; Generalized Anxiety Disorder 7-Item (GAD-7)

Introduction

Hiccup is a repeated involuntary inspiration with a spasmodic and temporary contraction of the diaphragm, accompanied by a sudden closure of the glottis that produces its characteristic sound. It is considered "persistent" when it lasts more than 48 hours and "intractable" when it last for more than 1 month [2] and it can indicate a disease of the central nervous system [3]. Various organic and psychogenic factors, such as anxiety, can result in chronic and intractable hiccups that can lead to depression, insomnia, and poor quality of life. The physiopathological mechanisms of hiccups are unclear, but some researchers suggest that deep brainstem structures, especially the medulla oblongata, are involved in the generation of hiccups [4].

Non-invasive neuromodulation techniques constitute a promising non-pharmacological approach, since they allow the modulation of altered brain activity. One of these techniques is transcranial direct current stimulation (tDCS). There is growing evidence for modulating

both cortical and subcortical areas with tDCS through top-down mechanisms [5], propagating electric stimuli from cortical areas towards deeper subcortical areas, such as those related to hiccups. Our goal was to demonstrate the effectiveness of a neuromodulation treatment, specifically by tDCS, applied in person and remotely, to reduce the symptoms of chronic hiccups, describing a clinical case. The study was approved by the Institutional Review Board (IRB), and an informed consent was provided and signed by the patient.

Methods

A 77 years old, with 12 months of persistent hiccups, and anxiety symptomatology according to the generalized anxiety disorder 7-item (GAD-7), underwent a tDCS intervention prolonging the protocol proposed by Shiozawa, *et al.* [1] for the same symptomatology: anodal tDCS at 2 mA, during 30 minutes per day, with the anode over F3 and cathode over F4. We performed 15 sessions every day from Monday to Friday for three weeks. The montage, as stated by Shiozawa, *et al.* [1] targeted modulatory effects over the lateral region of brainstem, particularly the medulla oblongata.

We collected sociodemographic and clinical data, and assessed pre- and post-treatment levels of anxiety, depression, and quality of life: State-Trait Anxiety Inventory (STAI); Beck Depression Inventory-II (BDI-II); Patient Health Questionnaire-9 (PHQ-9); Generalized Anxiety Disorder Scale (GAD-7); European Quality of Life-5 Dimensions (EQ-5D); World Health Organization Quality of Life-BREF (WHOQOL-BREF). All the tests were applied in their Spanish versions.

Results

After the 15 sessions, the pre-post analysis showed no changes in depressive or anxiety symptoms, perceived quality of life nor general health. Brain electrical activity can be modulated by tDCS to improve the symptoms of different neurological disorders [6]. However, in the case of this patient it seems that the hiccups were secondary to an emotional response, and neuromodulation may not be effective without prior work on the patient's emotional response.

During the treatment (after the eighth tDCS session) the patient started taking 0.5 mg of Trankimazin (Alprazolam) every day, following the recommendation of a doctor outside our research group, half a pill in the morning and the other half at night. The hiccup only went away for a couple of days, but it returned when the patient experienced a situation with high emotional distress, despite continuing taking medication. After completing the tDCS intervention, the patient continued the pharmacological treatment, doubling the dosage with no positive results.

Discussion

Brain electrical activity can be modulated by tDCS to improve the symptoms of different neurological disorders [6]. However, in the single case here reported it seems that the hiccups were secondary to an emotional response, and neuromodulation may not be effective without prior or concurrent work on the patient's emotional response. This is evidenced when the hiccups disappear after starting pharmacological treatment and reappear after a stressful event with a high emotional burden. The remission of hiccups may be due to the combined effect of the pharmacological treatment and tDCS or a placebo effect of the drug itself. We believed that the recommendation should be a psychological therapy in addition to tDCS to enhance its effect. Exploring alternative stimulation targets associated with emotional responses is another avenue worth investigating.

Conclusion

The temporal remission of hiccups may be due to the combined effect of the pharmacological treatment and tDCS, or to a placebo effect of the drug itself. We believed that the recommendation for this patient should be psychological therapy in addition to tDCS to enhance its effect. Exploring alternative stimulation targets associated with emotional responses is another avenue worth investigating.

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All authors have approved the final version of the manuscript.

Declaration of Conflicting Interest

The author(s) declare(s) that there is no conflict of interest.

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