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Neuro-Cognitive Rehabilitation of Attention Disorders in Depressed Patient by TMS

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Abstract **Introduction**: The aim of this study was to evaluate the application of this tool in the neurocognitive rehabilitation of depressed patients. **Case presentation**: This study was done on a 41 years-old Iranian woman who presented distraction associated with depression. We evaluated her during 6 weeks since 2012. 5. 22 until 2012. 7. 7 in Functional Neurosurgery Research Center of Shohada Hospital, Tehran, Iran. Before entering the study it was necessary for the patient to give informed consent. She had to be examined first by psychiatrist, neurologist and later by cognitive neuroscientist for neurocognitive assessments. We evaluated attention measure through STROOP and CPT tasks and mental evaluations were implemented by using MMSE, Beck depression questionnaires before and after TMS. Based on the performance assessment of the patient before and after TMS, a difference was observed between measures of tasks and questionnaires. **Conclusions**: Cognitive and mental impairments could be improved by TMS.

Keywords: *neuro-cognitive rehabilitation, attention, depression, TMS*

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1. Introduction

TMS has expanded in 1985 and has been studied significantly since 1995. TMS can modulate neural excitability and behavior recognition; it makes neural plasticity and flexibility. It is a non-invasive technique for stimulating the cerebral cortex and altering cortical and subcortical activities [3]. TMS has two types high-frequency and low-frequency stimulation. High-frequency stimulation (5-20 Hz) has been provided to increase cortical excitability and low-frequency stimulation (1 Hz) to inhibit cortical excitability [11].

Neurocognitive impairments are main symptoms of many neuropsychiatric diseases. This technique can induce alterations in neural networks offering cognitive functionsand [1] thus may provide a means for neurocognitive rehabilitation.

The purpose of this study was to evaluate the use of this tool in the neuro-cognitive rehabilitation of depressed patient.

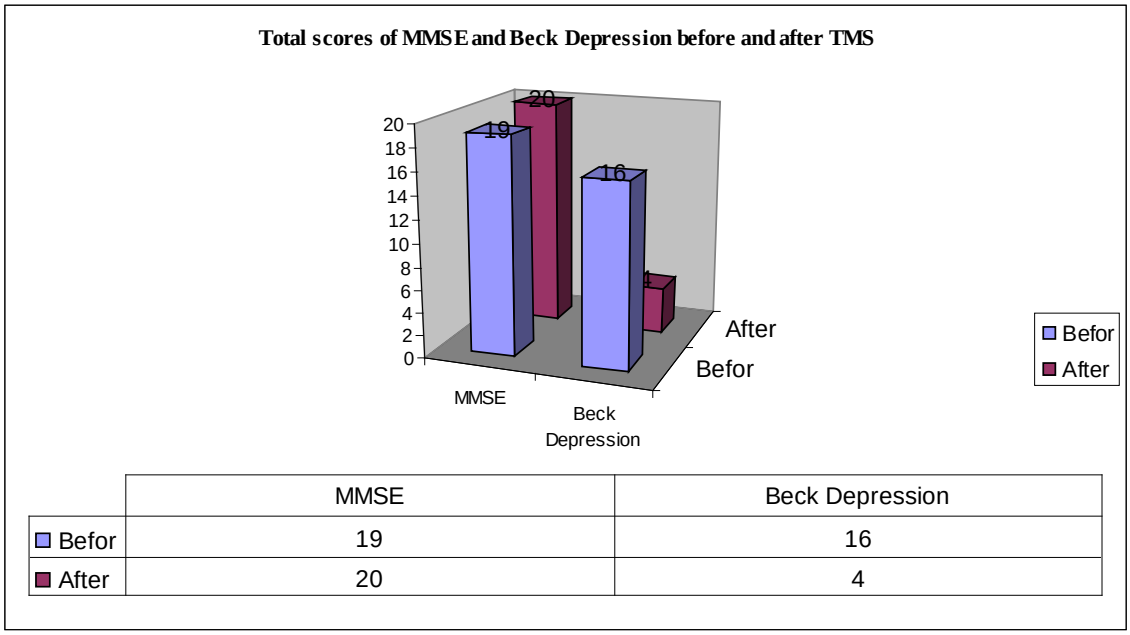
2. Case Presentation

A study was conducted during 6 weeks since 2012. 5. 22 until 2012. 7. 7 on a 41 years-Old Iranian woman who showed distraction associated with depression at Neuroscience Department of Functional Neurosurgery Research Center (FNRC) of Shohada Hospital, Tajrish, Tehran, Iran. Before entering the study the patient was asked to fill the informed consent. She had to be examined first by psychiatrist and neurologist and then she had to be evaluated by cognitive neuroscientist for neurocognitive assessments. Cognitive evaluations for attention were done through STROOP, CPT tasks [16,17] and mental evaluations were made by using MMSE [7], Beck depression [1] questionnaires. She was faced with attention disorders and depression. Finally, she was referred to TMS therapy at Shohada Hospital.

3. TMS Therapy

As in previous studies, treatment was based on the procedures of the approved TMS device. Assessments were performed at baseline [2,14]. The primary outcome was change in the clinical symptoms. Secondary outcomes were change in continuous and categorical outcomes on tasks and questionnaires. In this method, anesthesia was not performed and TMS was placed on prefrontal cortex [4]. High-frequency stimulation was exerted over the left dorsolateral prefrontal cortex and low-frequency stimulation over the right side. Previous studies have revealed that high-frequency stimulation over the left increases cerebral blood flow (CBF) in the left prefrontal cortex, orbitofrontal cortex, anterior cingulate, and subcallosal area (subgenual cingulate cortex) along with improvement of depression whereas low-frequency

stimulation over the right decreases CBF in the right prefrontal cortex, orbitofrontal cortex, and subcallosal area with improvement of depression [11]. In our study, TMS therapy was conducted with high-frequency stimulation over the left prefrontal cortex.



	MMSE	Beck Depression
Befor	19	16
After	20	4

Figure 1. Total Scores of MMSE and Beck depression questionnaires before and after TMS

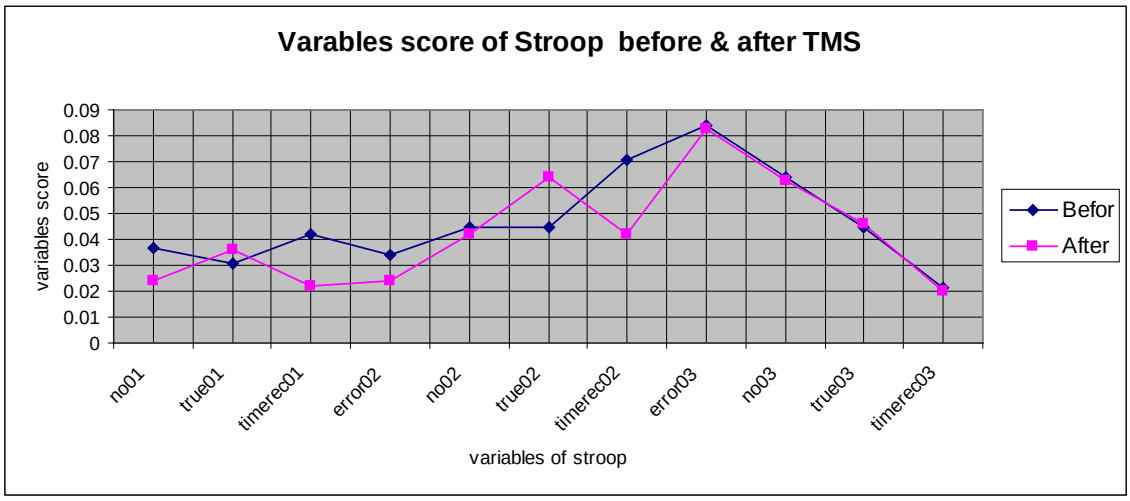


Figure 2. Variables Score of STROOP before and after TMS

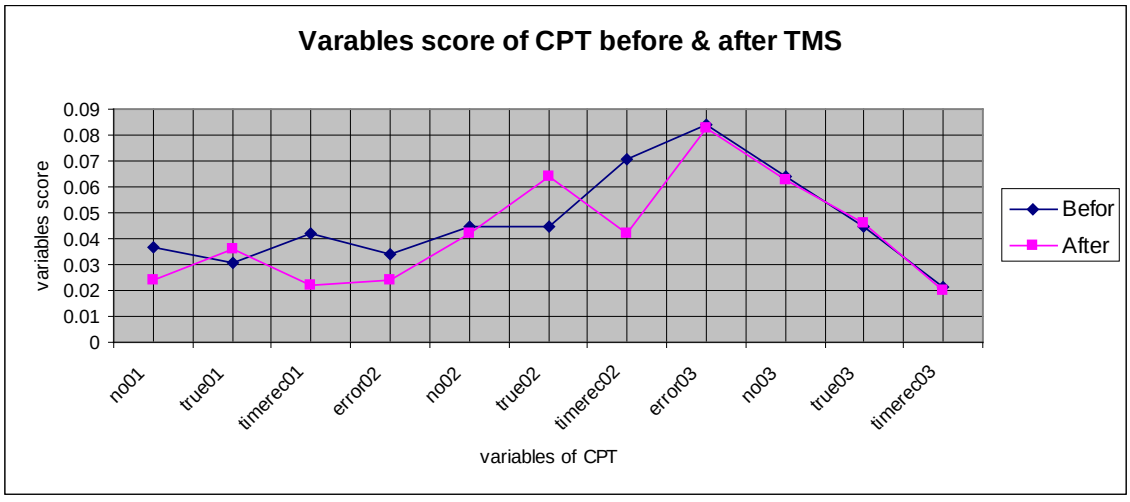


Figure 3. Variables Score of CPT before and after TMS

The number of sessions will depend on the research protocol, TMS can be used 2 sessions per day, each session about 20 minutes with a break of 30 minutes between them in 10 days, with a rest period of two days between the first 5 days (considering five times a week) and early rehabilitation was occurred in 20 sessions. Evaluation of research protocols during treatment is different, but most require at least two weeks of daily stimulation five times a week, some take up to two weeks to 6 weeks in the study, respectively [2]. In this study, we used TMS in 20 sessions. Each session was 20 minutes per day with a rest period of two days after 5 days. We didn't observe known side effects such as loss of memory, negative changes in concentration and other cognitive impairments. In our study, the patient had a feeling of knocking on the head, jaw muscle contraction and mild headaches during TMS therapy. These symptoms were ended after 15 minutes.

A significant difference was observed between tasks and questionnaires variables before and after TMS. Findings indicated that cognitive and mental impairments could be improved by TMS.

Total Scores of MMSE and Beck depression questionnaires have shown improvement before and after TMS (Figure 1).

Variables Score of STROOP have shown improvement before and after TMS (Figure 2).

Variables Score of CPT have shown improvement before and after TMS (Figure 3).

4. Discussion

Researchers studied a significant number of patients with depression, and found that medication and treatment may not be sufficient to treat and require other methods such as TMS Therapy. TMS is noninvasive technique and can easily be focused on small areas of the brain, and can alter brain activity and this makes it well suited for treating brain. This method in many cases can be used for investigation [8,13], rehabilitation and treatment of cognitive impairments. It considers attention, learning, memory, creativity, speech, hearing, visual communication, understanding and brain functions [4,5,10,15,16,17,18].

TMS influences on dorsolateral prefrontal cortex for specific brain function. This can alleviate diseases such as anxiety, depression, bulemia, schizophrenia and depersonalization [6,13]. Finally, several hypotheses are presented about possible mechanisms of TMS in cognitive function among depressed patients [9,11,12]. With this method, plasticity and resilience mechanisms can lead to cognitive and behavioral modifications. One of its important applications is neurological rehabilitation and improving cognitive and psychiatric symptoms which we have experienced it in this study. Therefore, it is suggested that TMS can be a useful tool in neurocognitive rehabilitation and future researches.

Abbreviations

TMS: Transcranial magnetic stimulation.
CBF: Cerebral blood flow.

Consent

Written informed consent was obtained from the patient for publication of this case report and any Data.

Competing Interests

The authors declare that they have no competing interests.

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