

Original Article

Comparing the Efficacy of Emotion-Focused Therapy and Transcranial Direct Current Stimulation On Impulsivity, Emotion Regulation, And Suicidal Ideation In Young People With Borderline Personality Disorder

Mohammadreza Noroozi Homayoon¹, Zahra Akhavi Samarein², Masoud Sadeghi³, Mohamad Hatami Nejad^{4*} & Mahdi Jafari Moradlo⁵

1. PhD Student in Counseling, Department of Counseling, Faculty of Educational Sciences and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran.
2. Associate Professor, Department of Counseling, Faculty of Education and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran.
3. Associate Professor, Department of Psychology, Faculty of Literature and Humanities, Lorestan University, Khorramabad, Iran.
4. PhD student in Clinical Psychology, Department of Psychology, Faculty of Psychology and Educational Sciences, University of Tehran, Tehran, Iran.
5. MSc Family Counseling, Department of Counseling, Faculty of Educational Sciences and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran.

Abstract

The present study was conducted to compare the effectiveness of emotion-focused therapy and transcranial direct current stimulation on impulsivity, cognitive-emotional regulation, and suicidal thoughts in young people with borderline personality disorder. The current research is a semi-experimental type with pre-test–post-test and control group. The statistical population of this research includes people with borderline personality disorder who were referred to the psychiatric hospital in Ardabil city in the summer of 2022. The statistical sample of the research consisted of 45 people with borderline personality disorder who were selected by purposive sampling. The current survey includes three groups with at least 15 participants in each group. Subjects were randomly assigned to two groups of emotion-focused therapy, transcranial direct current stimulation and control group. The tools of this research included Barrett's impulsivity questionnaire, Garnefsky's cognitive-emotional regulation (CERQ), Beck Scale for Suicidal ideations (BSSI), and the research tools included emotion-focused therapy and transcranial direct current stimulation. The results of the Bonferroni test in the post-test stage indicated a significant difference between emotion-focused therapy and transcranial direct current stimulation in emotional cognitive regulation, impulsivity and suicidal thoughts; However, no significant differences were found between the two experimental groups across any of the variables. Emotion-focused therapy and transcranial direct current stimulation are effective in emotional cognitive regulation, impulsivity and suicidal thoughts in young people with borderline personality disorder; Therefore, it is suggested to use these two interventions to regulate emotional cognition, reduce impulsivity and reduce suicidal thoughts.

Keywords

Emotion-focused therapy
Transcranial direct current stimulation
Impulsivity
Cognitive-emotional regulation
Suicidal thoughts
borderline personality disorder

Received: 2024/01/21

Accepted: 2024/05/04

Available Online: 2025/02/20

Introduction

Borderline personality disorder is one of the most common psychiatric disorders (Sabri et al., 2022). According to DSM 5, borderline personality disorder is a persistent and severe mental disorder that affects 1–2% of the population, and its prevalence in women is twice that

of men. Individuals with this disorder have a pervasive pattern of instability in interpersonal relationships, self-image, and individual desires (Zafaranchizadeh Moqadam et al., 2022). Borderline personality disorder is a complex mental illness characterized by numerous deficiencies in interpersonal relationships, self-concept, cognitive, emotional and behavioral actions; experts

Corresponding author: PhD student in Clinical Psychology, Department of Psychology, Faculty of Psychology and Educational Sciences, University of Tehran, Tehran, Iran. E-mail: hataminejad.mh@fh.lu.ac.ir



classify individuals with this disorder at the borderline between neuroticism and psychosis (APA, 2013). This disorder is a chronic psychological disorder with emotional dysregulation, self-injury, and dysfunctional interpersonal relationships, which may have been caused by a defect in cognitive functions (Esmailian et al., 2020). Borderline personality disorder is a serious, debilitating and severe disorder characterized by feelings of escape, impulsivity, hypersensitivity in interpersonal relationships, an unstable sense of self, frequent suicidal thoughts, and acts of self-harm (Noroozi Homayoon et al., 2023). It may disrupt crucial psychological characteristics such as executive functions, cognitive regulation, attachment styles, and overall quality of life, which hold significant importance. Consequently, these individuals may experience difficulties in emotion regulation, experiential avoidance, suicidal thoughts, and other psychological challenges (Amini et al., 2022; Mohammad Hatami Nejad, fazlolah mirderikvand, et al., 2024; Mohamad Hatami Nejad et al., 2024; Mohammad Hatami Nejad, Esmail Sadri Damirchi, et al., 2024; Nejad et al., 2025; Noroozi Homayoon, Hatami Nejad, & Sadri Damirchi, 2024; Noroozi Homayoon, Hatami Nejad, Sadri Damirchi, et al., 2024).

Therefore, one of the variables that can be related to borderline personality disorder is impulsivity. People with borderline personality disorder show instability in all aspects of life, including interpersonal relationships, self-concept, and feelings and emotions. They also show high impulsivity, which typically emerges before early adulthood (Masoumi & Nowbakht, 2022). In other words, the core of borderline personality disorder is the difficulty in emotion regulation, and a person with borderline personality disorder is characterized by a pattern of instability of mood, interpersonal relationships, identity, and impulsivity, which imposes a high cost on the health systems of countries (Dehghani et al., 2022). One of the main characteristics of individuals with BPD is impulsiveness because high risk-taking endangers people's physical and mental health and prevents them from proper social functioning. Therefore, various studies have investigated the risk factors of impulsivity pathology (Zohrabi & Sarafraz, 2021). High extravagance, unsafe sex, overeating, substance abuse, delinquency, pathological gambling, violence, and drunken driving are examples of their impulsive behaviors (Inanloo et al., 2022; Strickland & Johnson, 2021). Also, another characteristic of such patients is the person's intense involvement with issues such as severe and widespread disorders of emotion, behavior, and cognition (Perrotta, 2020).

Another concept related to borderline personality disorder is cognitive-emotional adjustment (Sorgi-Wilson & McCloskey, 2022). Poor cognitive-emotional regulation can make a person face mood disorders, including anxiety disorders and depression, and, as a result, make a person prone to borderline personality disorder (Rodas et al., 2022). Frequent and intense responses to emotional stimuli are characteristic of borderline personality behavior patterns, and this emotional vulnerability causes

the patient to be emotionally aroused. The result of this high arousal is behavioral instability, poor control over emotions, and poor interpersonal communication (Cavelti et al., 2021). Therefore, relationship defects and instability are the most basic characteristics of borderline personality disorder sufferers, which lead to interpersonal problems and emotional instability (Stoffers-Winterling et al., 2020). On the other hand, in this disorder, cognitive and emotional symptoms are damaged, and the cognitive regulation of emotions is disturbed. Cognitive regulation of emotion is defined as the process, the beginning of maintenance, adjustment, or change in the occurrence, intensity, or continuity of inner feeling and emotion related to social, psychological, and physical processes in achieving one's goals, and it is a mechanism by which people consciously or unconsciously control their emotions. They change to achieve the desired result (Siroos et al., 2021). Therefore, considering that emotion regulation is defined as the use of mechanisms, skills, and strategies to maintain, increase, or suppress an existing emotional state, it can be used as a strategy for mood management (Betegón et al., 2022). Cognitive-emotional regulation is also considered one of the usual strategies of emotional regulation, which involves cognitive regulation and refers to how individuals think when experiencing a harmful or distressing event (Salehi et al., 2021). Therefore, considering that people with borderline personality disorder have many problems in cognitive and emotional regulation processes, it seems that cognitive-emotional regulation strategies are highly related to borderline personality symptoms in both clinical and non-clinical samples (Kahya & Munguldar, 2023).

Another variable that seems to be related to borderline personality disorder is suicidal thoughts. Suicidal thoughts seem to be severe in people with mood disorders, and considering the high coexistence of borderline personality disorder with mood disorders, it seems that these types of thoughts are related to borderline personality disorder (Söderholm et al., 2023). The fifth edition of the *Statistical and Diagnostic Manual of Mental Disorders* (2013) describes one of the criteria for borderline personality disorder as follows: "Suicidal behavior, gestures, or repeated threats of suicide; patients with this disorder have chronic thoughts of suicide, and in this case, they take many actions." Various studies show that patients with borderline personality disorder are at high risk of suicide; therefore, their suicidal behavior and thoughts should be taken seriously (Neece et al., 2013).

There is reasonable evidence that psychotherapy interventions are useful for people with borderline personality disorder (Stoffers-Winterling et al., 2020), among which one of the interventions that seems to be effective in addressing the challenges faced by individuals with borderline personality disorder is emotion-focused therapy, which is an integrative treatment that combines three systematic perspectives: empiricism, adult attachment theory to deal with various individual and couple anxiety disorders, personality disorders, especially borderline personality disorder, and

a wide range of traumas and distresses caused by life events (MacIntosh et al., 2019). Greenberg's emotion-focused therapy is based on the belief that emotions are often incomprehensible and impenetrable to reason. He believes that people who cannot throw away their negative feelings should be encouraged to reconnect with those feelings and find a positive understanding of them. He also believes that when people change their perception of a person or event, they can change their emotional reactions accordingly (Greenberg, 2014). Some available research evidence indicates that the use of an emotion-focused therapeutic approach can lead to more use of positive cognitive strategies for emotion regulation and, on the contrary, reduce the use of cognitive regulation strategies in negative cognitive styles (Greenberg, 2014). In this regard, Babapour et al. (2023) showed in their research that emotion-focused therapy has a positive effect on borderline personality disorder and will reduce the symptoms of these people. Saeidmanesh and Demehri (2022) showed in their research that emotion-focused therapy is effective in improving the nightmares and emotional instability of people with borderline personality disorder. Afsar et al. (2022) showed in research that improving emotional regulation and attachment styles through emotion-focused therapy can enhance the mental health of women with borderline personality disorder. Afsar et al. (2021) showed that the effectiveness of emotion-focused therapy is more effective than schema therapy in the treatment of borderline personality disorder.

Among other interventions that seem to be able to reduce the symptoms of borderline personality disorder is transcranial direct current stimulation (Noroozi Homayoon et al., 2023). Transcranial Direct Current Stimulation (tDCS) is a safe and non-invasive method of brain stimulation (Ebrahimi & Azizi, 2022). Transcranial Direct Current Stimulation is a neuromodulation technique that induces a low-intensity direct current to brain cells that causes spontaneous stimulation or inhibition of neural activity, and it has been used as an effective method to improve cognitive function, mental health, and physical performance (Amini & Vaezmousavi, 2021; Arshadi et al., 2022; Torabi & Mortazaeedarsara, 2022). Among the studies that investigated the effect of transcranial Direct Current Stimulation on borderline personality disorder is the research of Gallucci et al. (2023), who showed that tDCS applied to the Ventromedial prefrontal cortex (VLPFC) led to a reduction of negative emotions in patients with borderline personality disorder. Chiappini et al. (2022) showed in their research that modulating brain functions by repetitive transcranial magnetic stimulation (rTMS) and transcranial Direct Current Stimulation (tDCS) seems to play a role in the treatment of borderline personality disorder. Noroozi Homayoon et al. (2023) also showed that tDCS and rTMS led to a reduction in impulsive behaviors and self-harm behaviors in individuals with borderline personality disorder. Molavi et al. (2020) showed in their research that direct tDCS showed a significant improvement in the main areas of executive

function, which ultimately led to the improvement of cognitive re-evaluation, emotion regulation, and several emotional processing factors involved in emotion control. Cullen et al. (2019) showed that targeting rumination with conscious breathing and transcranial direct current stimulation reduced suicidal ideation symptoms in adolescents. Azizaram et al. (2021) showed in their research that tDCS is effective in improving emotion regulation and dysfunctional attitudes in people with borderline personality disorder. Considering the numerous challenges faced by individuals with borderline personality disorder and their impact on those around them, and also considering that both current treatment methods (emotion-focused therapy and tDCS) are among the new treatments, In today's era, however, no research has been done to determine which intervention is more effective than another. Therefore, this research seeks to compare the effectiveness of emotion-focused therapy and tDCS on impulsivity, cognitive-emotional regulation, and suicidal thoughts in young people with borderline personality disorder.

Method

Participants

The current research is semi-experimental, with a pre-test, post-test, and control group. The statistical population of this research includes people with borderline personality disorder who were referred to the psychiatric hospital in Ardabil City in the summer of 2022. The statistical sample for the research consisted of 45 people with borderline personality disorder who were selected using a non-random sampling method.

Instrument

Barratt Impulsivity questionnaire 11:

The Barratt Impulsivity Questionnaire 11 (Patton, Stanford, and Barrett, 1995) was used in this research. Barratt Impulsivity Scale 11 included 30 four-point Likert-scaled items scored from never (1) to always (4). The content of this questionnaire is summarized in the form of three impulsivity factors from the original version of this tool: lack of planning, motor impulsivity, and cognitive impulsivity. Cognitive impulsivity represents tolerating complexities and resistance in immediate decision-making situations. Movement impulsivity shows action without thinking and reflection, and impulsivity based on a lack of planning shows inattention to foresight in behavior and actions. Also, all items have a positive score (Karadag & Demir, 2023). In the research of Javid et al. (2012), who standardized this questionnaire, the number of items was reduced from 30 to 25 items, and 5 items were removed from the questionnaire due to their factor loading being less than 0.30. In the research of Javid et al. (2012), the reliability and retesting of the questionnaire were respectively for the subscales of unplanned impulsivity (0.80, 0.79), motor impulsivity (0.67, 0.73), cognitive impulsivity (0.70, 0.49), and the whole scale (0.81, 0.77), indicating that the

questionnaire has good validity.

Cognitive Emotion Regulation Questionnaire (CERQ):

The cognitive regulation of emotion questionnaire was first prepared by Garnefski (2006); each question deals with a person's thinking after experiencing a threatening or stressful event. In the shortened version of the questionnaire, it was reduced to 18 questions (Besharat, 2016) standardized in Iran. Each component was evaluated using two items to facilitate data analysis. This questionnaire examines people's reactions to stressful situations. The questionnaire will be used for people over 12 years old. The mentioned questionnaire is an 18-item instrument, and the cognitive regulation strategies of emotions in response to life-threatening and stressful events are scored on a five-point scale from 1 (never) to 5 (always); According to nine subscales: self-blame, blaming others, rumination, catastrophizing, decision-making, positive refocusing, positive reappraisal, acceptance, and planning. Cognitive maladaptive strategies include: focusing on thinking, self-blame, blaming others, and catastrophizing, and cognitive adaptive strategies include: decision-making; positive refocusing; positive reassessment; the reception; Planning shows that the higher the person's score in those components, the greater the use of that cognitive strategy. The alpha coefficient for the subscales of this questionnaire has been reported by Garnefski et al (2002) in the range of 0.71 to 0.81. The psychometric properties of the questionnaire have been reported as favorable and suitable. (Garnefski et al., 2002; Garnefski, Ban, and Kraij, 2005; Kraij et al., 2003). Cronbach's alpha calculated for compatible and incompatible strategies was 0.75 and 0.73, respectively, which is an acceptable value.

Beck Scale for Suicidal Ideations (BSSI):

This questionnaire was created in 1979 by Aaron Beck. The Beck Scale for Suicidal Ideations is a 19-question self-assessment tool. This questionnaire was prepared to reveal and measure the intensity of attitudes, behaviors, and plans for suicide over the past week. The scale is set based on 3 points from 0 to 2, and the total score of the person is calculated based on the sum of the scores, which is from 0 to 38. Each question has three options; the measurement scale is from zero to two (a score of zero means nothing, a score of one means to some extent, and a score of two means a lot). The range of scores for the desire to die with five questions from zero to ten and passive suicide with four questions Zero to eight and active suicide with ten questions is from zero to 20, and the total score of the person based on the sum of the scores is from zero to 38. In this test, the higher the score of the person, the higher the level of suicidal thoughts. Cronbach 0.82 and the correlation of this tool with the SCL-90-R mental disorders test in a sample

including 535 people and 51 people reported values equal to 0.57 and 0.50, respectively (Esfahani et al., 2015). In another study in Iran, Cronbach's alpha coefficient was equal to 0.9, and using the test-retest method, its reliability was equal to 0.74 (Sadri Damirchi et al., 2019).

Transcranial Direct Current Stimulation (tDCS):

It is a non-invasive method that delivers a mild electric current through the skull to the brain (Nitsche et al., 2008). In the present study, transcranial direct current stimulation was applied using the two-channel NEUROSTIM 2 device, manufactured by Medina Medical Company. Using two independent energy sources, this device provides two cathode electrodes and two anode electrodes that are completely isolated and separate. In this method, the anode pole leads to an increase in cortical excitability, and the cathode pole leads to a decrease in cortical excitability (Fregni et al., 2005). The output current of the device can be adjusted from 0.1 mA to 2 mA. The carbon electrodes were conductive, and to prevent the chemical reaction, the contact point between the electrode and the skin was placed inside artificial sponges dipped in a 0.9% sodium chloride solution. This device can constantly control the impedance of the electrodes and prevents any risk of burns and skin damage.

Procedure

The current research includes three groups, and it is suggested that at least 15 people be present in each group (Delavar, 2008). Participants were randomly assigned to three treatment groups: emotion-focused therapy, Transcranial Direct Current Stimulation, and the control group. The inclusion criteria for this study include diagnosis of borderline personality disorder by a psychiatrist and psychologist; having a high school diploma or higher; not having other disorders (especially psychosis); age group between 18 and 30 years; absence of metal objects in the body or head and the absence of intracranial implants such as stimulants; informed consent of the patient and his family to participate in the study. The exclusion criteria for the sample of this research are: not taking anticonvulsants or antipsychotic drugs, participant absence for more than two sessions, lack of patient cooperation, and inability to understand pre-test concepts criteria for subject withdrawal from the study. They were carefully examined by a psychiatrist. Subjects were guaranteed confidentiality and information non-disclosure. Then, for the group treated with Transcranial Direct Current Stimulation, the function and side effects of the Transcranial Direct Current Stimulation (tDCS) device were also explained to the participants regarding the test process. Before the interventions were carried out, the subjects were asked to answer the scales of impulsivity, emotional cognitive regulation, and suicidal thoughts as a pre-test. They participated in tDCS programs for a 20-minute session. The end electrode was placed in the F3 part, and the cathode electrode was placed in the F4 part with an intensity of 2 milliamperes (mA). In the control

group, there was no intervention; the schedule of visits to the clinic of the Effort group was planned on different days and hours so that they did not have any collisions with each other that would have a side effect on the results of the research. At the end of the sessions, participants were once again asked to complete questionnaires on impulsivity, emotional cognitive regulation, and suicidal thoughts as a post-test. Of course, no treatment was done in the control group; only pre-tests and post-tests were taken from the participants.

Finally, the data collected from the participants was analyzed for descriptive and inferential statistics using SPSS-26 software at a significant level ($p < 0.05$).

Greenberg's Emotion-focused Therapy Protocol (1980):

Emotion-focused Therapy sessions in 12 sessions of 90 minutes and weeks. The experiment was performed twice on one of the groups. A summary of treatment sessions in Table 1 is presented.

Table 1. Greenberg's emotion focused therapy protocol (1980)

Session Content
First session, Introducing and getting to know the members/explaining the objectives of the meetings/explaining the method of doing work/explaining the rules of the meeting/Creating good communication
Second session, Observing and evaluating participants' problems based on the ability to focus on inner experiences and conceptualization of Emotion-focused therapy and introducing emotional instability to them
Third session, Creating conditions for the emergence of usually unpleasant emotional experiences in the context of communication and family and so on Challenging them and creating a favorable emotional cycle
Fourth session, Creating conditions for the emergence of usually unpleasant emotional experiences in the context of communication and family and so on, challenging them, and creating a favorable emotional cycle
Fifth session, Each narrative in the form of an emotional plan included elements proposed: the position of perception Symbolic recognition, action orientation and recognition of the primary emotional core
Sixth session, Expressing unmet needs and validating them through attention to markers (signs Non-verbal: body language, contradictory expression, unpleasant expression and voice quality)
Seventh session, For unresolved interpersonal issues and emotional wounds, calls for the presence of a significant other, A new experience and a response to the old situation
Eighth session, For the split related to self-evaluation (self-critical, self-experienced, self-inhibited) and conflict in decision-making, breaking the sense of duality in oneself and exploring two different aspects of one's experience.

Results

The results of the recent study, which involved 45 individuals with borderline personality disorder and educational backgrounds ranging from diploma to master's degree, consisted of 30 women and 15 men divided into two experimental groups and a control group. The transcranial direct current stimulation test group comprised 11 women and 4 men aged 18 to 29, with an average age of 23.45 (SD = 5.31); the emotion-oriented test group had 9 women and 6 men aged 21 to 28, with an average age of 25.75 (SD = 4.55); and the control group included 10 women and 5 men aged 19 to 30, with an average age of

27.60 (SD = 7.58). Covariance analysis assumptions were then assessed. The data's normal distribution was confirmed by the Kolmogorov-Smirnov test and Z statistic results for variables across research rounds and groups ($p < 0.05$), indicating a normal data distribution with 95% confidence. Levene's test showed non-significant statistics for all variables, establishing homogeneity of variances and covariance matrices. The homogeneity of variance hypothesis was also supported before conducting covariance tests between variables. Descriptive statistics for the mean and standard deviation of the three groups in the variables under study are presented in Table 2.

Table 2. Mean and standard deviation of variables in various groups during pre-test and post-test phases

Groups	Stages	tDCS		emotional therapy		control	
		Mean	±SD	Mean	±SD	Mean	±SD
Adaptive cognitive strategies	Pre-test	22.9	7.14	23.6	10.8	20.8	10.6
	Post-test	33.84	9.81	34.36	11.9	22.59	8.9
Inconsistent cognitive strategies	Pre-test	24.6	8.92	25.86	7.11	28.93	9.17
	Post-test	16.54	10.17	16.93	8.9	26.86	10.09
Impulsiveness	Pre-test	79.94	13.52	80.19	15.22	80.56	12.36
	Post-test	67.42	14.78	67.2	13.76	76.83	13.25
Suicidal thoughts	Pre-test	18.84	3.91	18.37	4.79	19.27	3.32
	Post-test	13.54	3.16	12.82	3.59	17.69	3.53

After analyzing Table 2, it is clear that the average pre-test and post-test scores of the test groups—transcranial direct current stimulation and Emotion-focused therapy—indicate an improvement in adaptive cognitive strategies and a reduction in cognitive strategies. Furthermore, there was a reduction in inconsistency, impulsivity, and suicidal thoughts. A multivariate

covariance analysis (MANCOVA) was conducted to assess the assumptions. The results indicated that normality assumptions were tested using the Shapiro-Wilk test, revealing that the sub-variables of compatible and incompatible cognitive strategies, impulsiveness, and suicidal ideation across all three groups and the two stages of pre-test and post-test exhibited a normal

distribution. Levene’s test and Box’s M test also indicated non-significance for all research variables. Thus, the assumption of variance homogeneity for the

research variables was not rejected. Table 3 displays the results of the multivariate covariance test.

Table 3. Multivariate analysis of covariance test

	Variables	Source	T-squares	Df	M sq	F	sig	Eta.coef
Cognitive emotional regulation	Adaptive cognitive strategies	Group	1267.354	2	579.342	61.34	0.02	0.67
		Error	246.7	42	5.764			
		Total	39157	45				
	Inconsistent cognitive strategies	Group	1124.54	2	601.142	76.13	0.001	0.82
		Error	168.564	42	5.189			
		Total	18686	45				
Impulsiveness	Group	301.485	2	156.846	22.72	0.001	0.71	
	Error	101.352	42	6.375				
	Total	15684	45					
Suicidal thoughts	Group	1064.09	2	491.303	31.245	0.006	0.66	
	Error	209.21	42	6.984				
	Total	26543	45					

Controlling for pre-test scores, the group's impact on post-test scores of cognitive-emotional regulation, impulsivity, and suicidal thoughts proved significant. Following the intervention, compatible cognitive strategies scores notably increased, while incompatible cognitive strategies, impulsivity, and suicidal thoughts decreased significantly. These results suggest that transcranial direct current stimulation and Emotion-

focused therapy effectively contribute to cognitive emotion regulation, reducing impulsivity and suicidal thoughts in individuals with borderline personality disorder. To accurately assess differences between experimental and control groups, Bonferroni's post hoc test was utilized, with results detailed in Table 4 (P<0.05).

Table 4. Bonferroni post hoc test

Variables	Group	MD	sig
Adaptive cognitive strategies	tDCS - control	6.25	0.021
	Emotional therapy-control	7.52	0.009
	tDCS-Emotional therapy	0.733	1
Inconsistent cognitive strategies	tDCS - control	-8.688	0.001
	Emotional therapy-control	-9.573	0.001
	tDCS-Emotional therapy	3.187	0.37
Impulsiveness	tDCS - control	-7.674	0.024
	Emotional therapy-control	-6.575	0.036
	tDCS-Emotional therapy	0.800	1
Suicidal thoughts	tDCS - control	-10.342	0.001
	Emotional therapy-control	-6.842	0.001
	tDCS-Emotional therapy	-3.182	0.254

The post-test Bonferroni analysis revealed a significant disparity in emotional cognitive regulation, impulsivity, and suicidal thoughts between the experimental groups and the control group. Nevertheless, no notable distinction was observed in any variables between the two experimental groups.

Discussion

This study aimed to assess the impact of emotion-focused therapy and transcranial direct current stimulation on impulsivity, cognitive-emotional regulation, and suicidal ideation in individuals with borderline personality disorder. The analysis revealed significant differences in impulsivity, cognitive strategies, and suicidal thoughts between the experimental and control groups across pre-test and

post-test measurements. Notably, while the experimental groups showed improvements in these areas post-treatment, the control group did not exhibit significant changes. Moreover, adaptive cognitive strategy scores increased in the experimental group's post-treatment, contrasting with the control group. The results supported the hypothesis that emotion-focused therapy can reduce impulsivity, maladaptive cognitive strategies, and suicidal thoughts while enhancing adaptive cognitive strategies in individuals with borderline personality disorder. These findings align with previous research by [Afsar et al. \(2022\)](#), [Saeidmanesh and Demehri \(2022\)](#) and [Afsar et al. \(2021\)](#). The study suggests that emotional dysregulation, emotional suppression, and childhood traumas contribute to impulsivity and suicidal ideation

in individuals with this disorder, emphasizing the importance of addressing these issues.

Emotion-focused therapy, which integrates attachment-oriented and experiential systemic approaches, has emerged as a promising intervention for individuals with borderline personality disorder. This approach focuses on intrapersonal factors and conflict processes, aiming to delve into underlying psychological structures within interpersonal relationships rather than merely resolving conflicts. The findings supported the effectiveness of emotion-focused therapy in improving impulsivity, cognitive-emotional regulation, and suicidal ideation.

Similarly, the study demonstrated that transcranial direct current stimulation (tDCS) can reduce impulsivity, maladaptive cognitive strategies, and suicidal thoughts while enhancing adaptability in individuals with borderline personality disorder. These results are consistent with prior studies by [Noroozi Homayoon et al. \(2023\)](#), [Amini and Vaezmousavi \(2021\)](#), [Torabi and Mortazaedarsara \(2022\)](#), [Aziziarani et al. \(2021\)](#), [Molavi et al. \(2020\)](#) and [Cullen et al. \(2019\)](#). In explaining this discovery, it can be suggested that the stimulation zone likely plays a crucial role in alleviating symptoms of borderline personality disorder in individuals. One effective intervention for reducing these symptoms is transcranial direct current stimulation, which enhances the physical, psychological, and cognitive functions of individuals. Through altering neuron excitability and modulating the membrane potential of surface neurons towards depolarization or hyperpolarization, transcranial direct current stimulation influences the firing of brain cells. Additionally, by impacting the resting potential of nerve cell membranes, stimulation in the targeted region can alter neuron resting times, thereby enhancing brain excitability and normalizing nervous system function. Stimulation with direct electric current in the left lateral dorsal prefrontal region can decrease impulsivity and aggression. Furthermore, applying tDCS to the left hemisphere of the brain reduces depression symptoms, particularly suicidal tendencies, by 67% in individuals with borderline personality disorder ([Hadley et al., 2011](#)). tDCS is typically administered at positions F3 and F4, corresponding to electrode placement. The dorsolateral prefrontal region is crucial for cognitive control of emotional processes and emotional information processing. Reduced activity in this area is linked to impulsive behaviors and emotional dysregulation, while external electrical stimulation increases cortical activity, enhancing emotional control and cognitive regulation ([Noroozi Homayoon et al., 2023](#)). Thus, the research supports the second hypothesis that transcranial direct current stimulation affects impulsivity, cognitive-emotional regulation, and suicidal ideation in individuals with borderline personality disorder. The study, like others, had limitations, including sampling methods, a small sample size, reliance on clinical interviews for diagnosis, and potential biases. Given the results indicating the impact

of emotion-focused therapy and transcranial direct current stimulation on impulsivity, cognitive-emotional regulation, and suicidal thoughts in individuals with borderline personality disorder, it is recommended that larger-scale studies be conducted with extended follow-up periods to validate the findings. These therapeutic approaches could be adopted as non-pharmacological treatments by mental health professionals in psychological service centers and neuropsychiatric clinics. The present study also has limitations that hinder generalization. These include the non-random and purposeful sampling method, lack of control over intervening variables and use of questionnaires as a self-assessment tool leading to potential errors. Future researchers are expected to address these limitations.

Conclusion

Finally, it can be concluded that emotion-focused therapy and transcranial direct current stimulation (tDCS) were effective in reducing impulsivity, improving cognitive-emotional regulation, and decreasing suicidal ideation in young individuals. A significant difference was observed between the two experimental groups, suggesting the superiority of one treatment over the other. Based on these findings, specialists and psychotherapists in the field of personality disorder treatment are encouraged to incorporate emotion-focused therapy (tDCS) into their treatment plans to enhance symptom reduction and overall outcomes.

Acknowledgment

We would like to express our deepest gratitude to all those who supported us during the completion of this study.

Disclosure Statement

The authors reported no conflict of interest.

ORCID

Mohamad Hatami Nejad: <https://orcid.org/0000-0001-9655-0434>

References

- Afsar, M., Hasani, F., & Farzad, V. (2022). The effectiveness of emotion therapy on emotion regulation and attachment styles in women with borderline personality disorder. *Medical Journal of Mashhad university of Medical Sciences*, 65(2), 654-666. doi: 10.22038/mjms.2022.63257.3709
- Afsar, M., Hassani, F., Farzad, V., & Golshani, F. (2021). Comparison of the Effectiveness of Emotionally-Focused Therapy (EFT) and Mindfulness-Based Schema Therapy (MBST) on Emotion Regulation in Women with Borderline Personality Disorder (BPD). *Journal of Applied Family Therapy*, 2(1), 276-262. doi: 10.22038/mjms.2021.19612
- Amini, A., & Vaezmousavi, M. (2021). The Effect of Transcranial Electrical Stimulation on Athletic

- Performance Optimization: Systematic Review, Meta-Analysis, and Proposing a Theoretical Model. *The Neuroscience Journal of Shefaye Khatam*, 9(4), 81-104. doi: 10.52547/shefa.9.4.81
- Amini, D., Almasi, M., & Noroozi Homayoon, M. (2022). Effectiveness of sensory-motor integration exercises and computerized cognitive rehabilitation on executive functions (working memory, response inhibition and cognitive flexibility) in children with Attention Deficit/Hyperactivity Disorder. *Empowering Exceptional Children*, 13(2), 95-79. doi: 10.22034/ceciranj.2022.318579.1619
- APA. (2013). Diagnostic and statistical manual of mental disorders. *Am Psychiatric Assoc*, 21(21), 591-643.
- Arshadi, S., Nokani, M., Asgari, M., & Sepahvand, T. (2022). The effectiveness of cognitive rehabilitation of inhibitory control, transcranial direct current stimulation and combination of inhibitory control and transcranial direct current stimulation on inhibitory control and working memory in children with attention deficit disorder/hyperactivity. *Journal of Research in Psychopathology*, 3(10), 35-47. doi: 10.22098/jrp.2022.10977.1108
- Azizaram, S., Basharpour, S., Atadokht, A., & Molavi, P. (2021). The effectiveness of Transcranial Direct Current Stimulation (tDCS) on improving Emotion Regulation and dysfunctional attitudes in people with Borderline Personality Disorder. *Rooyesh-e-Ravanshenasi Journal (RRJ)*, 10(7), 115-126. doi: 20.1001.1.2383353.1400.10.7.5.7
- Babapour, S., Shafiabadi, A., Shamir, A. S., & Andbil, A. F. (2023). The effectiveness of emotion-focused therapy on borderline personality disorder. *Journal of Personality and Psychosomatic Research (JPPR)*, 1(1), 6-9. doi:10.61838/kman.jppr.1.1.2
- Besharat, M. A. (2016). Cognitive emotion regulation questionnaire: instruction and scoring. doi: 1054776
- Betegón, E., Rodríguez-Medina, J., Del-Valle, M., & Irurtia, M. J. (2022). Emotion regulation in adolescents: Evidence of the validity and factor structure of the cognitive emotion regulation questionnaire (CERQ). *International Journal of Environmental Research and Public Health*, 19(6), 3602. doi:10.3390/ijerph19063602
- Cavelti, M., Thompson, K., Betts, J., Fowler, C., Luebbers, S., Cotton, S. M., & Chanen, A. M. (2021). Borderline personality disorder diagnosis and symptoms in outpatient youth as risk factors for criminal offenses and interpersonal violence. *Journal of personality disorders*, 35(Supplement C), 23-37. doi: 10.1521/pedi_2021_35_503
- Chiappini, S., Picutti, E., Alessi, M. C., Di Carlo, F., D'Andrea, G., Miuli, A., Pettorruso, M., Martinotti, G., & di Giannantonio, M. (2022). Efficacy of noninvasive brain stimulation on borderline personality disorder core symptoms: a systematic review. *Journal of personality disorders*, 36(5), 505-526. doi: 10.1521/pedi.2022.36.5.505
- Cullen, K., Thai, M., Lim, K., & Klimes-Dougan, B. (2019). Targeting rumination with combined mindful breathing and tDCS in adolescents with suicidal thoughts. *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation*, 12(2), 583. doi:10.1016/j.brs.2018.12.935
- Dehghani, M., Sadeghi-Firoozabadi, V., Heidari, M., & Khatibi, A. (2022). Structural equation modeling of borderline personality disorder and alexithymia: the mediating role of depression and anxiety. *Journal of Modern Psychological Researches*, 16(64), 153-169. doi: 20.1001.1.27173852.1400.16.64.14.3
- Delavar, A. (2008). Research method in psychology and educational sciences. Tehran. In: Payame Noor Publications.
- Ebrahimi, Z., & Azizi, Z. (2022). Investigating the effectiveness of Transcranial Direct Current Stimulation (tDCS) on the treatment of anxiety disorder in chronic renal dialysis patients. *Journal of Research in Psychopathology*, 3(8), 19-25. doi: 10.22098/jrp.2022.10331.1064
- Esfahani, M., Hashemi, Y., & Alavi, K. (2015). Psychometric assessment of beck scale for suicidal ideation (BSSI) in general population in Tehran. *Medical journal of the Islamic Republic of Iran*, 29, 268. doi: PMC4715388/
- Esmaeilian, N., Dehghani, M., Moradi, A., & Khatibi, A. (2020). Attention bias and working memory in people with borderline personality symptoms with and without non-suicidal self-injury. *Adv Cogn Sci*, 22(1), 36-48. doi:10.30699/icss.22.1.36
- Fregni, F., Boggio, P. S., Nitsche, M., Bermpohl, F., Antal, A., Feredoes, E., Marcolin, M. A., Rigonatti, S. P., Silva, M. T., & Paulus, W. (2005). Anodal transcranial direct current stimulation of prefrontal cortex enhances working memory. *Experimental brain research*, 166, 23-30. doi: 10.1007/s00221-005-2334-6
- Gallucci, A., Lisco, A., Fabietti, C., Preti, E., Riva, P., De Panfilis, C., & Lauro, L. J. R. (2023). The regulation of emotions associated with social exclusion: modulating effects of tDCS on patients with borderline personality disorder. *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation*, 16(1), 325-326. doi: 10.1016/j.brs.2023.01.607
- Greenberg, L. (2014). The therapeutic relationship in emotion-focused therapy. *Psychotherapy*, 51(3), 350. doi: 10.1037/a0037336
- Hadley, D., Anderson, B. S., Borckardt, J. J., Arana, A., Li, X., Nahas, Z., & George, M. S. (2011). Safety, tolerability, and effectiveness of high doses of adjunctive daily left prefrontal repetitive transcranial magnetic stimulation for treatment-resistant depression in a clinical setting. *The journal of ECT*, 27(1), 18-25. doi: 10.1097/ycet.0b013e3181ce1a8c
- Hatami Nejad, M., mirderikvand, f., & sepahvandi, m. (2024). Structural Relationships of Anxiety Sensitivity and Sense of Coherence with Readiness to Use Substances in College Students: The Mediating Role of Difficulty in Emotion Regulation [Research].

- Research on Addiction*, 17(70), 149-174. doi:10.61186/etiadjpajohi.17.70.149
- Hatami Nejad, M., Noroozi Homayoon, M., Sadeghi, M., & Sadri Damirchi, E. (2024). Development of a student social anxiety model based on uncompromising perfectionism and experiential avoidance with a mediating role of difficulty in emotion regulation. *Journal of Applied Psychological Research*. doi: 10.22059/japr.2024.375061.644904
- Hatami Nejad, M., Sadri Damirchi, E., Akhavi Samarein, Z., Jafari Moradloo, M., & Noroozi Homayoon, M. (2024). Comparing the effectiveness of narrative therapy and emotion focused therapy on primary maladaptive schemas, impulsivity and depression in students with suicidal thoughts. *Journal of Psychological Studies*, 20(3), 7-23. doi:10.22051/psy.2024.47061.2955
- Inanloo, M., Bashardoust, S., & Abolmaali Alhosseini, K. (2022). The modeling structural prediction of online games addiction based on HEXACO personality and parent-child relationships with role mediator impulsivity. *Journal of Applied Family Therapy*, 3(1), 285-310. doi:10.22034/aftj.2022.293484.1131
- Javid, M., Mohammadi, N., & Rahimi, C. (2012). Psychometric properties of an Iranian version of the Barratt Impulsiveness Scale-11 (BIS-11). *Psychological Models and Methods*, 2(8), 23-34. doi: 20.1001.1.22285516.1391.2.8.2.1
- Kahya, Y., & Munguldar, K. (2023). Difficulties in emotion regulation mediated the relationship between reflective functioning and borderline personality symptoms among non-clinical adolescents. *Psychological reports*, 126(3), 1201-1220. doi:10.1177/00332941211061072
- Karadag, M., & Demir, B. (2023). The impact of impulsivity and school attendance on COVID-19 spread: A web-based cross-sectional questionnaire. *Psychology in the Schools*, 60(5), 1581-1593. doi:10.1002/pits.22700
- MacIntosh, H. B., Fletcher, K., & Ainsworth, L. (2019). Measuring mentalizing in emotionally focused therapy for couples with childhood sexual abuse survivors and their partners. *Journal of Couple & Relationship Therapy*, 18(4), 303-329. doi:10.1080/15332691.2019.1590274
- Masoumi, M., & Nowbakht, M. (2022). The Effect of Dialectical Behavior Therapy on Reducing Impulsivity in women with Comorbid Borderline Personality Disorder and Glass Abuse in Welfare Social Emergency Clients in Hamadan Province. *Journal of Psychology New Ideas*, 11(15), 1-14. doi:1-662-en.html
- Molavi, P., Aziziaran, S., Basharpour, S., Atadokht, A., Nitsche, M. A., & Salehinejad, M. A. (2020). Repeated transcranial direct current stimulation of dorsolateral-prefrontal cortex improves executive functions, cognitive reappraisal emotion regulation, and control over emotional processing in borderline personality disorder: A randomized, sham-controlled, parallel-group study. *Journal of Affective Disorders*, 274, 93-102. doi:10.1016/j.jad.2020.05.007
- Neece, C. L., Berk, M. S., & Combs-Ronto, L. A. (2013). Dialectical behavior therapy and suicidal behavior in adolescence: linking developmental theory and practice. *Professional Psychology: Research and Practice*, 44(4), 257. doi: 10.1037/a0033396
- Nejad, M. H., Damirchi, E. S., Sadeghi, M., & Homayoon, M. N. (2025). Developing a Model of Experiential Avoidance Based on Childhood Trauma and Victimization, Mediated by Insecure Attachment Styles. *European Journal of Trauma & Dissociation*, 100513. doi:10.1016/j.ejtd.2025.100513
- Nitsche, M. A., Cohen, L. G., Wassermann, E. M., Priori, A., Lang, N., Antal, A., Paulus, W., Hummel, F., Boggio, P. S., & Fregni, F. (2008). Transcranial direct current stimulation: state of the art 2008. *Brain stimulation*, 1(3), 206-223. doi:10.1016/j.brs.2008.06.004
- Noroozi Homayoon, M., Almasi, M., Sadri Damirchi, E., & Hatami Nejad, M. (2023). Comparing the effectiveness of transcranial direct current stimulation and repeated Transcranial Magnetic Stimulation treatment on working memory, impulsivity and self-harm behaviors in people with borderline personality. *Neuropsychology*, 8(31), 1-19. doi:10.30473/clpsy.2023.65222.1678
- Noroozi Homayoon, M., Hatami Nejad, M., & Sadri Damirchi, E. (2024). The effectiveness of psychodrama group therapy and cognitive behavioral play therapy on executive functions (working memory, response inhibition, cognitive flexibility and emotional self regulation) in male students with social anxiety disorder. *Neuropsychology*, 9(35). doi:10.30473/clpsy.2024.68482.1710
- Noroozi Homayoon, M., Hatami Nejad, M., Sadri Damirchi, E., & Sadeghi, M. (2024). Comparing the Effectiveness of Emotion Regulation Training and Transcranial Direct Current Stimulation on Improving Executive Functions and Impulsivity in Male Students with Attention Deficit Hyperactivity Disorder. *Neuropsychology*, 10(37). doi:10.30473/clpsy.2024.71022.1742
- Perrotta, G. (2020). Borderline personality disorder: Definition, differential diagnosis, clinical contexts, and therapeutic approaches. *Annals of Psychiatry and Treatment*, 4(1), 043-056. doi:10.17352/apt.000020
- Rodas, J. A., Jara-Rizzo, M. F., Greene, C. M., Moreta-Herrera, R., & Oleas, D. (2022). Cognitive emotion regulation strategies and psychological distress during lockdown due to COVID-19. *Int J Psychol*, 57(3), 315-324. doi:10.1002/ijop.12818
- Sabri, V., Yaghubi, H., Hasani, J., & Mahmodalilo, M. (2022). The effectiveness of dialectical behavior therapy and emotional schema therapy on reducing the symptoms of borderline personality disorder. *Clinical Psychology and Personality*, 19(2), 1-16. doi: 10.22070/cpap.2021.13899.1048
- Sadri Damirchi, E., Zakibakhsh Mohammadi, N., & Basir Amir, S. M. (2019). The role of thwarted

- belongingness, perceived burdensomeness, self-efficacy and ego strength in predicting suicidal ideation of nurses. *Health in emergencies and disasters quarterly*, 4(2), 85-92. doi:10.32598/hdq.4.2.85
- Saeidmanesh, M., & Demehri, F. (2022). effectiveness of emotionally focused therapy (eft) on nightmare and emotional instability in people with borderline personality disorder. *Rooyesh-e-Ravanshenasi Journal (RRJ)*, 11(10), 119-128. doi:20.1001.1.2383353.1401.11.10.11.6
- Salehi, H., Hoseinian, S., & Yazdi, S. M. (2021). The relationship between successful marriage and self-differentiation: The mediating role of cognitive emotion regulation. *Journal of Woman and Family Studies*, 9(4), 63-78. doi:10.22051/jwfs.2021.34813.2635
- Siroos, M., Mirzaian, B., & Hasanzadeh, R. (2021). The effectiveness of functional analytical therapy on controlling, expressing and internalizing anger in patients with a borderline personality disorder. *International Journal of Health Studies*, 12-16. doi:10.22100/ijhs.v7i4.877
- Söderholm, J. J., Socada, J. L., Rosenström, T. H., Ekelund, J., & Isometsä, E. (2023). Borderline personality disorder and depression severity predict suicidal outcomes: A six-month prospective cohort study of depression, bipolar depression, and borderline personality disorder. *Acta Psychiatrica Scandinavica*, 148(3), 222-232. doi:10.1111/acps.13586
- Sorgi-Wilson, K. M., & McCloskey, M. S. (2022). Emotion regulation strategies among individuals with borderline personality disorder relative to other groups: A review. *Clinical Psychology & Psychotherapy*, 29(5), 1655-1678. <https://doi.org/https://doi.org/10.1002/cpp.2738>
- Stoffers-Winterling, J., Storebø, O. J., & Lieb, K. (2020). Pharmacotherapy for borderline personality disorder: an update of published, unpublished and ongoing studies. *Current Psychiatry Reports*, 22, 1-10. doi:10.1007/s11920-020-01164-1
- Strickland, J. C., & Johnson, M. W. (2021). Rejecting impulsivity as a psychological construct: A theoretical, empirical, and sociocultural argument. *Psychological review*, 128(2), 336. doi:10.1037/rev0000263
- Torabi, F., & Mortazaeedarsara, Z. (2022). The effect of direct brain electrical stimulation on concentration and the record of pistol shooter. *Journal of Sports and Motor Development and Learning*, 13(4), 407-425. doi: 10.22059/jmlm.2021.328654.1601
- Zafaranchizadeh Moqadam, M., Mojtabaie, M., & Bashardoust, S. (2022). Study of the relationship between dark triad of personality with cold empathy with mediating role of emotional and cognitive theory of mind in individuals with borderline personality disorder symptoms. *Journal of Modern Psychological Researches*, 17(65), 129-142. doi:10.22034/jmpr.2022.14882
- Zohrabi, M., & Sarafraz, M. R. (2021). Impulsivity Prediction Model: The Role of Perfectionism Dimensions and Coping Strategies. *Military Psychology*, 12(47), 89-108. doi:0.1001.1.25885162.1400.12.47.5.8