Comparison of the effects of emotionally focused therapy and transcranial direct current stimulation on anxiety and quality of life of patients with coronary artery disease during COVID-19 pandemic

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Research Article

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Abstract

Background

The COVID-19 pandemic has increased psychological distress and impacted diagnosis and treatment of noncommunicable diseases. This study aimed to examine the comparative effectiveness of Emotionally Focused Therapy (EFT) and Transcranial Direct Current Stimulation (tDCS) on anxiety and quality of life in patients with coronary artery disease (CAD) during COVID-19 pandemic.

Methods

A total of forty-five participants who met criteria for a current episode of CAD chosen by convenience sampling method from Tehran city were randomly assigned to a 9-week/60-min EFT (n = 15) group therapy, 5-week/20-min tDCS (n = 15) experimental group and one control group (n = 15). They were assessed at pre-treatment, post-group, and 3-month follow-up. The study subjects completed the self-reported questionnaires, Beck Anxiety Inventory (BAI) and Health-Related Quality of Life (HRQOL).

Results

Repeated measures analysis of variance, ANOVA, was used to measure inferential statistics. There were significant improvements in Anxiety and Quality of Life scores in both EFT and tDCS groups over the post and follow-up period (P > 0.05). However, difference was found when EFT had a greater effect on Anxiety and Quality of Life.

Conclusions

These results showed EFT and tDCS have effective interventions in reducing anxiety and improving the quality of life of CAD patients, but improvements with EFT were greater than those with tDCS.

Introduction

COVID-19 is a worldwide crisis with a great impact in health structures which delay in the management of routine medical conditions has been reported during this pandemic (Endamena et al., 2021). Cardiovascular complications, especially acute coronary syndromes, are effective factors in the mortality rate of COVID-19 subjects (Kermani-Alghoraishi, 2021). Data are limited on the psychological disorders of patients with cardiovascular disease during the post-COVID-19 period, although mental health status is associated with morbidity and mortality (Wu et al., 2021). Coronary syndrome, the manifestations of which are physical-psychological, in addition to pain and vomiting, patients suffer from stress (Li et al., 2020) and psychological injuries (Shao et al., 2020). The resulting deaths of coronary artery disease (CAD) by year 2030 will reach about 23.6 million people which majority will be from South Asia (Saha et
al., 2021). Due to this high prevalence and high mortality, this disease has received a lot of attention in recent decades and so far, many studies have been conducted on pathophysiology (Shah et al., 2022), prevalence and risk factors for coronary heart disease (CHD) (Dugani et al., 2021; Yang et al., 2021).

Risk factors for CHD include high blood pressure (Kim et al., 2020), diabetes (Christle et al., 2020), inadequate physical activity (Thomas et al., 2020), unhealthy diet and lifestyle (Bos et al., 2021). Patients with CHD are at high risk for mental health disorders, and psychological issues like anxiety (Mirbolouk et al., 2020) may affect the quality of life of these patients (Tang et al., 2021). Anxiety, whether present before or after the onset of illness, can lead to many serious consequences (Chen et al., 2019). Anxiety is considered distinct from the emotion of fear and panic, which is functionally related to actual confrontation with danger, not simply the detection of and preparation for danger. In contrast to anxiety, fear is conceptualized as activity of the fight or flight system and is characterized by surges of autonomic arousal and the associated action tendencies of escape, active avoidance, or defensive aggression (Chorpita & Barlow, 1998). Farquhar et al. (2018) aimed to evaluate the treatment of anxiety in patients with CHD and this study shows that the patient therapist in these patients can relieve the psychological symptoms of the resulting injuries in patients.

The presence of anxiety predisposes to CHD or exacerbates symptoms in patients with CHD which can reduce the quality of life associated with patients' health (de Bakker et al., 2020). In heart disease, due to the inability of the heart to supply blood, these patients experience several symptoms such as shortness of breath, dizziness and angina. These symptoms lead to intolerance to activity and cause changes in the patient's lifestyle that affect the quality of life (Zou et al., 2020). Since 1948, when the World Health Organization defined health as being not only the absence of disease and infirmity but also the presence of physical, mental, and social well-being, quality of life issues have become steadily more important in health care practice and research (Testa & Simonson, 1996). A model of quality of life is proposed that integrates objective and subjective indicators, a broad range of life domains, and individual values. It takes account of concerns that externally derived norms should not be applied without reference to individual differences. It also allows for objective comparisons to be made between the situations of particular groups and what is normative. Considerable agreement exists that quality of life is multidimensional. Coverage may be categorized within five dimensions: physical wellbeing, material wellbeing, social wellbeing, emotional wellbeing, and development and activity (Felce & Perry, 1995). According to a study, CHD patients experience lower levels of health-related quality of life due to physical and psychological problems (Drewes et al., 2021).

Depending on the problems of CHD patients, various interventions have been used to improve their problems, but what has not been addressed in previous research is emotionally focused therapy (EFT) and transcranial direct current stimulation (tDCS). EFT is a combination of systemic, humanistic, and attachment theory perspectives (Zwack & Greenberg, 2020). EFT is proposed for couples, families, and individuals to enhance the quality of people's emotional ties to significant others and their subjective sense of social connectedness. Strengthening of emotional, interpersonal bonds, which is the primary focus of all forms of EFT, can help restore emotional balance, thereby protecting people from chronic
feelings of isolation and the host of health problems that they can cause (Greenman & Johnson, 2022). The main hypothesis in this study is that EFT and tDCS are effective on anxiety and quality of life of patients with CAD. Based on the extensive research that has been done in this field, this is the first time that this issue has been expressed, especially during Covid-19 spread.

EFT views chronic anxiety as problematic in relationships, and sees a positive sense of connection as promoting flexibility and the tolerances of differences. Attachment-oriented approaches like EFT would view processes of seeking love or support as expressions of basic human needs that, if accepted, clearly expressed, and responded to are likely to lead to connection and so also to a stronger sense of self (Johnson, 2012). Reinitz (2018) in a systematic review aimed to explore how EFT may be an effective treatment for couples suffering from symptoms of anxiety and depression. In the study five areas of focus were uncovered that support the claim that EFT may be an effective treatment for couples suffering from symptoms of anxiety and depression.

Also tDCS is a non-invasive brain stimulation technique increasingly used to modulate neural activity in the living brain (Fonteneau et al., 2019) which was first introduced in animal and human experiments in the 1950s, and added to the standard arsenal of methods to alter brain physiology as well as psychological, motor, and behavioral processes and clinical symptoms in neurological and psychiatric diseases about 20 years ago (Stagg et al., 2018). tDCS is a neuromodulatory technique that delivers low-intensity, direct current to cortical areas facilitating or inhibiting spontaneous neuronal activity (Brunoni et al., 2012). tDCS involves a pair of electrodes that are placed over the scalp in order to pass a low intensity current through the cortex (Sallard et al., 2021). Several stimulation parameters may have an influence on efficacy of tDCS in individuals, including (1) the placement of the electrodes (e.g., the montage and the neural targets), (2) the intensity of the current, (3) the duration of the stimulation, (4) the timing of the stimulation (e.g., when the stimulation should be applied) (Lefebvre & Liew, 2017). According to research results, tDCS can improve anxiety (de Oliveira et al., 2019).

Since anxiety and lifestyle are important factors in the incidence and persistence of CHD, tDCS can play an important role in reducing CHD. tDCS can improve heart rate recovery and attenuate the central and peripheral blood pressure well as sympathetic modulation (Ministro et al., 2022). Miuli et al. (2020) aim to evaluate the use of tDCS on phantom pain (amputation pain): Efficacy and safety in patients with implantable cardiac defibrillator showed that the use of tDCS can stimulate and blood supply to the amputated limb in patients with cardiac defibrillator. Given the above, no research has compared the effectiveness of EFT and tDCS on health-related anxiety and quality of life in CHD patients. While both methods have advantages, it is questionable which treatment is more effective in reducing the psychological and emotional problems of CHD patients. Is it effective in Covid-19 pandemic or not?

Materials And Methods

Sample
The present study was an applied in terms of purpose and quasi-experimental in terms of research method with pre-test and post-test design with control group with a follow up of 3 months. The statistical population of this study was all patients with CAD referred to Shahid Rajaee Heart Hospital in Tehran in 1398 during the Covid-19 pandemic. By available voluntary sampling (non-random selection and random replacement) of 45 patients with CAD based on inclusion and exclusion criteria (inclusion criteria in the research include: 1. conscious consent to participate in the study, 2. Age range between 35 to 70 years, 3. Lack of history of physical and psychological illnesses (examination through medical records), exclusion criteria include: 1. Use of psychiatric and psychotropic drugs, 2. Absence from more than two sessions in therapeutic sessions, 3. Drug abuse And smoking 4. having psychiatric disorders) were selected and divided into two experimental groups and one control group (15 patients in the EFT group, 15 patients in the tDCS group and 15 patients in the control group).

Since in a similar study, the number of 15 subjects has been suggested to be appropriate (Sarmad et al., 2004), in this study the number of 15 people were selected and assigned to each research group. The EFT group was received 9 sessions of 60 minutes and the tDCS group was received 5 sessions of 20 minutes. In this study, no dropout occurred in any of the experimental and control groups and the number of people in each group remained constant until the end of the study.

**Psychometric instruments**

**Anxiety: the Beck Anxiety Inventory (BAI)**

The BAI is a single-factor, non-subscale list of 21 questions. The response indicates how much they have been bothered by each symptom over the past week. It was developed as a measure adept at discriminating between anxiety and depression (Beck & Steer, 1990). The grading method is done in a 4-point Likert scale (0 to 3) in such a way that zero score not at all, mild (it did not bother me much) 1 point, moderate (it was very unpleasant but I could stand it) 2 points and severe (I could barely stand it) 3 points are ranged. The score of the questionnaire is obtained in the range of zero to 63. Scores from 0 to 9 normal anxiety, 10 to 18 mild to moderate anxiety, 19 to 29 moderate to severe anxiety, and 30 to 63 are classified as severe anxiety (Julian, 2011). In Iran, the reliability and validity of the Beck Anxiety Inventory have been assessed. In a study, Cronbach's alpha was used to assess the reliability of the questionnaire (Alpha = 0.92) and a good reliability (r = 0.72, p < 0.001), a very good validity (r = 0.83, p < 0.001) (Kaviani & Mousavi, 2008). Abroad, the reliability of the Beck Anxiety Inventory has been investigated. In a study by the manufacturers, high internal consistency (Cronbach's $\alpha = .92$) and test–retest reliability, $r(81) = .75$ is reported (Beck et al., 1988). In other studies, Cronbach's alpha coefficient of questions ranged from 0.90 to 0.94 and the reliability coefficient by retest method at 7 weeks interval was 0.62. Also in other studies, Cronbach's alpha coefficient of 0.95 and halving coefficient of 0.92, Cronbach's alpha coefficient of 0.91 (Østergaard et al., 2020).

**MacNew Heart Disease HRQOL questionnaire**
MacNew's Health-Related Quality of Life Questionnaire has 27 questions that measure the three components of physical function, emotional function, and social function. Fourteen questions are about physical functioning, 14 questions are about emotional functioning, and 13 questions are about social functioning, and quality of life of cardiac patients. The time frame for the MacNew is the previous two weeks. Based on the scoring of the original MacNew Quality of Life Questionnaire, questions 1 and 6 in both physical and emotional areas and questions 2, 13 and 23 in both emotional and social areas and questions 17, 20, 21, 24, 25 and 26 in both physical and social domains and question 12 in all three domains of physical, emotional and social can be calculated. The questionnaire is graded on a 7-point Likert scale from 1 to 7. In this way, there are always 7 points, often 6 points, many times 5 points, half of the time 4 points, a little bit of time 3 points, rarely 2 points and never 1 point. Higher scores indicate a healthier quality-related quality of life (Lim et al., 1993; Valenti et al., 1996). Abbasi et al. (2017) calculated internal consistency (α = 0.94) and reproducibility (ICC = 0.84) of the Persian version of the MacNew. The Factor analysis confirmed three factors as the original MacNew. Convergent and divergent validity of the MacNew was confirmed by its correlation pattern with physical and mental components of the SF-36. Discriminative validity was confirmed statistically and clinically for the differences in the MacNew scores on the Global scale and each subscale between Iranian patients with and without anxiety and depression. Also in another study, Cronbach's alphas of the total scales ranged from 0.70 to 0.81 and of the subscales from 0.70 to 0.82. The Pearson correlation coefficient was used to determine construct validity; similar constructs were confirmed with correlation coefficients ranging from 0.50 to 0.69 and dissimilar constructs with correlation coefficients ranging from 0.28 to 0.29 (P < 0.010) (Saba et al., 2020).

**Emotionally Focused Therapy**

In this study, there are 9 sessions of EFT based on Johnson and Greenberg theory and Bowlby (1969) attachment theory that people in the experimental group are trained. The validity of these sessions has been confirmed in the research of Johnson (2008) and Johnson (2012).

During sessions 1 to 3, the facilitators familiarized the participants with the objective of the intervention. They explained the general rules of treatment, introduced the principles of EFT and performed the pretest. Unrecognized emotions that underlie interactive situations were identified. They focused more on the needs, emotion and fears of attachment. The experiences, attachment, needs and desires of participants were validated. Focused on the secondary emotions that are revealed in the interactive cycle, and explored them to identify basic and unknown emotions. Initial emotions were discussed and processed, and awareness of primary emotions and hot cognitions of participants were raised.

During the fourth to sixth sessions the facilitators re-stated problems in terms of underlying feelings and needs of attachment. They emphasized participants’ ability to express emotions, explained the impact of fear and its defense mechanisms on cognitive and emotional processes, described the cycle in the context and field of attachment. The subjects were encouraged to identify rejected needs and aspects of self-denial, to draw their attention to how they interact with each other, to express attachment needs and also to identify denied needs and increase acceptance of corrective experience. Facilitators informed
people about underlying emotions and revealing each person's position in the relationship. They emphasized the acceptance of the individual's experiences and new ways of interacting, highlighting and re-describing attachment needs, and pointing to their health and naturalness.

Sessions 7 to 9 involved developing needs, and desires. The expectations and early emotional experiences were expressed and internal needs and relationships were recognized. Facilitators tried to create new attachments with secure bonds. Interactive situations between people were created, tried to end old interactive patterns. Attachment needs were clarified and recalled. The changes that have taken place during treatment were strengthened. The differences between current and old interactions were highlighted. A relationship based on a secure link was formed so that discussed problems and searched solutions do not harm them. Changes were evaluated, and facilitators implemented posttest.  

Transcranial Direct Current Stimulation

The tDCS protocol basically follows the method reported by (Loo et al., 2010) and was given three times per week (Monday, Wednesday, Friday) 9:0 in the morning. The 15 subjects were treated using a continuous current electric stimulator (Caputron Activa Dose II, Gilroy, USA). The montage was bifrontal with the anode over F3 (left dorsolateral PFC) and the cathode over F4 (right dorsolateral PFC) according to the international 10/20 EEG system. Conductive rubber electrodes (7×5 cm = 35 cm$^2$) were placed in saline-soaked surface sponges. The amount of saline per sponge was standardized (15–20 ml per sponge). After careful skin cleaning, electrodes were secured in position with an elastic tubular netting. A conductive electrolyte gel was used between the electrode and the skin. Stimulation was given at 1 mA for 20 min for five treatment sessions.

At the end of the last session, subjects answered Beck's anxiety test and health-related quality of life questionnaire. The data obtained from the questionnaires were analyzed using SPSS software (version 24; IBM Corp., Armonk, NY, USA) in two descriptive and inferential sections (repeated measures analysis of variance, ANOVA).

Results

Demographic information and descriptive statistics, including frequency, and mean and standard deviation, are reported in this section. The mean age in the EFT group was 55.40 and the standard deviation was 10.43, in tDCS group the mean was 50.42 and the standard deviation was 9.27, and in the control group the mean was 55.07 and the standard deviation was 10.38. Also, among the sample members in the experimental group, 53.3% were male and 46.7% female, and in the group of tDCS 42.9% were male and 57.1% were female. In Table 1, the mean and standard deviation of the study groups in pre-test, post-test and follow-up are presented separately.
Table 1
Mean and standard deviation of research variables in pre-test, post-test and follow-up

<table>
<thead>
<tr>
<th>Pre-test</th>
<th>Post-test</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research variables</td>
<td>Group</td>
<td>Mean</td>
</tr>
<tr>
<td>Anxiety</td>
<td>Control</td>
<td>92/29</td>
</tr>
<tr>
<td></td>
<td>Experimental (EFT)</td>
<td>73/29</td>
</tr>
<tr>
<td></td>
<td>Experimental (tDCS)</td>
<td>07/29</td>
</tr>
<tr>
<td>Quality of life</td>
<td>Control</td>
<td>21/116</td>
</tr>
<tr>
<td></td>
<td>Experimental (EFT)</td>
<td>0/134</td>
</tr>
<tr>
<td></td>
<td>Experimental (tDCS)</td>
<td>85/131</td>
</tr>
</tbody>
</table>

Table 1 presents the mean and standard deviation of research variables. In general, as it is known, the mean index of anxiety and quality of life in the three research groups of control, EFT and tDCS in the pre-test are close to each other. The mean degree in post-test anxiety and quality of life decreased in the two groups of EFT and tDCS, but the difference in EFT was relatively greater than tDCS.

Table 2
Results of repeated measures analysis of variance for within-group effects and interaction

<table>
<thead>
<tr>
<th>Within Subjects Effect</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
<th>Eta squared</th>
<th>Test power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>31/372</td>
<td>67/1</td>
<td>03/223</td>
<td>72/10</td>
<td>0001/0</td>
<td>29/0</td>
<td>97/0</td>
</tr>
<tr>
<td>Anxiety and group</td>
<td>17/523</td>
<td>67/1</td>
<td>41/313</td>
<td>06/15</td>
<td>0001/0</td>
<td>37/0</td>
<td>99/0</td>
</tr>
</tbody>
</table>

As shown in Table 2, there was a significant difference between pre-test, post-test and follow-up test scores in anxiety (p ≤ 0.01). Also, a significant interaction was observed between factor levels (pre-test, post-test and follow-up) and groups in anxiety at the level (p ≤ 0.01). These results indicate the effectiveness of tDCS in reducing anxiety in heart disease patients. Based on the degree of effect or difference (Eta squared), 37% of the changes in the variance of anxiety scores are due to tDCS. Statistical power was also 0.99. The Bonferroni post hoc test was used to determine in which test stage the level of anxiety differed significantly.
As shown in Table 3, there was a significant difference between factor levels (pre-test, post-test and follow-up) in quality of life \((p \leq 0.01)\). Also, a significant interaction was observed between factor levels (pre-test, post-test and follow-up) and groups in quality of life \((p \leq 0.01)\). These results indicate a significant difference in the effectiveness of EFT and tDCS on quality of life in heart patients. According to the comparison of means, it can be said that EFT has been able to improve the quality of life in heart patients to a greater extent.

### Discussion And Conclusion

The aim of this study was to compare the effectiveness of EFT and tDCS on anxiety and quality of life of patients with CAD. According to the results of Table 2, which showed the effectiveness of EFT and tDCS on anxiety, it can be concluded that one way to reduce anxiety is to use EFT throughout the lives of these patients, and in addition, they can benefit from tDCS. Also, according to the results of Table 3, which shows the effectiveness of EFT and tDCS on quality of life, it is necessary to benefit from these two treatments for the greater well-being of patients and creating favorable conditions for patients with heart disease.

In general, anxiety is high in patients with heart disease (Meyer et al., 2019; Ryan, 2020a). Regarding the effectiveness of psychological interventions and treatment of tDCS in reducing anxiety syndrome, the results of the present study are consistent with the study of Naeim et al. (2021) and Ski et al. (2019) In addition, the effectiveness of EFT compared to other therapies is consistent with the results of a meta-analysis by Rathgeber et al. (2019). New concepts and ways of understanding emotion help us work with it more effectively, and many of these new ways offer an exquisite fit with EFT interventions to demonstrate less neural reactivity to rejection situations and suffer less from severe anxiety and depression (Johnson, 2019). Chen et al. (2021) also showed that because of the high frequency of anxiety and depression after percutaneous coronary intervention in patients with CAD and its effect on performance and treatment, the recovery requires special attention to this issue and efforts to Investigating effective and appropriate factors and strategies to reduce it.

Explaining the results, emotionally focused group therapy gives patients the ability to control negative emotions such as anxiety and increase their psychological adjustment by increasing emotional
awareness. Emotion group therapy methods try to encourage patients to question their disturbing thoughts during treatment and examine alternative self-talk to deal with these emotions and rumination that cause physical and mental disturbance (Judd, 2016). Also, according to emotionally focused group therapy, patients' disturbances are caused and continue by pervasive states of negative emotion and attachment disorders, disregard for inner needs and desires, negative interaction patterns, and inappropriate emotional experience. In fact, emotionally focused group therapy tries to identify emotions and turn them into understandable and constructive messages. Emotional skills, defined as the ability to recognize and express emotions, as well as the ability to empathize with others, reduce anxiety and increase feelings of security, reduce uncriticism in patients, and are essential in maintaining and maintaining interpersonal communication (Greenberg et al., 2003). EFT as a process-oriented psychotherapy, is an ideal approach to working with relationships during the global pandemic helping to solidify an “in it together” approach required to survive the pandemic (Allan et al., 2021).

Also, the results showed that EFT and tDCS are effective in improving the quality of life, and each of them individually was able to improve the quality of life in patients with heart disease. In addition, EFT was more effective in improving quality of life than tDCS. Quality of life is an important factor in patients with CAD so that there is a relationship between physical inactivity and quality of life in patients with CAD. Thus, physical inactivity can explain the physical weakness and quality of life associated with the health of these patients, which in turn worsens the psychological symptoms in heart patients (Ryan, 2020b; Wardoku et al., 2019). The treatment of tDCS through the blood supply of sedentary patients seems to provide the basis for their mobility (Miuli et al., 2020) and this mobility in heart patients can provide the basis for improving the quality of life so that the results showed tDCS to improve quality of life. Each of the treatment approaches, from a specific point of view, has considered individuals and addressed the issue of adaptation and quality of life. Among these, EFT integrates experiential and systemic perspectives. People are viewed as constructive, self-organizing beings having inherent tendencies to survive and grow (Greenberg & Johnson, 1988). Johnson et al. (1999) mentioned four key assumptions of EFT: First, emotional responses and interactional patterns are reciprocally determining and both must be addressed in therapy. Second, partners are stuck in negative patterns that preclude the responsiveness necessary for secure bonding. They are not viewed as immature or unskilled but, rather, as needing support to formulate their attachment needs and fears in a manner that promotes secure bonding. Third, emotion is seen as a key element in the definition and the redefinition of close relationships. New emotional experience and new interactions are necessary for change to occur. Fourth, adult intimacy is best viewed as an attachment process.

The result of a research by Kazemi Rezaei et al. (2019) showed that emotion regulation training, helps individuals manage their conflicting emotions by making them aware of feeling and how to properly use of cognitive emotion regulation strategies and provides the basis for how emotions can be managed appropriately to improve the quality of life of patients with Cardiovascular diseases.

Although in this study, in order to control the interfering variables and possible biases, individuals were randomly divided into two experimental groups and a control group but the lack of research related to the
subject, especially in the country, was one of the limitations of this research in terms of discussing the findings. Also, the use of self-report questionnaires was another limitation of the present study. Therefore, it is suggested that due to the characteristics of patients with CAD, such as anxiety and behavioral disorders and reduced quality of life in special cases, more attention should be paid to the use of EFT. It is also suggested that in future studies, this study be tested in various hemodialysis centers across the country.

**Abbreviations**

EFT: Emotionally focused therapy; tDCS: Transcranial direct current stimulation; CAD: Coronary artery disease; CHD: Coronary heart disease; BAI: Beck anxiety inventory; HRQOL: Health-related quality of life.

**Declarations**

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**Authors’ contributions**

SG developed the main idea, carried out the experiment, analyzed data and assessed scales. SE wrote the manuscript with support from SG. Both of the authors read and approved the final manuscript.

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No financial support was received for this research.

**Availability of data and materials**

Not applicable because this is a protocol.

**Ethics approval and consent to participate**

It should be noted that the present study was approved by National Ethics Committee for Biomedical Research with the code ID: IR.IAU.NAJAFABAD.REC.1398.088 and the privacy and confidentiality of the collected data was observed. The control group was also trained to observe the ethical standards of EFT and tDCS.

**Consent for publication**
During sampling, a session was held. We received consent for publication from each participant.

Competing interests

The authors declare that they have no competing interests.

References


