



Journal of Fundamentals  
of Mental Health



Mashhad University  
of Medical Sciences



Psychiatry and Behavioral Sciences  
Research Center

*Original Article*

# Comparing the effectiveness of transcranial magnetic stimulation and cognitive-behavioral therapy on anxiety and depression

\*Alireza Salemi Khamene<sup>1</sup>; Saeed Bakhtiaripour<sup>2</sup>; Farah Naderi<sup>2</sup>; Alireza Heidari<sup>2</sup>; Parvin Ehteshamzadeh<sup>2</sup>

<sup>1</sup>Ph.D. student in psychology, Islamic Azad University, Research Science Branch of Khouzestan, Iran

<sup>2</sup>Assistant professor of psychology, Islamic Azad University, Research Science Branch of Khouzestan, Iran

---

## **Abstract**

**Introduction:** The purpose of this study was to compare the efficacy of transcranial magnetic stimulation and cognitive-behavioral therapy in reducing anxiety and depression in patients referred to psychiatric clinics in Tehran.

**Materials and Methods:** This clinical trial was conducted on clients referred to psychology clinics in Tehran during 2015 with diagnosis of depression and anxiety by psychiatric commission. Sixty individuals were selected by convenience sampling method. They were randomly divided into three groups (two experimental and one control). The research tool was Beck Depression Inventory and Beck Anxiety Inventory. One group received 12 sessions of cognitive-behavioral therapy and the other group received transcranial magnetic stimulation for 20 sessions. The control group did not receive any intervention. Data were analyzed by SPSS software using covariance analysis.

**Results:** There was a significant difference between transcranial magnetic therapy and cognitive-behavioral therapy in reducing anxiety and depression in clients ( $P < 0.01$ ).

**Conclusion:** It seems that transcranial magnetic stimulation and cognitive-behavioral therapy are effective in reducing anxiety and depression but cognitive-behavioral therapy can reduce depression and anxiety more than transcranial magnetic stimulation.

**Keywords:** Anxiety, Cognitive-behavioral therapy, Depression, Transcranial magnetic stimulation

---

*Please cite this paper as:*

Salemi Khamene A, Bakhtiaripour S, Naderi F, Heidari A, Ehteshamzadeh P. Comparing the effectiveness of transcranial magnetic stimulation and cognitive-behavioral therapy on anxiety and depression. *Journal of Fundamentals of Mental Health* 2020 Jan-Feb; 22(1): 31-35.

---

---

\*Corresponding Author: Islamic Azad University, Research Science

Branch of Khouzestan, Iran

Received: May. 31, 2017

Accepted: Feb. 02, 2018

## Introduction

Regarding to the high prevalence of depression and anxiety among adult populations and their burden on individuals, families and the societies, it is necessary that researchers focused on the new therapeutic approaches (1,2).

The evidences suggest that cognitive-behavioral therapy can be effective in reducing symptoms in cases who experience the mild-moderate levels of depression and anxiety (3-6).

Also, neuromodulatory techniques are considered as safe and effective methods to reduce anxiety and depression (7-9).

Transcranial Magnetic Stimulation (TMS) is a safe and non-invasive procedure to stimulate nervous system. In this technique, a current flows through the coil that is placed on the person's head. This electric current generates a local magnetic field that crosses the skull, and depolarizes the neurons (10,11).

While the majority of research in this area has shown that this method is effective, there are still findings that indicate that it is ineffective compared to other biological methods. Therefore, experimental studies on the efficacy of this technique and achieving optimal TMS parameters for the treatment of depression and anxiety disorder are still ongoing (12,13).

So, this research aimed to compare the effectiveness of CBT and TMS on anxiety and depression among the clients of psychological clinics.

## Materials and Methods

This clinical trial was conducted on clients referred to psychology clinics in Tehran during 2015 with diagnosis of depression and anxiety by psychiatric commission. Sixty individuals were selected by convenience sampling method. They were randomly divided into three groups (two experimental and one control). The research

tool was Beck Depression Inventory and Beck Anxiety Inventory. One group received 12 sessions of cognitive-behavioral therapy and the other group received transcranial magnetic stimulation for 20 sessions.

Transcranial brain stimulation conducted based on the common protocol, which includes a frequency of 10 Hz for a duration of 5 seconds, a distance of 16 seconds for each stimulus, 120% of motor threshold, a stimulation location equal to f3 in the 10-20 system, or LDLPFC and 20 minutes duration. The control group did not receive any intervention.

Research instrument

*A) Beck Depression Inventory-II:* Beck Depression Inventory is one of the most appropriate tools for measuring the severity of depression. The revised form of the Beck Depression Inventory is more in line with the DSM-IV than the original form. In addition, the second version of the questionnaire covers all the elements of depression based on the cognitive theory of depression. Each item receives a score of zero to 3 and thus the total score of the questionnaire ranges from zero to 63. The Beck Depression Inventory (Second edition) did not contain four items from the current version, and additional items were added to the questionnaire. In this questionnaire, two items (16 and 18) have been edited to be more sensitive to depression. This questionnaire is applicable to a population of 13 years or older (14,15).

The psychometric characteristics of this inventory reported as acceptable among Iranian population (Cronbach  $\alpha=0.87$ ) (16).

*B) Beck Anxiety Inventory:* Beck et al. (1990) developed the Beck Anxiety Inventory, which specifically measures the severity of clinical anxiety in individuals. Each of the 21 questions is scored on a 4-grade scale from 0 to 3. Each of the test

items describes one of the most common anxiety symptoms (mental, physical, and phobic symptoms) (17).

Studies show that this questionnaire has high validity and reliability. Its internal consistency coefficient (alpha coefficient) was 0.92 with a one-week test-retest reliability of 0.75 and its correlation coefficients ranged from 0.30 to 0.76. Kaviani and Mousavi examined the psychometric properties. The validity of this test in Iranian population reported a reliability coefficient of 0.72 and test-retest reliability coefficient of 0.83 and Cronbach's alpha of 0.92 (18).

The data were analyzed in two parts: descriptive and inferential statistics, mean and standard deviation were used in the descriptive part. Inferential statistics were used to compare and compare groups differences in pre-test and post-test by multivariate analysis of covariance (MANCOVA). SPSS software version 22 was used for data analysis.

### Results

The descriptive data related to the 3 groups of the research is presented in Table 1.

**Table 1.** The scores of depression and anxiety in pre-test and post-test

Variable	Group	Phase	Mean $\pm$ SD
Anxiety	Control	Pre-test	40.70 $\pm$ 4.45
		Post-test	39.05 $\pm$ 3.20
	TMS	Pre-test	38.80 $\pm$ 6.77
		Post-test	21.95 $\pm$ 3.60
	CBT	Pre-test	39.25 $\pm$ 3.30
		Post-test	18.90 $\pm$ 3.02
Depression	Control	Pre-test	39.05 $\pm$ 3.20
		Post-test	39.60 $\pm$ 4.18
	TMS	Pre-test	36.75 $\pm$ 4.83
		Post-test	19.30 $\pm$ 3.23
	CBT	Pre-test	39.50 $\pm$ 3.96
		Post-test	19.15 $\pm$ 3.23

As seen in Table 1, there were not significant differences between 3 groups in scores of depression and anxiety in pre-test phase but these scores reduced after intervention in experimental groups.

To inferential statistics, the normality of the data was assessed through Leven test. Leven's test results showed that all three groups are homogeneous in variance (F anxiety= 1.127, DF1= 2, DF2= 57 and P=0.080; F depression= 2.818, DF1= 2, DF2= 57 and P=0.110).

To determine the effectiveness of cognitive behavioral therapy and transcranial magnetic stimulation on reducing anxiety and depression in the participants, multivariate covariance analysis was performed. The results showed that there are significant differences between experimental and control groups in post-test phase (P<0.01). Also, the differences between the scores of depression and anxiety in pre-test and post-test phases were presented in Table 2.

**Table 2.** The differences between the scores of depression and anxiety in pre-test and post-test phases

Variable	Phase	Group I	Group J	Mean difference (J-I)	P
Depression	Pre-test	Control	CBT	0.100	0.997
			TMS	2.850	0.094
	Post-test	Control	CBT	19.200	0.000
			TMS	19.050	0.000
Anxiety	Pre-test	Control	CBT	1.450	0.638
			TMS	1.900	0.464
	Post-test	Control	CBT	20.150	0.000
			TMS	17.100	0.000

The findings indicated that both CBT and TMS are effective in reducing depression and anxiety in participants compared to controls but the scores of CBT group decreased more than TMS group especially in anxiety ( $P=0.01$ ).

### Discussion

In this study, the scores of depression and anxiety assessed before and after CBT and TMS intervention compared to control group. The findings indicated that both CBT and TMS can reduce depression and anxiety significantly but CBT is more effective.

As mentioned, transcranial magnetic stimulation has positive outcomes in depression and anxiety (19,20). This method is effective and safe and patients preferred this technique more than older treatments (21). In this line, in a study by White and Tavakoli 13 adult patients with major depressive disorder and generalized anxiety disorder received 24 to 36 sessions of repetitive TMS in 5-6 weeks. The results showed that symptoms reduced more than 50% from baseline. These finding support the present study (22).

### References

1. Wang J, Wu X, Lai W, Long E, Zhang X, LiW, et al. Prevalence of depression and depressive symptoms among outpatients: a systematic review and meta-analysis. *BMJ Open* 2017; 7(8): e017173.
2. Bandelow B, Michaelis S. Epidemiology of anxiety disorders in the 21<sup>st</sup> Century. *Dialogues Clin Neurosci* 2015; 17(3): 327-35.
3. National Institute for Health and Care Excellence. Depression: The treatment and management of depression in adults update Clinical guideline 90 London: National Institute for Health and Care Excellence; 2009.

Cognitive behavioral therapy is well-established protocol to reduce depression and anxiety based on the evidences (23) and in the present research it is effective strongly in reducing depression and anxiety among participants.

Regarding the lack of studies with the same protocol (CBT vs TMS) in depression and anxiety, the comparison between the present study and other researches was not possible.

It is recommended that the future studies be focused on the effectiveness of the two methods and preferences of patients about choosing TMS or CBT.

This research has some limitations such as small sample size and the lack of follow ups to evaluate the long effectiveness of the two treatments.

### Conclusion

It seems that transcranial magnetic stimulation and cognitive-behavioral therapy are effective in reducing anxiety and depression but cognitive-behavioral therapy can reduce depression and anxiety more than transcranial magnetic stimulation.

4. National Institute for Health and Care Excellence. Generalised anxiety disorder and panic disorder (with or without agoraphobia) in adults: Management in primary, secondary and community care Clinical guideline 113 London: National Institute for Health and Care Excellence; 2011.
5. Clark DM. Implementing NICE guidelines for the psychological treatment of depression and anxiety disorders: the IAPT experience. *Int Rev Psychiatry* 2011; 23: 318-27.
6. Twomey C, O'Reilly G, Byrne M. Effectiveness of cognitive behavioural therapy for anxiety and depression in primary care: a meta-analysis. *Fam Pract* 2015; 32(1): 3-15.
7. Barker AT, Jalinous R, Freeston IL. Non-invasive magnetic stimulation of human motor cortex. *Lancet* 1985; 1(8437):1106-7.
8. Pascual-Leone A, Rubio B, Pallardó F, Catalá MD. Rapid-rate transcranial magnetic stimulation of left dorsolateral prefrontal cortex in drug-resistant depression. *Lancet* 1996; 348(9022): 233-7.
9. van der Donk L. The effects of repetitive transcranial magnetic stimulation on treatment resistant depression and its biological underpinnings. Tilburg University, 2013.
10. Hasey GM. Transcranial magnetic stimulation: Using a law of physics to treat psychopathology. *J Psychiatry Neurosci* 1999; 24: 97-101.
11. Klomjai W, Katz R, Lackmy-Vallée A. Basic principles of transcranial magnetic stimulation (TMS) and repetitive TMS (rTMS) *Ann Phys Rehabil Med* 2015; 58: 208-13.
12. Holtzheimer PE, Avery D, Schlaepfer TE. Antidepressant effects of repetitive transcranial magnetic stimulation. *Br J Psychiatry* 2004; 184: 541-5.
13. Martin JL, Barbanog MJ, Schlapfer TE, Thompson E, Perez V, Kulrsevesley J. Repetitive transcranial magnetic stimulation for the treatment of depression. Systematic review and meta-analysis. *Br J Psychiatry* 2003; 183: 480-91.
14. Steer RA, Beck AT. Modifying the Beck Depression Inventory: A reply to Vredenburg, Krames, Flett. *Psychol Rep* 1985; 57: 625-6.
15. Beck AT, Steer RA, Brown GK. Manual for the Beck Depression Inventory – II. San Antonio; The Psychological Corporation. Harcourt Brace and Company; 1996.
16. Dabson KA, Mohammadkhani P. [The psychometric properties of Beck Depression Inventory– II in a large population of patients with major depressive disorder]. *Journal of rehabilitation* 2008; 8: 80-86. (Persian)
17. Beck AT, Steer RA. The Beck Anxiety Inventory manual. San Antonio, TX: The Psychological Corporation; 1996.
18. Kaviani H, Mousavi AS. [Psychometric properties of the Persian version of Beck Anxiety Inventory (BAI)]. *Journal of Medical Faculty of Tehran University of Medical Sciences* 2008; 65: 136-40. (Persian)
19. Brasil-Neto JP, Boechat-Barros R, Mota-Silveira DA. [The use of slow-frequency transcranial magnetic stimulation in the treatment of depression at Brasília University Hospital: preliminary findings]. *Arq Neuropsiquiatr* 2003; 61(1): 83-6. (Portuguese)
20. Mantovani A, Aly M, Dagan Y, Allart A, Lisanby SH. Randomized sham controlled trial of repetitive transcranial magnetic stimulation to the dorsolateral prefrontal cortex for the treatment of panic disorder with comorbid major depression. *J Affect Disord* 2013; 144(1-2): 153-9.
21. Magnezi R, Aminov E, Shmuel D, Dreifuss M, Dannon P. Comparison between neurostimulation techniques repetitive transcranial magnetic stimulation vs electroconvulsive therapy for the treatment of resistant depression: patient preference and cost-effectiveness. *Patient Prefer Adherence* 2016; 10: 1481-7.
22. White D, Tavakoli S. Repetitive transcranial magnetic stimulation for treatment of major depressive disorder with comorbid generalized anxiety disorder. *Ann Clin Psychiatry* 2015; 27(3): 192-6.
23. Flynn AH, Warren R. Using CBT effectively for treating depression and anxiety. *Curr Psychiatry* 2014; 13: 45-53.

