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Research paper

Comparing the Effectiveness of Cognitive-Behavioral Therapy and Trans- Cranial Direct Electrical Stimulation on Emotional Information Processing in People with Post-Traumatic Stress Disorder

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Abstract

The research aim was to compare the effectiveness of cognitive-behavioral therapy (CBT) and transcranial direct electrical stimulation (tDCS) on the rumination of people suffering from post-traumatic stress disorder (PTSD). The research method was a semi-experimental design of pre-test, post-test and follow-up with a control group. From people suffering from PTSD, aged 20 to 45, who referred to psychological centers in Kish Island in 2024, a sample of 45 was selected, purposefully, divided randomly equal into 3 groups. The research tools were Post-Traumatic Stress Disorder Questionnaires and the Rumination Response Style. The intervention with CBT was 8 sessions of 90 mins and with tD CS was 8 sessions of 40 mins. The ANOVA with repeated measures were applied to data. The results showed that CBT reduced rumination more and it can be concluded that CBT is more effective than tDCS on the rumination of people suffering from post-traumatic stress disorder.

Keywords: CBT, PTSD, rumination, tDCS

Introduction

Post-traumatic stress disorder (PTSD) is a mental health condition triggered by a traumatic event. Symptoms of this disorder include involuntary and recurring experiences of the event, avoidance of reminders of the stressful situation, and negative cognitive and mood responses related to the stressor (Brown et al., 2023). Individuals with PTSD often struggle with issues such as distress, anxiety, anger, and fear. Proper emotional processing can help improve their condition (Adugna et al., 2024). Emotional information processing refers to an individual's ability to recognize, interpret, and manage emotions. Normally, this process occurs naturally in the brain. However, in some individuals with PTSD, this process may be disrupted (Brown et al., 2023). Several therapeutic approaches aim to improve emotional information processing in people with PTSD. These include cognitive methods, which are used to increase awareness

of emotions and change negative thoughts (Romero Rebolar et al., 2020), such as, Cognitive Behavioral Therapy (CBT)which has been proved its usefulness on the treatment of PTSD. Additionally, non-invasive brain stimulation techniques have recently gained popularity (Mandel et al., 2023), as tools both for studying brain functions and as strategies to support them, such as transcranial magnetic stimulation. The present study, based on theoretical foundations and existing research findings, seeks to answer below question: Is there a difference in the effectiveness of CBT and transcranial direct current stimulation in emotional information processing in individuals with PTSD**?**

Method

This study was semi-experimental, employing a pre-test, post-test, control group design with a two-month follow-up. The population included individuals aged 20 to 45 years with PTSD who visited psychological and psychiatric centers and clinics on Kish Island 2023. The sample consisted of 45 individuals purposefully selected from these centers and randomly assigned to two experimental groups and one control group (15 individuals per group). The CBT group received group therapy for 8 sessions, each lasting 90 minutes, according to the treatment protocol. The transcranial direct current stimulation group received 8 sessions, each lasting 40 minutes. Research data were collected during three stages before and after the intervention and two months later. Data were analyzed using repeated measures ANOVA and Tukey and Bonferroni post hoc tests*.*

Tools at 0.86*.*

Baker's Emotional Information Processing Questionnaire (EPS-25): The original 48-item version was developed by Baker et al. (2007). The version used in this study consists of 25 items. The Cronbach's alpha reliability of this tool was reported as 0.92 and for this study was

Post-traumatic Stress Disorder Scale: The 19-item PTSD Scale was developed by Foa et al. (1993). Mohammadi et al. (2020) reported for this scale. In the present study, the internal consistency with a Cronbach's alpha was 0.92*.*

Results

The results of the M. Box statistic for none of the components and the total score of emotional information processing were significant, indicating that the assumption of homogeneity of covariance matrices of dependent variables among the data was met. Additionally, the chi-square value from the Mauchly's test for the emotional control component was significant (p = 0.025).

Table 1: Results of Repeated Measures ANOVA in Comparing the Effects of Independent Variables on Emotional Information Processing

Variable	Effects	SS	SSE	F	p-value	η^2
	Group Effect	7166.18	4399.42	34.21	0.001	**0.620**

Emotional Information Processing	Time Effect	3410.18	4738.87	30.22	0.001	**0.418**
	Group × Time Interaction	4264.71	9408.30	9.52	0.001	**0.312**

Table 1 shows (F = 9.52-3.81, p = 0.007-0.001).

Table 2: Results of Bonferroni Post Hoc Test for Emotional Information Processing

Variable	Stages		Mean Difference	Standard Error	p-value
Total Score	Pre-test vs	Post-test	14.22	2.31	0.001
	Pre-test vs	Follow-up	12.31	2.24	0.001
	Post-test vs	Follow-up	-1.91	2.14	1.00

Variable	Group Effect		Mean Difference	Standard Error	p-value
Total Score	**CBT**	**Transcranial Stimulation**	-8.69	2.16	0.001
	CBT	**Control Group**	-17.84	2.16	0.001
	Transcranial Stimulation	**Control Group**	-9.16	2.16	0.001

The Bonferroni test results in Table 2 indicate that the mean differences in components and the total score of emotional information processing between the pre-test and post-test, as well as the pre-test and follow-up stages, are statistically significant. However, the mean differences between the post-test and follow-up stages are not significant, indicating that both treatments were effective in improving emotional information processing and the difference of the average components and the total score of emotional information processing in the two groups of cognitive-behavioral therapy and transcranial direct electrical stimulation is significant compared to the control group. So that the average of the components and the total score of emotional information processing in both experimental groups has decreased compared to the control group.

Discussion and Conclusion

The findings of this study showed that both Cognitive Behavioral Therapy (CBT) and transcranial direct current stimulation had an impact on emotional information processing. Deficiencies associated with PTSD in cognitive control are linked to reduced reactivity in the prefrontal cortex, which follows emotional stimuli. In healthy individuals, the prefrontal cortex plays a role in cognitive control and, in addition, helps regulate emotions by inhibiting the amygdala and regions associated with the initial processing of emotional information from top to bottom. This finding can be explained by the fact that patients with PTSD suffer from emotion regulation deficiencies and chronic emotional instability, often lack insight into the psychological aspects of their disorder. Patients following the emotional processing cycle through this intervention, all are identified and becoming aware of them, modify using specific techniques. Even with the help of the therapist through techniques such as self-regulatory

soothing, the emotions regulation is managed. The limitations of the present study were the use of non-random and available sampling, non- equalizing the intensity of stress, as well as the time of its occurrence. It may be suggested that in future researches, by controlling these cases and also possible use of different intensities of tDCS, more generalizable results can be achieved

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Conflicts of interest

There is no conflict of interests for researchers.