



Reduce Depression and Anxiety in Methadone Users with Transcranial Direct Current Stimulation

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Abstract

Background: Research shows that transcranial direct current stimulation is effective in reducing depression and anxiety.

Objectives: This research is aimed at reducing depression and anxiety in methadone users with transcranial direct current stimulation.

Methods: This study is a randomized clinical trial with a pretest-posttest. The sample of this study was 60 methadone users who had severe depression and anxiety. Participants were allocated to two experimental (n = 30) and control groups (n = 30). The two regions, F3 (cathode) and F4 (anode) were stimulated with a current of 2 mA for 20 minutes in 10 sessions. Participants were assessed before and after stimulation with Beck's depression inventory and Berger's anxiety test.

Results: Data analysis showed that tDCS reduced the symptoms of depression and anxiety in methadone users (P < 0.01).

Conclusions: It seems that the method of tDCS can reduce the severity of symptoms of depression and anxiety. Therefore, it can be claimed that this intervention can be considered by experts as a complementary intervention along with other psychological and pharmacological treatments.

Keywords: Anxiety, Depression, Methadone, tDCS

1. Background

Transcranial direct current stimulation (tDCS) is a non-invasive method of stimulating the brain in which a weak, intermittent current is sent from the skull to the underlying layers, altering the excitability of the cerebral cortex. For years, tDCS has been tested on animal specimens. Weak and intermittent electrical current is sent to the lower layers of the skull alters the reactivity of brain nerve cells. To this end, researchers have combined drug treatment of depression and anxiety with transcranial direct current stimulation, or tDCS. Electrical stimulation of the brain seems to be as effective as medication for people with depression and anxiety therapy, but the combination of the two methods has been shown to be more therapeutic. The tDCS researchers say painless therapy with a weak, intermittent electrical current is used to stimulate a specific part of the brain has been used for a variety of conditions, including stroke, anxiety, obsession, pain, and Parkinson's, and is an exciting treatment for depression and anxiety, as well as improving brain function (1). The per capita prevalence of depression among the addicts is about 50 to 60 percent,

and the prevalence of minor depressive disorder is about 10%. Also, the per capita prevalence of addiction among the total patients with psychological disorders is about 29%, and among the depressed patients referring to psychiatric clinics, it is about 56% (2). It is stated that 40 percent of the people who have drug abuse (opiate or non-opiate) have had a period in their lives in which they had the diagnostic criteria of major depressive disorder (3). Quality of life is considered as a valid scale for evaluating the outcome of the therapeutic and service methods provided for a damaged person (4). Quality of life includes the persons' physical health, psychological state, social relationships, religious and personal beliefs, and it is evaluated based on the persons' mental experiences (1). Researchers have shown that abuse of opiate drugs, calmatives, and alcohol is related to the low quality of life. The results of the research about the effect of methadone maintenance treatment on the addicts' psychological health are contradictory. For example, some research has shown that compared with the general population, the addicts under treatment by methadone have had a high level of psychologi-

cal problems, and they have experienced most of the mood and emotional disorders such as depression and anxiety (5). In treatment with methadone, special centers deliver this drug to patients in the form of edible syrup and in a controlled way. From the experts' view, the replacement of methadone can decrease the prevalence of injection addiction and dangerous diseases such as AIDS, and on the other hand, communication of the addicts with drug distributors is prevented and the probability of crime is decreased (6). In the late 90s, a method called tDCS was introduced which invaded the nerve tissue by induction of electric current. In this method, the anode electrode is connected to the considered point, and, as a reference, the cathode electrode is connected on a point distant from the anode electrode. Electric current is directed from the anode electrode, which is a stimulator, to the cathode electrode, which is inhibitory. One of the newest methods of brain stimulation is transcranial direct current stimulation (tDCS), which has been considered for two reasons: being non-invasive and economically cheap. Also, this method, along with magnetic stimulation, is considered as one of the harmless and non-seizure causing methods. In the tDCS method, a weak electric current enters the nerve tissue through the skin and cranium and changes the irritability of this tissue. The commonly used protocols of tDCS are related to two electrodes connected on the skin, one of which works as the anode and the other works as the cathode. An electric current of one to two mA is applied for 20 minutes between these two electrodes, each of which usually has a cross-section of 35 cm². The direction of the current is from the cathode to the anode, and depending on the direction and intensity of the current, irritability of the cerebral cortex is increased or decreased (7).

2. Objectives

With respect to the aforementioned, the aim of this study was to evaluate the effectiveness of transcranial direct current stimulation (tDCS) on depression and anxiety in methadone users.

3. Methods

This study is a randomized clinical trial with a pretest-posttest. The sample of this study was 60 methadone users who had severe depression and anxiety. Participants were allocated to two experimental ($n = 30$) and control groups ($n = 30$). The two regions, F3 (cathode) and F4 (anode), were

stimulated with a current of 2 mA for 20 minutes in 10 sessions. Participants were assessed before and after stimulation with Beck's depression inventory and Berger's anxiety test. This study was consistent with the Helsinki Declaration (1964) on the observance of ethical standards. Conscious consent was obtained from all participants, and the study was approved by the Ethics Committee.

3.1. Procedure

After getting a written consent letter and insuring the persons about the privacy of their information, questionnaires (which are available in the appendix) were filled. Beck's depression inventory, whose reliability and validity had been measured in domestic studies, was used. In the study performed by Dobson and Mohammad Khani, Cronbach's alpha coefficient was reported as 96 percent for this test. Beck's test includes 21 questions and four choices for each question. If the respondent chooses the first choice of all the questions, the resulted score will be zero, and if the person chooses the fourth choice of all the questions, the score will be 63. In this test, if the person gets a score of less than 16, the result suggests no depression, for the scores of 17 - 25 suggest mild depression, the scores of 26 - 33 moderate depression, and for the scores of more than 34 point towards severe depression. For evaluating the anxiety, Berger's test was used, the reliability and validity of which were determined.

Also, the subjects have an age range of 20 to 50 years old, and for controlling the gender, the research population has been selected from among the men. In order to prevent the effect of temperature and climatic conditions on further tiredness, all the tests were done in the evening. All the subjects were asked not to have any physical exercise for 24 hours before the test and to have enough rest and sleep. The conditions of execution of the test were the same for all the subjects. All the subjects are healthy persons.

3.2. Transcranial Direct Current Stimulation (tDCS)

The treatment was performed by stimulating the black electrode in the middle of the forehead and the red electrode on the left side of the skull with a current of 2 amps. The number of these treatment sessions was 10 sessions, each of which lasted approximately 20 minutes. The interval between sessions was 48 hours, and the treatment generally lasted 30 days.

3.3. Statistical Analysis

For analyzing the data, covariance analysis was used. All the statistical studies were done using SPSS-22.

4. Results

In the present study, the information obtained was evaluated using statistical analysis of covariance analysis. [Table 1](#) shows the descriptive findings of the experimental and control groups in pre-test and post-test in relation to depression and anxiety.

One of the defaults of covariance analysis before the covariance analysis test to assume the homogeneity assumption is the pre-test and post-test regression slope. The results of regression slope homogeneity analysis showed that the relationship between (pre-test) and (post-test) variables at the level of regression slope homogeneity study in the two groups was not significant. Levene's test was then performed to check the homogeneity of the variance, the results of which are shown in [Table 2](#).

According to [Table 2](#), the results showed that the variables of depression (0.054) and anxiety (0.076) were not significant. So the defaults of analysis of covariance is established.

According to [Table 3](#), the variable of depression (50.17, 0.001) and the variable of anxiety (46.815, 0.001) after the test are significant at the level of (0.001). Therefore, it can be said that there is a difference between the scores of the experimental and control groups in the post-test with respect to the adjustment of the pre-test effect, which is the highest coefficient of effect related to depression (0.82). In other words, tDCS appears to have had a greater effect on the depression of methadone users than on their anxiety.

5. Discussion

The study was conducted to evaluate reduce depression and anxiety in methadone users with transcranial direct current stimulation. The results of covariance analysis after adjusting the mean and controlling the interventions indicate a significant decrease in the depression and anxiety scores of the experimental group compared to the control group. According to the results of the post-test phase, it seems that the tDCS method can be effective in reducing the symptoms of depression and anxiety in methadone users.

The results of this research are similar to the results of the researches performed by (8-15). Some researches have found that tDCS is effective in reducing the severity of depression and anxiety (16-18). Oraki *et al.* (19) research is consistent with the results of the present study. The results of their research showed that using tDCS, the symptoms of depression were significantly reduced.

Paying attention to depression and anxiety and the effect of tDCS on these variables in the addicts has great importance. Therefore, the role of these stimulations in the performance of the nervous system in different age groups, their effect on depression and anxiety, and especially on promotion of life quality is very significant. Although depression and anxiety usually simultaneously exist in people with drug addiction, the role of electric tDCS has been paid less attention to, and sometimes, contradictory results have been reported by the researchers. However, for treating depression and anxiety, magnetic stimulations have been used more than electric stimulations, while electric stimulations are much cheaper and simpler and have lower risks (8). Therefore, research on the effect of tDCS on depression and anxiety in methadone users has not been considered. Regarding the fact that drug consumption is one of the most important health problems in society, performing such projects will be useful. Most of these people are single and unemployed, and they have about 5 to 10 years of drug consumption background. Such patients have mostly started their addiction with psychedelic pills, and at the later stages, they prefer crystal to other drugs. The important point is that among the population of this research, most of them are educated persons with associate and bachelor's degrees who are about 30 to 35 years old. However, after referring to addiction treatment centers, these people began to consume methadone under the control of the center staff. According to the results, their depression and anxiety level is much lower than the people who have not decided to quit their addiction yet.

Footnotes

Authors' Contribution: Mahdi Naeim developed the original idea and the protocol, abstracted and analyzed data, wrote the manuscript, and is the guarantor. Ali Rezaisharif and Sahar Aligholizadeh Moghadam contributed to the development of the protocol, abstracted data, and prepared the manuscript.

Conflict of Interests: As a corresponding author, I confirm by the authors that there is no conflict of interest. At my own expense and in my own private office.

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Table 1. Descriptive Statistics on Depression and Anxiety in Experimental and Control Groups, Pre-test and Post-test

Variable	Examination Group		Control Group	
	Pre-test	Post-test	Pre-test	Post-test
Depression				
Average	27.70	10.05	28.51	28.72
Standard deviation	9.81	5.14	11.01	11.38
Anxiety				
Average	45.91	28.09	46.19	46.37
Standard deviation	8.15	7.02	7.73	8.12

Table 2. Levene's Test Results to Check the Assumption of Homogeneity of Variances

Variable	Level	F	df1	df2	Sig.
Depression	Post-test	0.054	1	6	0.045
Anxiety	Post-test	0.076	1	9	0.91

Table 3. The Results of One-way Analysis of Covariance in Depression and Anxiety, the Difference Between the Experimental Group

Variable	The Experiment Ss	Error Ss	The Experiment Ms	Error Ms	F	P	Eta
Depression	851.60	365.12	851.60	21.82	50.17	0.001	0.82
Anxiety	2736.183	1647.30	2736.183	75.491	46.815	0.001	0.481

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