



## CASE REPORT

# Effectiveness of Repetitive Transcranial Magnetic Stimulation (rTMS) on Borderline Personality Disorder Symptoms: A Case Report

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### ABSTRACT

Repetitive Transcranial magnetic stimulation (rTMS) is a non-invasive brain stimulation method used in the treatment of treatment-resistant major depressive disorder patients. Although it is approved in the treatment of major depressive disorder, it can also be used off-label in the treatment of various other psychiatric disorders. Borderline personality disorder (BPD) is a psychiatric disorder with severe functional loss and recurrent suicidal behaviors. Studies suggested that the impairments in certain brain regions might have been the underlying condition. In this report, we report use of rTMS in a patient with impulsive control disorder and recurrent suicide attempts. We recommend consideration of rTMS as a new alternative treatment method in the management of BPD symptoms due to positive clinical progress in our case.

**Keywords:** Borderline personality disorder, rTMS, transcranial magnetic stimulation, treatment

## INTRODUCTION

Repetitive Transcranial Magnetic Stimulation (rTMS) is a safe, effective and non-invasive brain stimulation treatment for the treatment of the treatment-resistant major depressive disorder. Until today, the competency of rTMS has been supported by the double-blind and the randomized controlled studies and the meta-analyses (1). In the rTMS treatment, the short-term and rapidly changing magnetic pulses are produced. The mentioned pulses can be given at high (10-20 Hz) or at low frequency (lower than or equal to 1 Hz) (2). It was shown in the studies carried out that stimulation at different frequencies can have different or even antagonistic

effects on neuronal activity. It is known that high frequencies lead to hyperactivity in brain while low frequencies lead to hypoactivity or inhibition (3). The rTMS is done on an outpatient basis and contrary to electroconvulsive treatment (ECT); it does not require anesthesia induction and monitoring. Although it is effective and reliable, no major adverse effects have been reported, except for moderate headache and discomfort in the application area.

Although rTMS was approved by the US Food and Drug Administration (FDA) only in the treatment of the treatment-resistant major depressive disorder in 2008, it has also been tried in various psychiatric disorders including obsessive compulsive disorder (4), schizophrenia (5), auditory hallucinations (6), and bipolar disorder (7). The effectiveness of them in treatment of the mentioned disorders is still inconsistent. However, the use of high-frequency rTMS in treatment of borderline personality disorder is present in literature with the reports in the form of case reports (8,9). In addition, there are also studies

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which examine the effect of rTMS on impulsiveness in borderline personality disorder (10,11).

Borderline Personality Disorder (BPD) is considered being a chronic psychiatric disorder due to loss of function and recurrent suicidal behaviors it causes. Although it is a controversial concept, it is a complicated case, in which the impulse control, interpersonal relations, sense of self, mood changes, starting in early periods in patients, the temporary psychotic symptoms, the self-destruction and suicidal behaviors, the instability in mood and behavior, the feeling of loneliness and emptiness can be seen (12). The studies suggest that this situation depends on activity changes of the relevant regions of brain. It is considered that hippocampus and dorsolateral prefrontal cortex (DLPFC) play an important role in regulating emotion and impulsiveness and the emotional instability and impulsivity seen in BPD patients might be associated with DLPFC activity changes (13). In the present case report, the effectiveness of rTMS treatment on symptoms of a BPD patient was described.

## CASE PRESENTATION

The twenty-one-year-old, student, male patient was brought by his family to our outpatient clinic due to his self-mutilative actions and suicide attempts. Patient had been receiving psychiatric treatments for the last seven years. Mood stabilizers (carbamazepine, valproic acid), antidepressants (escitalopram, sertraline, fluoxetine) and antipsychotics (risperidone, olanzapine, trifluoperazine, and quetiapine) were used for sufficient time and in effective dose but no improvements were observed in terms of his functionality, except short-term well-being. He had no history of alcohol, cigarette, and illicit drug use. The patient was diagnosed with BPD after suicide attempt five years ago. In his last presentation, he dropped out the school and attempted to suicide after the stressor he had in his personal life. After the detailed mental examination and laboratory tests (complete blood count, biochemistry lab, vitamin D and vitamin B12 levels); he was diagnosed with BPD based on the Diagnostic and Statistical Manual of Mental Disorders - 5th ed. (DSM-5) criteria (14). The

Beck Depression Inventory (BDI) score of the patient was 18 (mild depression); his Beck Anxiety Inventory (BAI) score was 22 (moderate anxiety); his Barratt Impulsiveness Scale (BIS) score was 43 (high-level impulsiveness), and his Beck Scale for Suicide Ideation (BSSI) score was 21 (moderate suicide ideation). The patient refused the medical treatment and inpatient hospitalization was recommended. Written consent of the patient and his relatives were received. The rTMS monotherapy was recommended to the patient. He received 1200 high-frequency (20Hz) repetitive sessions with 40 pulses (4 seconds each) on his left DLPFC for 26 second pulse at 110-120% of motor threshold for three weeks (Consecutive 21 sessions/ 30 min every day). The rTMS was applied using Magstim1 Rapid2 stimulator (The Magstim Company Ltd., Whitland, Carmarthenshire, Wales, England). A significant decrease occurred in BDI (score of 8), BAI (score of 15), BIS (score of 19) and BSSI (score of 6) assessments of the patient before and after the rTMS. A significant decrease occurred in active suicide ideation of the patient and the patient started attending his school again. In his monthly follow-up exams, it was reported and also observed that functionality of the patient was improved and his complaints did not recur.

## DISCUSSION

In our case; the effectiveness of rTMS treatment, which was applied for three weeks in a 21-year-old, male and adult case having the diagnoses of BPD and Major Depressive Disorder, on patient's functionality and suicide ideation was presented. With the increase in the use of rTMS, a non-invasive brain stimulation method; its off-label use in various psychiatric disorders also started to increase.

When the literature was examined, the effectiveness of rTMS applications applied to BPD patients was seen (10,11,15). The studies carried out by De Vidovich et al. and Zaman et al. indicated that rTMS had a positive effect on impulsiveness in BPD patients (10,11). Arbabi et al. showed that hypoactivation occurred on DLPFC and amygdala after the treatment in a BPD patient in whom they performed fMRI imaging before and after rTMS (8).

It can be considered that the aforementioned hypofunction occurring on DLPFC and amygdala might be related to therapeutic effectiveness of rTMS in BPD. In our case, a depressive disorder accompanying BPD was present. BPD can be seen with depressive disorder by 83% during lifetime (9). Furthermore, response to antidepressant treatment can be weak in BPD accompanied by comorbid depressive disorder. In a case report in literature; development was observed in symptoms of BPD and depressive disorder with 10-session high-frequency left DLPFC-rTMS application (8). In another report consisting of three BPD cases; improvement was observed in depressive symptoms, impulse control, mood stabilization, and behavior control, with bilateral 20-session DMPFC-rTMS application (9). Furthermore, in a study in which 10-session right DLPFC-rTMS was applied (n=9); it was shown that some improvements were provided in anger, affective instability and planning but there were no changes in symptoms of depression (16). It is probable that depressive symptoms in our case have actively responded to the 20-session left DLPFC-rTMS application. With the rTMS application, improvement was also observed in impulsiveness and suicide ideation. It was determined in a study that a significant improvement occurred in impulsiveness in adult ADHD patients as a result of left DLPFC-rTMS stimulation. Regulating DLPFC activity is likely to increase the level of inhibitor control over impulsivity (17). Moreover, left DLPFC activation increases the goal-directed effort in regulating emotional intensity (18). In a study carried out on treatment resistant depression patients with suicide ideation; it was determined that bilateral DLPFC-rTMS application significantly decreased the suicide ideation for 3-6 weeks and this decrease was also significant in terms of improvement in depressive symptoms (19). In the treatment of BPD; difficulties in mood stabilization and behavior control, impulsivity, suicidal ideation, self-destructive behaviors and the presence of comorbid depression can make the treatment method difficult. Antidepressant treatments can display limited effectiveness and specific form of psychotherapies such as dialectical behavioral therapy (DBT) administered for

sufficient time can be effective but can fail to satisfy patient's needs in acute attacks. However, it should be also considered that impulsiveness can also respond to cerebellum stimulation, apart from DLPFC, in BPD cases. In addition, the improvement in our case can be associated with the natural course of the disorder. Use of self-report measures can pose another limitation while interpreting our results. Specific clinical interview tools and structured interviews for the BPD symptoms could have been used along with researchers being blind to the treatment.

For management of personality disorders; we recommend rTMS as an alternative treatment with its proven advantages in acute treatment settings and its adverse effect potential being low, together with the positive response which we received in our case. Randomized controlled studies with moderate to large sample size are needed in order to clarify the effectiveness of rTMS on the BPD symptoms.

**Patient Informed Consent:** Written informed consent was obtained from the patient for the publication of the case report.

**Conflict of Interest:** Authors declared no conflicts of interest.

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