Biotechnology in Psychiatry: Transcranial Magnetic Stimulation (TMS) Treatment Outcomes for Major Depressive Disorder (MDD) and Assessment of Gender Differences

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Introduction

Transcranial Magnetic Stimulation is an FDA-approved treatment option for patients with treatment refractory major depressive disorder and obsessive-compulsive disorder ***(Figure 1).*** Previous studies have suggested that there are significant differences in treatment outcomes for MDD based on gender[1]. The objective of this retrospective review of a case series was to determine if this difference was reproduced in the patient population of a new TMS clinic.

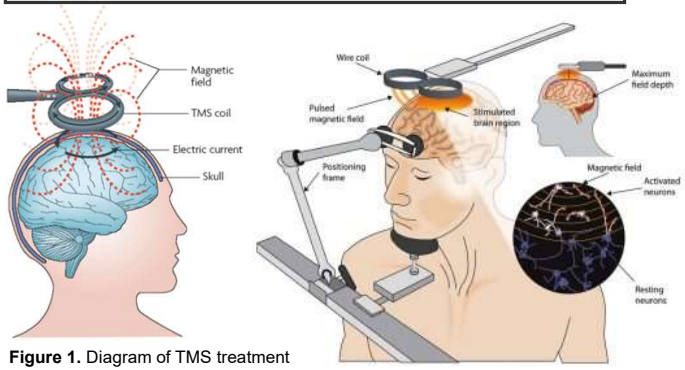

Figure 1. Diagram of TMS treatment
Source: *https://thebrainstimulator.net/brain-stimulation-comparison/*

Materials and Methods

- **Subjects**: patients ages 28 to 72 who underwent treatment with TMS for refractory major depressive disorder in 2019. (n=22 total; 16 female, 6 male)
- **Study design**: retrospective case series review.
- **Procedures**: the Beck's Depression Inventory-II (BDI-II) was used to gauge symptom severity at the initiation and completion of treatment, and the differences between the BDI-II for each patient was used to calculate the change in BDI-II as the primary outcome measure.
- **Data**: the BDI-II changes divided by patient sex, and the averages of each group were analyzed.
- **Analysis**: averages of each group were analyzed using the two-sample T-test. A secondary analysis was performed after separating the female cohort into premenopausal up to age 50 and postmenopausal groups.

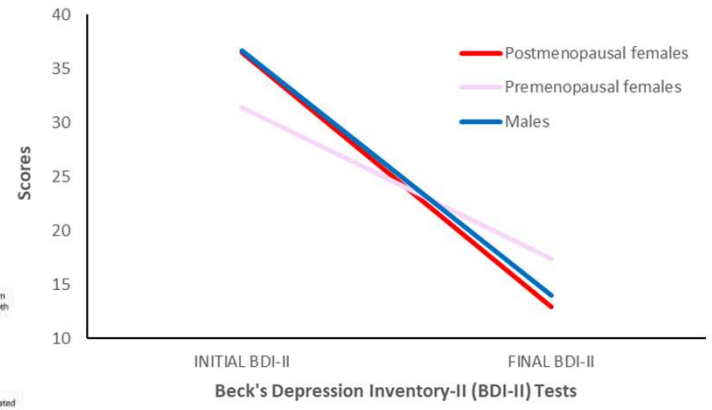

Figure 2. *Line graph demonstrating the course of treatment with TMS via average initial BDI scores and average final BDI scores (n=22); cohorts grouped by sex & menopausal status according to age: postmenopausal female (age > 50, n = 11), premenopausal female (age < 50, n=5), and male (n = 6)*

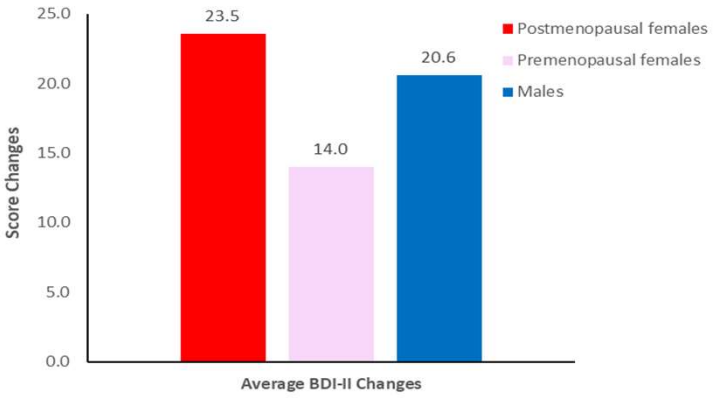

Figure 3. *Bar graph demonstrating the average difference in BDI-II between the initial BDI-II score and final BDI-II score (n=22); cohorts grouped by sex & menopausal status according to age: postmenopausal female (age > 50, n = 11), premenopausal female (age < 50, n=5), and male (n = 6)*

Results

Of the 22 cases reviewed, 16 were female and 6 were male. The statistical analysis of treatment outcomes revealed no significant differences in BDI-II changes between females versus male patients, even when separating the female cohort into premenopausal (n=3) and postmenopausal groups (n=13); $p > 0.05$, two-tailed test ***(Figures 2-3)***.

Discussion

Treatment-resistant depression (TRD) is diagnosed when MDD is resistant to medications, psychotherapy, or ECT.[2] Previous studies have identified TMS treatment is an excellent alternative to pharmacologic therapies, especially in pregnant patients, due to the better safety profile. Typically, antidepressive agents can be augmented with mood stabilizers or antipsychotics; however, these therapies have either not been well studied in pregnant patients (such as second-generation atypical antipsychotics) or are well-established teratogens (such as lithium). Thus, determining if there are gender differences in TMS treatment outcomes is important in assessing the necessity of exploring alternative treatment options. Previous studies have suggested that males and postmenopausal females have similar treatment outcomes on average, while premenopausal females have generally worse treatment outcomes; this was not supported by a retrospective review of cases at this institution.

Conclusion

The results of this analysis found no evidence of significant differences between female and male patients in the treatment of MDD using TMS, even when taking menopausal status into consideration. Caveats to this retrospective review include a small sample size with a particularly small sampling of male patients, lack of control for additional therapies or medications, and a possible selection bias for insurance status. Additionally, these findings represent a single institutional experience in the utilization of TMS in the treatment of MDD amongst a diverse patient population.

References:

1. Huang C, Wei I, Chou Y, et al. Effect of age, gender, menopausal status, and ovarian hormonal level on rTMS in treatment-resistant depression. *Psychoneuroendocrinology* 2008; 33(6): 821-831.
2. Mayberg HS, Lozano AM, Voon V, et al. Deep Brain Stimulation for Treatment-Resistant Depression. *Neuron* 2005; 45(5): 651-660.