

Investigate the Effect of Transcranial Direct Current Stimulation on Cognitive Emotion Regulation in Women with Depression in Tehran City

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ABSTRACT:

Introduction: Postpartum depression is a type of depression that many parents experience after the birth of their child. Affects more than 1 in 10 women during the postpartum year. The aim of this study was to investigate the effect of transcranial Direct Current Stimulation on emotion regulation in Women had postpartum depression.

Materials and Methods: In this quasi-experimental study with pre-test and post-test, 40 women with postpartum depression were randomly selected, of which 20 were in the experimental group and 20 in the control group. they got. Their emotion regulation test scores were compared by Gratz and Roemer (2004) emotion regulation test in two time periods before and after treatment. In the control group, each patient received 10 sessions of dummy electrical stimulation (20 minutes) and in the experimental group received 10 sessions of simultaneous anodic and cathodic stimulation (2 mA - 20 minutes) in the left and right dorsal peripheral cortex, respectively. Data analysis was performed using analysis of covariance.

Results: Data analysis showed that the score of emotion regulation test in women with postpartum depression after active treatment was significantly reduced compared to the control group with dummy electrical stimulation ($P < 0.05$).

Conclusion: According to the results of this study, it seems that transcranial Direct Current Stimulation in the lateral dorsal peripheral cortex increases the ability to regulate emotion in women with postpartum depression and can be used in the rehabilitation program of these patients.

KEYWORDS: transcranial Direct Current Stimulation, Emotion regulation, Women with postpartum depression

INTRODUCTION

Postpartum depression (PPD) is characterized by low mood and feelings of inadequacy, guilt, and hopelessness, often beginning 6-12 weeks after delivery [1]. Research has also shown that PPD often persists for months or years. Remain after birth [2]. One study showed that more than half of the women who visited a psychiatrist in the first 2 months after giving birth and in the second half of the year after giving birth were still symptomatic [3]. Bigley et al found that 31% of women had major depression. The symptoms continued to increase at 2 months after delivery, and the symptoms of depression remained at 12 months after delivery. It also depends on factors such as low socio-economic status and the greater the intensity of poverty, the greater the intensity of depression [4].

Oxytocin is one of the causes of postpartum depression, especially emotional regulation problems. Oxytocin is involved in postpartum depression, which has a known role in regulating emotions, social interaction, stress, and mother-infant relationships, childbirth, breastfeeding, and attachment [5]. In addition, they found that depression and emotion regulation problems in postpartum depression are largely related to the role of oxytocin [6].

Emotional regulation refers to the processes of modifying emotions based on experience and over time, which are expressed through emotions [7]. Studies have shown that the ability to regulate emotions is significantly correlated with individual social performance, emotional state, cognitive level, and academic growth. . Difficulty in emotional regulation worsens a person's subjective emotional experience and gradually expands them. Negative emotions aggravate the symptoms of depression and depression is the most common mental illness in the world, which is considered as an emotional regulation disorder [8]. Difficulty in emotion regulation is the main symptom of major depression and is an important risk factor for developing depression [9]. Problems in negative emotional regulation and symptoms of reduction of positive emotions in patients with depression have led to depression in these

Investigate the Effect of Transcranial Direct Current Stimulation on Cognitive Emotion Regulation in Women with Depression in Tehran City

patients and these patients are prone to problems in emotional regulation. Therefore, treatment of emotional regulation problems in patients with depression can reduce their problems to a great extent [10].

Recently, transcranial direct current stimulation (tDCS), which sends a low and constant direct current to the brain through electrodes, has been widely used due to its potential to improve depression-related symptoms [11, 12]. A meta-analysis of patients with acute major depressive episodes showed that active tDCS treatment was significantly more effective than sham conditions and its effect size [13].

Transcranial direct current stimulation of the brain is a neuromodulation technique in which surface electrodes (anode and cathode) transmit a weak direct current to the brain through the scalp [14]. It is challenging to talk about the antidepressant effect of tDCS. Although there are several randomized controlled trials that showed tDCS to be superior to sham (sham condition) [15, 16].

Most importantly, Moofa et al. (2020) provided evidence that was longer and therapeutic ways of transcranial direct electrical current stimulation of the brain can lead to increased effectiveness [17].

So far, no study has been conducted to investigate the effect of electrical stimulation of the brain from the skull on emotional regulation of women with postpartum depression. Due to the fact that emotional regulation is one of the main problems in patients with postpartum depression, and on the other hand, despite taking medication, their emotional regulation problems are not completely corrected, so there is a need for research and evaluation of other therapeutic techniques. There is a solution to this problem. On the other hand, talking about the antidepressant effect of tDCS is challenging. Therefore, our aim in this study is to investigate the effectiveness tDCS from the skull on emotional regulation of women with postpartum depression.

MATERIALS AND METHODS

Study design and participants

This research is quasi-experimental with pre-test/post-test design using the control group. The statistical population included women with postpartum depression who referred to psychological clinics in Tehran city, which were about 350 people. A total of 40 women with postpartum depression were selected using a purposive sampling technique and were randomly assigned into groups of sham control (n=20, mean age=35.82±4.38 years) and intervention (n=20, mean age=36.49±3.57 years).. The inclusion criteria were having postpartum depression according to clinical tests and psychiatrist confirmation, age range of 30 to 40 years, not using other treatment methods such as psychotherapy and psychiatric drugs. The exclusion criteria were the presence of a disorder other than postpartum depression, the use of psychiatric drugs, and lack of motivation to participate in the research. In addition, based on the individual report of the patient's companion and the patient himself and his medical record, it was ensured that they do not have convulsive and psychiatric diseases. Each person completed the consent form to participate in the research. Based on the type of intervention (experiment or sham control in which the device was turned off), they were randomly divided into two groups.

Measure

Emotional Regulation Questionnaire (ERQ)

It is a 36-item scale designed by Gratz and Romer (2004). It has a general score and 6 specific scores in sub-scales related to different dimensions of difficulty in emotional regulation. These sub-scales include: non-acceptance of emotions, inability to use appropriate behaviors, difficulty in impulse control, lack of emotional awareness, low access to emotional regulation strategies and lack of emotional clarity. How to answer this scale is based on a 5-point Likert scale. These researchers investigated the reliability and validity of this scale in a sample of 479 undergraduate students. This scale showed good internal consistency in the total score (Cronbach's alpha coefficient 0.93) and in all subscales (alpha coefficient greater than 0.8) and its test-retest reliability was also reported in a period of 4-8 weeks. [18]. Haidari et al. (2009) examined the reliability and validity of this scale in Iran. The reliability of this scale was calculated by two methods, Cronbach's alpha and half-measure, which are 0.84 and 0.76, respectively, indicating its appropriate validity.[19]

Intervention procedure

Transcranial Direct Current stimulation (tDCS)

The use of small amounts of electric current to change brain function has a history of about 200 years. Preliminary investigations on animal samples indicate the change in the activity of the cerebral cortex due to the passage of electric current in the form of a decrease or increase in excitability, depending on the conditions of the electric current passed. These effects persist for some time due to changes in the amount of proteins and intracellular levels of cyclic adenosine monophosphate (AMP) and calcium, but they are often reversible and do not have any complications in the function and structure of cells [20]. The device used is the iOMED device made in America (2011) which has two electrodes, anode and cathode. The electrodes are placed in a saline-soaked pad for electrical conduction.

Investigate the Effect of Transcranial Direct Current Stimulation on Cognitive Emotion Regulation in Women with Depression in Tehran City

Intervention

First, 40 women with postpartum depression were selected. The initial assessment of the patient takes place on the first day and lasts 1.5 hours. Also, information such as the time that has passed since the birth of the child and the treatments that have been done so far are completed. The treatment protocol used in this study for each patient was 10 20-minute treatment sessions of 2 mA in the Dorsolateral Prefrontal Cortex (DLPFC) area. The target area for stimulation is obtained by measuring the head. For this purpose, the 20/10 Electroencephalogram (EEG) system is usually used. But another method used in this study is as follows:

The middle of the distance between the nasal tip (the point between the forehead and the nose) and the back of the head (the most prominent bone behind the head) is marked on the skin, and then the distance between the two ears is taken into account and the middle is marked. On both sides of the point of intersection of two hypothetical transverse and longitudinal lines C3 and C4 (according to EEG), there is the primary motor cortex (M1). To locate the DLPFC, we consider five centimeters anterior to the location of M1. This method of measuring and locating the desired area is enough to use large electrodes. For more focal tDCS, we may need other cortical localization methods.[21]

In this study, the subjects receive two different types of tDCS in the DLPFC area, which are:

1. tDCS with a current whose anode electrode is placed on the left side and cathode electrode is placed on the right hemisphere. (Intervention group)
2. Sham tDCS (sham) as control (control group)

In the first meeting, the patient will complete the questionnaire and sign the consent form. Then, Gratz and Romer (2004) emotion regulation test is taken from him. At the same time, he experiences tDCS to relieve the patient's stress regarding the treatment protocol. We record the results in the patient questionnaire.

In the next session, the patient receives brain stimulation with direct electrical current from the anodic skull in the left DLPFC area and cathodal brain stimulation with tDCS in the right DLPFC area. It is worth mentioning that the electric current is of direct type, with an intensity of 2 milliamps and a duration of 20 minutes, which has been revealed based on previous studies that it has no adverse effect on the health of the participants in this project, and for the control group, the device is switched off in the fake mode. Stayed (for 30 seconds the device is on and then it turns off). Also, because the electrodes are wet with electrolytic liquid, we put a towel around the patient's neck. At the end of the treatment, we reassess the emotion regulation using the Gratz and Romer (2004) emotion regulation test and record the results in the patient questionnaire.

DATA ANALYSIS

The collected data were analyzed in SPSS 22 software. Mean and standard deviation to describe the data and ANCOVA was used to investigate the effect of the intervention on the dependent variable (emotion regulation) by removing the pre-test effect. Levin's test and The Shapiro-Wilk test was used to evaluate the assumptions From ANCOVA, the results of which showed equality of variances and the normality of the data distribution for the study Variable.

RESULTS

As shown in Table No. 1, the mean of pretest ERQ was 102 ± 9.85 in the intervention group and 99.35 ± 12.45 in the control group. In the post-test, the average of the intervention group was 79.45 ± 7.35 and was 97.32 ± 10.83 the average of the control group. The results of ANCOVA showed a significant difference between the pretest and posttest scores of the intervention group, $F(1, 23) = 10.76$, $p < 0.001$. Therefore, the tDCS decreased emotional difficulties of women with postpartum depression. The effect size indicated that 47% of the variances in emotional difficulties were related to the intervention.

Table 1. Mean and standard deviation of the emotional difficulties scores of the intervention and control groups before and after tDCS

	intervention group		control group	
	Pre test	Post-test	Pre test	Post-test
anxiety	102 ± 9.85	79.45 ± 7.35	99.35 ± 12.45	97.32 ± 10.83

DISCUSSION

The aim of this study was to investigate the effect of tDCS of the brain on the emotional regulation in women with postpartum depression. The results of the present study showed that tDCS of the brain has a significant effect on emotion regulation in women with postpartum depression and can lead to improvement in emotion regulation in these patients. The results of this research are in line with the study of Moofa and colleagues (2020), Brunoni and et al (2018) and Loo and et al (2022).[17,16,15].

In explaining the results of the present study, it should be said that the DLPFC region plays a role in emotional and cognitive processing and manages emotional experiences. Emotional-emotional stimuli act as moderators of executive functions. Emotionally

Investigate the Effect of Transcranial Direct Current Stimulation on Cognitive Emotion Regulation in Women with Depression in Tehran City

valuable information can attract attentional resources and thereby direct or change executive outcomes. In other words, attributing an emotional-emotional value to some stimuli increases the chance of their selection.[22]

tDCS of the brain modulates the function of brain neurons. Activity and excitability are applied by applying a weak direct electric current to the brain through the scalp. The electric current between the anode and cathode electrodes leads to an increase or decrease in the excitability of the cerebral cortex under the respective electrodes. This increase in the excitability of the anode electrode occurs due to the release of the neurotransmitter glutamate in the neurons, while in the cathode electrode, the release of the neurotransmitter gamma-aminobutyric acid (GABA) leads to a decrease in the excitability of the neurons.[23]

Previous tDCS studies have investigated the role of DLPFC in emotional processing separately. Based on these studies, in healthy individuals, anodal tDCS on the left DLPFC leads to an increase in positive mood and a decrease in negative mood, while anodal stimulation of the right DLPFC leads to disturbances in mood and negative emotional processing.[26 ,25 ,24]

In patients with depression, using stimulation of the right DLPFC and left cathodic stimulation to improve depression symptoms, a recent study of the combination of tDCS and demography in healthy people found a positive role of DLPFC in processing emotional images, while DLPFC is recorded in the distance of its response to emotional images. These studies show that the left DLPFC plays a greater role in positive emotions and the right hemisphere plays a greater role in negative emotions.[28 ,27]

According to the results of the present study, it can be said that since in the sample subjects who had postpartum depression disorder and naturally had more negative mood and excitement, 2 mA anodic stimulation of the left DLPFC area and cathodic stimulation of the right DLPFC area were performed, resulting in There was an increase in the activity of the left DLPFC region, which plays a greater role in positive emotions, and vice versa, in the right DLPFC region, which plays a greater role in negative emotions, and this has led to the modification of emotional function and improvement of emotion regulation in these patients.

STUDY LIMITATIONS

Several limitations must be considered in this study. Some of the patients withdrew from participating in the study because of the far distance between their houses and the hospital and also some patients neglected the time of sessions and did not continue the treatment sessions.

CONCLUSION

According to the results of this research, tDCS of the brain is recommended as a complementary treatment to specialists to improve the performance of emotion regulation in patients with postpartum depression.

Ethical Considerations

Compliance with ethical guidelines

It should be noted that this article has a code of Ethics from Academic Center for Education of Mashhad (IR.ACECR.JDM.REC.1401.085)

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Authors' contributions

SE, MS, ZF: Study design, acquisition of data, interpretation of the results, statistical analysis and drafting the manuscript;

ZA: Study design, interpretation of the results, And drafting the manuscript; EG: Interpretation of the results.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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Investigate the Effect of Transcranial Direct Current Stimulation on Cognitive Emotion Regulation in Women with Depression in Tehran City

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Investigate the Effect of Transcranial Direct Current Stimulation on Cognitive Emotion Regulation in Women with Depression in Tehran City

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