Accepted Manuscript

Title: Cognitive-behavioral therapy versus transcranial direct current stimulation (TDCS) for augmenting SSRIs in patients with obsessive-compulsive disorder

Authors: Mohsen Dadashi 1, Vida Yousefi Asl 2, Yousef Morsali 3*

1. Assistant Professor in the Department of Clinical Psychology, Zanjan University of Medical Sciences, Zanjan, Iran. Social Determinants of Health Research Center. Zanjan University of Medical Sciences, Zanjan, Iran.
2. MSc in Clinical Psychology, Department of Psychology, Zanjan University of Medical Sciences, Zanjan, Iran.
3. Assistant Professor in the Department of Psychiatry, Zanjan University of Medical Sciences, Zanjan, Iran.

To appear in: Basic and Clinical Neuroscience

Received date: 2018/09/06
Revised date: 2019/02/10
Accepted date: 2019/02/13

This is a “Just Accepted” manuscript, which has been examined by the peer-review process and has been accepted for publication. A “Just Accepted” manuscript is published online shortly after its acceptance, which is prior to technical editing and formatting and author proofing. Basic and Clinical Neuroscience provides “Just Accepted” as an optional and free service which allows authors to make their results available to the research community as soon as possible after acceptance. After a manuscript has been technically edited and formatted, it will be removed from the “Just Accepted” Web site and published as a published article. Please note that technical editing may introduce minor changes to the manuscript text and/or graphics which may affect the content, and all legal disclaimers that apply to the journal pertain.
Please cite this article as:


DOI: http://dx.doi.org/10.32598/bcn.9.10.405
Abstract

Background and Purpose of the study: Obsessive-compulsive disorder (OCD) is considered as one of the categories of psychiatric disorders that has the potential to turn into a chronic disease if the necessary treatments are not applied. The main feature of OCD is its embrace of the frequent or intense obsession and compulsion that can induce great pain and suffering in patients. Moreover, as one of the most prevalent abnormalities, depression usually follows OCD. The purpose of the present study is to compare the efficiency of CBT and tDCS treatments along with drug therapy in decreasing the severity of obsession-depression symptoms and improving the quality of life in OCD patients.

Method: This study adhered to a semi-experimental design including pre-test, post-test, and follow-up stage. The statistical population comprised all the patients diagnosed with OCD in Zanjan Province, Iran. Besides, 26 OCD patients, who had been referred to Shahid Beheshti Medical Center in Zanjan, were selected using purposive sampling and were randomly assigned to two treatment groups. The subjects of the study completed Y-BOCS, BDI 2, and Quality of Life Questionnaires in the pre-treatment, post-treatment, and follow-up stages (1 month and 2 months after the treatment). ANCOVA and RCI methods were used to measure statistical and clinical significances, respectively. The data were analyzed using SPSS, version 20.

Results: The findings showed no significant difference between the CBT and tDCS groups concerning the symptoms of OCD and depression in the post-test stage (p > 0.05). Conversely, in terms of life quality, there was a significant difference between the CBT and tDCS groups at the post-test phase (p < 0.05).

Conclusion: Although the findings of the study did not show any statistically significant difference between CBT and tDCS groups (except for the quality of life variable), the drug therapy-CBT combination proved to be more effective than its drug therapy- tDCS counterpart in the treatment of OCD patients.

Keywords: Cognitive-behavioral therapy (CBT), Transcranial direct current stimulation (tDCS), Obsessive compulsive disorder (OCD)

Introduction

OCD is generally defined as a mental disorder distinguished by the presence of frequent or intense obsession and compulsion that cause great pain and suffering for the patients. Furthermore, obsession and compulsion not only disturb normal life, work performance, routine social activities, and interpersonal relationships, but also waste OCD patient's valuable time. An OCD patient may suffer from obsession, compulsion, or both. OCD ranks the fourth among the most common psychiatric disorders following panic disorder, substance use disorder, and major depressive disorder. This mental disorder disrupts different dimensions of life and is accompanied by the exacerbation of symptoms (Sadock B, 2014).

There are several suggested treatments for OCD patients including psychodynamics, behavioral therapy, cognitive therapy, behavioral-cognitive, drug therapy, supportive psychotherapy, group therapy, family therapy, electroconvulsive therapy, deep brain stimulation, and Transcranial Direct Current Stimulation (tDCS). The likelihood of OCD improvement without applying any treatment has been shown to be low (20% in a reassessment
after 40 years) (Association, 2013). Although drug therapy and ERP are effective options in treating OCD (Steketee G, 2006), complete recovery has not been achieved in some patients for whom antipsychotics or cognitive-behavioral therapy including ERP are recommended as alternative treatments (Foà EB, 2005; Simpson HB, 2013). Previous evidence indicated that OCD is largely influenced by biologic factors for which some malfunctions were observed in some parts of the brain (Sadock B, 2014). OCD is regarded as a common disease and, in some cases, good progresses have been achieved in treating patients. However, 30-60% of the patients fail to tolerate the side effects of medications or at best present a relative response to the treatments combined with cognitive-behavioral therapy. There is mounting evidence confirming that the following neurobiological components were involved in the OCD outbreak: abnormal activity and communication in orbitofrontal-striato-pallido-thalamic networks, increased activity in orbitofrontal, SMA, Cingulate Gyrus, caudate nucleus, and reduced activity in the right and left cerebellum as well as Parietal lobe. TDCS is known as a non-invasive method that can be used to improve brain imbalance and brain-circuit communication. This method has not been sufficiently studied in spite of its usefulness in empowering the hospital staff as well as the therapists working in this field. Therefore, it tends to be absolutely necessary to conduct research projects with the purpose of evaluating the effectiveness of treatment and helping the patients who have not responded positively to the current treatments (Bation R, 2016).

**Method**

This study employed a clinical trial that was approved by Ethics Committee of Zanjan University of Medical Sciences on December 15, 2016 involving the following codes: ZUMS.REC.1394.336 and IRCT and IRCT2016061728504N1.

The sample consisted of all the patients diagnosed with OCD in Zanjan Province, Iran. Moreover, 26 OCD patients who had been referred to Shahid Beheshti Medical Center in Zanjan were selected using DSM-5 criteria and purposive sampling. All of the participants were randomly assigned to two treatment groups.

**Inclusion criteria**

The subjects were required to show the symptoms of OCD confirmed by a psychiatrist based on a diagnostic interview and a clinical psychologist based on SCID-I. They should have had the 3rd grade middle school education at least and been at the age range of 18-50. Finally, the participants needed to complete the written consent form and not to be exposed to any psychological and complementary therapies for at least 1 month before entering the research.

**Exclusion criteria**

Subjects who showed suicidal or homicidal thoughts, complete symptoms of personality disorder, and psychotic disorders were excluded from the study.

**Exit criteria**

The individuals who missed more than two sessions of the treatment meetings and did not do any homework were excluded from the study.
Instruments

In this research, the following questionnaires were used for data collection.

Structured Clinical Interview for DSM Disorders (SCID)

Diagnosing the mental health disorders was conducted based on the Diagnostic and Statistical Manual of Mental Disorders (SCID), Fourth Edition (DSM-IV). The follow-up interview was a flexible, comprehensive, and standard tool developed by Forrest et al. (1996). Tran and Smith reported a 60% Kappa coefficient as the validity coefficient among the raters of SCID. After translating the interview into Persian, Sharifi et al. (2008) conducted this interview on a sample of 299 people. The diagnostic agreement was analyzed to range from medium to good (Kappa>60%) for which the overall agreement was satisfactory (total Kappa diagnosis= 52% and the total lifetime diagnosis=55%) (W. Group, 1998).

Yale–Brown Obsessive Compulsive Scale (Y-BOCS)

The 10-item Y-BOCS scale was employed to measure the severity of OCD symptoms without being biased towards the type of content of obsessions or compulsions. In Y-BOCS scale, 5 out of 10 items focus on obsessive thoughts and the rest on compulsive behaviors. The inter-rater reliability of this scale was evaluated to be 0.98 based on its administration among 40 patients. The internal consistency coefficient was found to be 0.9, and test-retest reliability with a two-week interval was reported to be 0.84. In the preliminary examination phase, which was performed on 26 patients in order to examine the convergent validity, the correlation between the scores of this scale and the Maudsley Obsessional-Compulsive Inventory (MOCI) was found to be 0.72 (Pichakolayi, 2011).

Beck Depression Inventory (BDI-2)

This questionnaire is a revised version of Beck Depression Inventory which aims to measure depression severity. The present version is more consistent with DSM-IV compared to its first edition and covers all elements of depression which are rooted in a cognitive theory. Beck, Steer and Brown's findings have confirmed the high internal consistency of this questionnaire. The internal consistency as well as test-retest was found to be 0.87 and 0.73, respectively. In a sample of 94 people in Iran, Fata (2011) reported the Cronbach’s Alpha coefficient of 0.92 and a one-week test-retest reliability of 0.9. Respondents are required to be equipped with the reading ability of a 5th or 6th grader for understanding the items of the questionnaire. They are required to respond to each item based on a 4-point Likert scale ranging from 0 to 3 in which the minimum score is considered to be zero and the maximum three (Pichakolayi, 2011).

Personal Wellbeing Index-Adult (PWI-A)

The Personal Wellbeing Index-Adult was developed by Cummins and La in 2006 as requested by the International Welfare Group. The core set of items forming PWI-A comprises seven questions of satisfaction including specific life domains as follows: standard of living, personal health, achieving in Life, personal relationships, personal safety, community-connectedness, and future security. These seven items are integrated into the general question “how satisfied are you with your life as a whole?” In order to answer the questions, the person specifies the amount of satisfaction of each item on a scale varying from zero to 10. On this scale, zero
means no satisfaction at all and 10 demonstrates complete satisfaction. In case of Australian contexts, Cronbach’s Alpha has been reported to be ranging from 0.70 to 0.85 (I. W. Group, 2006).

**Method**

The present study used a quasi-experimental design involving pre-test, post-test and follow-up stages. The sample consisted of 26 OCD patients who had been referred to the Psychiatric Clinic of Shahid Beheshti Medical Center in Zanjan. These patients were diagnosed with OCD by a psychiatrist and entered the study after the initial evaluation. Then, the patients were randomly assigned into two treatment groups of CBT (n = 13) and TDCS (n = 13). Each group was evaluated four times as follows: before the intervention (pre-test), after the intervention (post-test), one month follow-up, and two-month follow-up by a person other than the researchers who was working as the master of clinical psychology at the educational-health center. In each of the CBT and tDCS groups, three patients were removed during the treatment. In the one- and two-month follow ups, one patient from the CBT and three from the tDCS groups were excluded from the study. It is worth mentioning that the treatment was performed individually and in case of the drug therapy, the patients were treated under the supervision of a psychiatrist. Furthermore, the type and drug dosage were controlled by the psychiatrist in order to minimize the differences between the two groups. The treatment process was as follows: The first session in both treatment groups was allocated to the OCD diagnostic interview as well as the establishment of a proper treatment relationship and collection of information about the patient's obsessive-compulsive disorder. BDI, Y-BOCS, and PWI-A questionnaires were administered as the pre-tests. Next, a form of informed consent and explanations of the treatment were provided for the patients. At the end of the treatment sessions, the questionnaires were completed as post-tests and then used in the follow-ups. In the treatment sessions, the patients were provided with some information regarding the onset of the OCD, the process of illness, treatments, and treatment logic. In the next section, we discuss the treatments implemented in each group.

*Drug therapy process*

In the SSRIs treatment (fluoxetine and fluvoxamine), the psychiatrist prescribed a standard dose of the drug for daily intake (between 40 and 60 mg for fluoxetine and between 100 and 200 mg for fluvoxamine). During the treatment process, the patient was presented with some information on the logic of treatment, the effects of drugs, and instructions on how to use the drug. Eventually, the appropriate dose was prescribed for the patient. At subsequent sessions, the patient was examined to determine the effects and side effects of the treatment. Then, the patient was encouraged to use the medication on a regular basis for a period of three months. The groups were matched in terms of the taken medication.

*TDCS*

Patients received TDCS treatment for 10 days as follows: Each day, for 20 minutes, the patients were treated using a flow of 2 mA, cathode electrodes in the orbitofrontal cortex (FP1), and anode on the right side of the cerebellum (Bation R, 2016). Direct flow was transmitted through the electrodes covered with saline soaked sponge. The size of the electrodes in this study was 4.5 × 4/4 cm.

*CBT*
In the CBT group, cognitive techniques were conducted from the third session. The rationale behind this method was to acquaint the patient with cognitive distortions, weaken (and not change) the obsessive beliefs, and prepare them for the ERP stage (Leahy R, 2012).

**Sessions 4-5 onwards**

ERP method was conducted at the beginning of the process. The purpose of this method was to weaken the relationship between obsessive thoughts and negative emotions. In the present technique, the patients were instructed to note that their anxiety and obsessive compulsions were reduced by being exposed to regular confrontation with obsessive thoughts as well as the situations which provoke those thoughts without avoiding or undermining them.

At the first stage, the patients were exposed to the situations that were less stressful for them under the supervision of the therapist. During exposure, the individual's anxiety levels were measured continuously on the scale of zero to 10 and the physical symptoms such as heart beat, body temperature, shortness of breath, dizziness, headache, and other anxiety symptoms were also examined. The exposure continued until the anxiety of the patient was significantly reduced in a way that it reached its base level which means before the onset of exposure or half of it. The first sessions of exposure to anxiety lasted about 90 minutes. Although getting accustomed to the treatment sessions was not considered as a crucial indicator of the success of treatment, it was recommended to reduce the anxiety to its minimum level.

Then, the patient was prescribed to perform the exposure on a daily basis as homework until the same position triggered the least anxiety. When the patient successfully dominated the first stage of the hierarchy, the confrontation with the next level of anxiety began. In other words, when the anxiety decreased within at least two consecutive sessions, the participant was able to move to the next stage of the hierarchy of anxiety. Response prevention directly targeted the obsessive-compulsive and avoidance behaviors of the patients and was utilized in conjunction with exposure. In this technique, the patients were trained to reduce their avoidance behaviors through the exposure to obsessive thoughts and finally eliminate them. As a consequence, they could withstand the anxiety caused by obsessive thoughts and natural stimulators. With the onset of exposure, the rules were set aside and the patients were encouraged to internalize two lessons: 1. the rules do not prevent the risk, and 2. the obsessions are not dangerous in nature. Hence, the patients needed to stop their rule governing behavior during the exposure and the day. Otherwise, they may decide to use the rules after the exposure and reduce their anxiety in this way.

When all the stages of anxiety exposure and response prevention were practiced, the treatment sessions ended. Eventually, the patient was not anxious in anxiety provoking situations and did not perform any obsessive behavior. Treatment practices were utilized with the purpose of preventing the recurrence of OCD and helping the patient to identify the potential sources of their anxiety that may reoccur. In the final session, BDI, Y-BOCS, and PWI-A questionnaires were completed as the post-tests. One- and two-month follow-ups were also conducted to evaluate the long-term efficacy of the treatment.

**Data analysis**

For analyzing the data, descriptive methods and inferential statistics such as ANCOVA, repeated measurement test, and covariance analysis were used to examine the effectiveness of the treatments using SPSS, version 20. It should be noted that the existence of significant
statistical differences between the pre-test and post-test scores did not necessarily mean an unsuccessful life for the patients. For this reason, it is necessary to use methods that complement the statistical tests and provide more precise results regarding the effectiveness of psychological therapies. In doing so, the contribution of reliable and clinically significant change method would be of great help. In this study, the Reliable Change Index (RCI) was applied to determine whether the resulting changes were reliable or merely occurred due to a measurement error:

\[
\text{RCI} = \frac{\text{Pre Test} - \text{Post Test}}{\sqrt{\left( \text{SE} \right)^2}}
\]

\[
\text{SE} = \frac{\text{SD}}{\sqrt{1 - r}}
\]

If the absolute value of the RCI index was greater than 1.96, with 95% of certainty, it could be concluded that the observed difference between the post-test and pre-test scores did not occur incidentally, while revealing a stable and real change (Asghari MA, 2015).

**Results**

The demographic characteristics of the subjects are presented in Table 1. The chi-square test was used to compare the two groups of CBT and tDCS in terms of gender, marital status, education, and occupation. Considering the normal distribution of age variables based on the Kolmogorov-Smirnov test as well as the similarity of variances in the two groups based on the Levene’s test, an independent samples t-test was run. The chi-square test showed that there was no significant difference between the two groups of CBT and tDCS in terms of gender, marital status, education, and occupation (Table 1). Similarly, the independent t-test depicted no significant difference between the two groups (Table 1). Therefore, based on the obtained results, it can be concluded that the two groups of CBT and TDCS are homogeneous in terms of demographic variables. In comparing the results of t-test in the case of the pre-test on dependent variables, no significant difference was observed at the alpha level of 0.5. In other words, at the pre-test stage, there was not a significant difference between the two groups of CBT and tDCS in terms of obsessive-compulsive symptoms, depression, and quality of life. The intergroup unilateral covariance analysis was used to compare CBT and tDCS therapies by controlling the initial differences between the groups in the pre-test stage which was considered as the covariate.

<table>
<thead>
<tr>
<th>Table 1. Demographic characteristics of subjects</th>
<th>Groups</th>
<th>Chi square test results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CBT</td>
<td>tDCS</td>
</tr>
<tr>
<td><strong>sample</strong></td>
<td>(100) 10</td>
<td>(100) 10</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>(80) 8</td>
<td>(70) 7</td>
</tr>
<tr>
<td>Male</td>
<td>(20) 2</td>
<td>(30) 3</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>(40) 4</td>
<td>(50) 5</td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>intermediate</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>M ± SD</td>
<td>M ± SD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>(305) 7.5</td>
<td>(28.3) 7.1</td>
</tr>
</tbody>
</table>

**Effectiveness of CBT and TDCS treatments**

Controlling the effect of the pre-test, the results of the covariance test showed that there was no significant difference between the CBT and TDCS groups with regard to the symptoms of obsessive-compulsive disorder and depression in the post-test in one- and two-month follow-ups. Although the mean for CBT group in the post-test and follow-ups was more than that of DDCS, there was no statistically significant difference between the two groups. The effectiveness of CBT in reducing OCD and depression based on the reported effects was measured to be greater than the one for tDCS (Table 2).

In both CBT and TDCS groups, the results of RCI effects on OCD presented significant clinical changes at pre-test, post-test, and follow-ups (Tables 3 and 4). The results of RCI impacts on depressive symptoms showed that the CBT group did not illustrate any meaningful change from the pre-test to post-test; however, it changed significantly in the one- and two-month follow-ups (Table 3). In other words, the changes did not occur due to chance and were absolutely stable.

In the TDCS group, with regard to the depression variable, the RCI results were not clinically meaningful, and it can simply be concluded that the observed changes were not the result of stable changes (Table 4). According to the results of Table 2, while controlling the pre-test effects, the results of the covariance test showed a significant difference between CBT and TDCS groups in terms of quality of life in the post-test phase. The CBT was statistically more effective in improving the patients' quality of life in the post-test phase. Besides, there was no significant difference between the CBT and TDCS groups in one- and two-month follow-ups. Although the mean value for the CBT group in one- and two-month follow-ups was higher than that of TDCS group, no statistically significant differences were found between the two
groups. Furthermore, there was no significant difference between the CBT and tDCS groups in one- and two-month follow-ups. Although the mean of CBT group in one- and two-month follow-ups was more than that of tDCS group, there was no statistically significant difference between the two groups. Based on the magnitude of reported effects in the tables, the effectiveness of CBT in improving the quality of life was more than the one in TDCS method.

**Table 2**: Average, standard deviation and Covariance analysis statistics for comparison of CBT group with tDCS in dependent variable: Obsessive-compulsive, depressive and quality of life symptoms.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Phase</th>
<th>CBT</th>
<th>tDCS</th>
<th>source</th>
<th>Df</th>
<th>Mean square</th>
<th>F</th>
<th>p.value</th>
<th>Eta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obsessive-Compulsive</td>
<td>Post Test</td>
<td>14.4 ± 11.9</td>
<td>22.2 ± 6.9</td>
<td>group 1</td>
<td>1</td>
<td>196.5</td>
<td>3.04</td>
<td>0.099</td>
<td>0.152</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Error 17</td>
<td>17</td>
<td>56.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Follow Up(1)</td>
<td>12.9 ± 13.9</td>
<td>21.7 ± 11.5</td>
<td>group 1</td>
<td>1</td>
<td>131.3</td>
<td>1.58</td>
<td>0.230</td>
<td>0.109</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Error 13</td>
<td>13</td>
<td>82.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Follow Up(2)</td>
<td>13.5 ± 11.4</td>
<td>20.7 ± 9.7</td>
<td>group 1</td>
<td>1</td>
<td>157.6</td>
<td>2.4</td>
<td>0.144</td>
<td>0.157</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Error 13</td>
<td>13</td>
<td>65.23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>Post Test</td>
<td>13.5 ± 12.7</td>
<td>17.9 ± 9.1</td>
<td>group 1</td>
<td>1</td>
<td>85.16</td>
<td>1.08</td>
<td>0.314</td>
<td>0.060</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Error 17</td>
<td>17</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Follow Up(1)</td>
<td>± 13.6</td>
<td>16.6 ± 9.1</td>
<td>group 1</td>
<td>1</td>
<td>0.221</td>
<td>0.003</td>
<td>0.958</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.6</td>
<td></td>
<td>Error 13</td>
<td>13</td>
<td>76.49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Follow Up(2)</td>
<td>12.9 ± 12.7</td>
<td>16.1 ± 8.4</td>
<td>group 1</td>
<td>1</td>
<td>1.12</td>
<td>0.016</td>
<td>0.903</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Error 13</td>
<td>13</td>
<td>71.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of Life</td>
<td>Post Test</td>
<td>± 21.4</td>
<td>43.4 ± 16</td>
<td>group 1</td>
<td>1</td>
<td>995.2</td>
<td>5.99*</td>
<td>0.026</td>
<td>0.261</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55.5</td>
<td></td>
<td>Error 17</td>
<td>17</td>
<td>166.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Follow Up(1)</td>
<td>± 26.1</td>
<td>43.6 ± 19.9</td>
<td>group 1</td>
<td>1</td>
<td>844.5</td>
<td>4</td>
<td>0.067</td>
<td>0.236</td>
</tr>
<tr>
<td></td>
<td></td>
<td>56.6</td>
<td></td>
<td>Error 13</td>
<td>13</td>
<td>210.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Follow Up(2)</td>
<td>± 26.2</td>
<td>45.1 ± 16.7</td>
<td>group 1</td>
<td>1</td>
<td>643.3</td>
<td>2.6</td>
<td>0.130</td>
<td>0.168</td>
</tr>
<tr>
<td></td>
<td></td>
<td>56.5</td>
<td></td>
<td>Error 13</td>
<td>13</td>
<td>245.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[P<0.01, *P<0.05\]

1 Average, standard deviation and Covariance analysis statistics for comparison of CBT group with tDCS in dependent variable: Obsessive-compulsive, depressive and quality of life symptoms.
Table 3. Estimation of RCI (CBT group)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre Test</th>
<th>Post Test</th>
<th>Follow Up(1)</th>
<th>Follow Up(2)</th>
<th>Pre-Post</th>
<th>Pre-Follow Up (1)</th>
<th>Pre-Follow Up (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M ±SD</td>
<td>M ±SD</td>
<td>M ±SD</td>
<td>M ±SD</td>
<td>RCIs</td>
<td>RCIs</td>
<td>RCIs</td>
</tr>
<tr>
<td>OCD</td>
<td>27.1 ± 4.8</td>
<td>14.4 ± 11.9</td>
<td>12.9 ± 13.9</td>
<td>13.5 ± 11.4</td>
<td>4.67</td>
<td>5.33</td>
<td>5</td>
</tr>
<tr>
<td>Depression</td>
<td>27.6 ± 10.3</td>
<td>13.5 ± 12.7</td>
<td>12.6 ± 13.6</td>
<td>12.9 ± 12.7</td>
<td>1.86</td>
<td>1.98</td>
<td>1.94</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>38.2 ± 17.9</td>
<td>55.5 ± 21.4</td>
<td>56.6 ± 26.1</td>
<td>56.5 ± 26.2</td>
<td>-1.37</td>
<td>-1.45</td>
<td>-1.45</td>
</tr>
</tbody>
</table>

Table 4. Estimation of RCI (tDCS group)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre Test</th>
<th>Post Test</th>
<th>Follow Up(1)</th>
<th>Follow Up(2)</th>
<th>Pre-Post</th>
<th>Pre-Follow Up (1)</th>
<th>Pre-Follow Up (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M ±SD</td>
<td>M ±SD</td>
<td>M ±SD</td>
<td>M ±SD</td>
<td>RCIs</td>
<td>RCIs</td>
<td>RCIs</td>
</tr>
<tr>
<td>OCD</td>
<td>28.5 ± 4.7</td>
<td>22.2 ± 6.9</td>
<td>21.7 ± 11.5</td>
<td>20.7 ± 9.7</td>
<td>2.37</td>
<td>2.6</td>
<td>2.93</td>
</tr>
<tr>
<td>Depression</td>
<td>28 ± 9.8</td>
<td>17.9 ± 9.1</td>
<td>16.6 ± 9.1</td>
<td>16.1 ± 8.4</td>
<td>1.4</td>
<td>1.58</td>
<td>1.65</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>40.5 ± 13.4</td>
<td>43.4 ± 16</td>
<td>43.6 ± 19.9</td>
<td>45.1 ± 16.7</td>
<td>-0.31</td>
<td>0.33</td>
<td>-0.46</td>
</tr>
</tbody>
</table>

2 Descriptive statistics and estimation of RCI in four time periods and their comparison in dependent variables (CBT group)
3 Descriptive statistics and estimation of RCI in four time periods and their comparison in dependent variables (tDCS group)
Discussion

The evaluation of the subjects' scores in CBT and TDCS groups showed that both methods have been effective in the treatment of OCD when they were combined with drug therapy. The analysis demonstrated that the clinical effectiveness for CBT method was more significant. In the following section, the results of the previous studies are presented for each variable:

Regarding the obsessive-compulsive symptoms, the results of the study by Alilu et al. (2008) which showed a significant difference between the control group and "cognitive behavioral therapy" and "exposure and response prevention" groups in the reduction of obsessive-compulsive symptoms - are consistent with the findings of the present study (Alilu M, 2008). The meta-analytic study carried out by Asadi et al. (2012) showed that cognitive behavioral therapy is an effective way of treating OCD (Asadi M, Shiralipour A, Shakuri Z, & SH, 2012). Concerning the aforementioned results, Abramowitz (2003) also argued that CBT is associated with significant changes in the reduction of obsessive-compulsive symptoms (Abramowitz J A, Foa EB, & ME, 2003).

In line with the findings of the present study, in a study by Bation et al. (2016) which used tDCS treatment as a cathode on the left OFC and anode on the right side of the cerebellum, the reduction of obsessive-compulsive symptoms was observed. Furthermore, it is worth mentioning that patients who were not involved in any kind of drug therapy did not respond to TDCS treatment. Therefore, the combination of SSRIs and TDCS could be more successful for treatment purposes than any other methods (Bation R, 2016). To put it differently, it seems that the significant effects of TDCS treatment on reducing the symptoms of OCD were primarily due to its combination with drug therapy. In the study of Kuo and Nietsche (2014) who used TDCS as a cathode in the F3 region and anode in the shoulder, there was no reduction in obsessive-compulsive symptoms. An increased number of samples in the present study can be the reason for this inconsistency. Additionally, co-administration of TDCS treatment and drug therapy may have contributed to its effectiveness (Kuo M, 2014).

Abramowits (2003) indicates that ERP treatment is associated with significant changes in the reduction of depressive symptoms (Abramowitz J A et al., 2003). Zandberg et al. (2015) have shown that changes in OCD and depressive symptoms had an effect on each other and OCD improvement has a greater impact on depression than the other way around. Generally speaking, changes in OCD symptoms had an overall effect on the treatment of depressive symptoms. The reduction of depressive symptoms which has occurred in response to ERP treatment may have reduced the symptoms of OCD. This decrease appears to be due to the reduction of symptoms of the main illness (Zandberg LJ, 2015). The results of the case study which is carried out by Alizadeh et al. (2016) showed that tDCS had a significant effect on depressive and obsessive-compulsive symptoms (Alizadeh Goradel J, Pouremsali A, Mowlaie M, & F, 2016). Aronson et al. (2014) showed that DLPFC, OFC, ACC, and corpus striatum acted as the most important brain structures related to depression, anxiety, and OCD whose cathodic stimulation leads to a decrease in the symptoms of depression, anxiety and OCD (Aronson, 2014).

Abramowitz (2006) investigated the effectiveness of ERP on depression symptoms in OCD patients who were co-morbid with severe depression and reported the results that were inconsistent with the findings of the present study. Of course, it should be noted that in patients who suffer from a co-morbid depressive disorder, the decrease in anxiety level cannot be
achieved due to an intense and highly emotional response. Furthermore, the result of the treatment (feeling comfortable in the next exposure to anxiety stimuli), as well as the understanding of the unrealistic nature of the patient's obsessive-compulsive discomfort, may not be achieved (Abramowitz J S, 2006).

Nowadays, life quality is regarded as one of the important health factors and has been measured in various studies. To the researchers’ best knowledge, regarding the effect of TDCS treatment on the quality of life, there has not been a separate and independent study so far. However, in line with the findings of the present study, the results of the study conducted by Sirvastava (2008) showed a significant improvement in quality of life before and after the CBT (especially ERP) treatment as well as a changed effect size from pre-test to post-test with respect to life quality. Furthermore, there was a significant relationship between Y-BOCS and life quality scores after treatment and follow-up stages (Srivastava S, 2008). Other studies have also indicated that improved quality of life in clients who have responded to treatment was higher than that of those who did not. In other words, as a result of the recovery from symptoms, the burden of disease in the individuals’ daily lives will decrease (Moritz S, 2005). Contrary to the aforementioned results, there was no significant relationship between the severity of OCD symptoms and quality of life in the study of Speisman (B, 2012). In the study of Vasudev (2015) on OCD, it was found that the quality of life only improved in the psychological and social spheres of these patients (Vasudev RG, 2015). The findings that indicated improvement in life quality are considered as sub-categories of obsessive-compulsive treatment such as drug therapy, CBT, TDCS, and DBS (Soh P, Vaingankar J A, Picco L, & A, 2013).

The following factors are among the limitations of this project that should be taken into consideration when interpreting the results. Firstly, the sample was selected from a single institution, namely Shahid Beheshti Medical Center of Zanjan. Secondly, the size of the sample, as well as participants’ differences in number of the years of infection, could be considered as other limitations of this study. The implementation of similar studies with a larger number of participants might increase the generalizability of these findings. It is also suggested to base TDCS treatment protocol on every individual’s specific brain map and QEEG to identify and treat the involved brain regions.

**Conclusion**

Based on the findings of this study, both CBT and TDCS treatments along with drug therapy could significantly reduce the symptoms of OCD and depression among patients from pre-test to post-test and follow-ups. Moreover, they may help improve the patients’ quality of life. In fact, in this study, the average scores for this change in the CBT group were higher and found to be more effective in this regard. Therefore, it is advisable to use this treatment along with medication in treating OCD patients. The findings of this study should be interpreted with great care. Although the researchers attempted to control the situation as much as possible, it is difficult to control all the conditions regarding psychological treatment in case of all human subjects. Further studies are warranted while addressing the suggestions and limitations of this study.

**Ethical Considerations**
This study was conducted in compliance with the ethical guidelines of Zanjan University of Medical Sciences. The ethics code No ZUMS.REC.1394.336 was issued for this study, and then it was registered in Iranian Registry of Clinical Trials with IRCT IRCT2016061728504N1.

**Funding**
This paper was based on a master's thesis entitled "Effectiveness of combination of exposure and response prevention (ERP) versus transcranial direct current stimulation (tDCS) in patients with obsessive-compulsive disorder".

**Conflict of interest**
There is no conflict of interest associated with this study.

**Acknowledgments**
We wish to express our sincerest appreciation to the subjects who agreed to participate in this study.

**References**


B, S. (2012). *Quality of Life in Adult Obsessive-Compulsive Disorder: The Role of Moderating and Mediating Variables*. University of South Florida Scholar Commons, College of Arts and Sciences University of South Florida.


