

Does Low Frequency versus High Frequency Transcranial Magnetic Stimulation (TMS) expedite mood symptom reduction?

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Introduction

What is Repetitive Transcranial Magnetic Stimulation (rTMS)?

rTMS has been a **method of treatment for mental symptoms** since 1985² and a treatment for major depressive disorder (MDD) through research beginning around the mid-1990s, that uses electromagnetic pulses to stimulate nerve cells in the brain to reset the pace of neuronal firing to a more normal frequency¹.



What is the study concentrating on?

Low Frequency (LF) and High Frequency (HF) Protocols

LF rTMS treatments have been shown to be as efficacious as HF rTMS treatments, and safer in many ways³; including a decrease in

- risk of seizures
- reported burning sensation
- exposure to electromagnetic pulses

What is happening in the field of rTMS?

Complications for rTMS treatments²

- deep-tissue localization
- TMS resource availability
- inability to directly and precisely stimulate deeper brain structures

Proposed resolutions for localization and depth treatment issues

- Coils of different shapes²
 - Heschl-coil (H coil); although precision becomes difficult
- Surgically implanted electrodes
 - ensure electric pulse to deeper tissues in the brain

Possible reasons for resource availability issues³

- insurance coverage
- general cost
- machine availability
- time constraints
 - insufficient amount of trained staff to run treatments

Research has found similar outcomes of LF (right dorsal lateral prefrontal cortex [DLPFC]) treatment compared to HF (left DLPFC) treatment; however differences in the rate of improvement of patients' symptoms is less well studied.

What is this project's goal?

To compare the rate of change in self-reported mood symptoms, through BDI and BAI assessment scores, of patients treated with HF TMS to patients that were administered LF TMS in efforts to investigate if one treatment provides earlier relief of depression and anxiety symptoms.

Methods

Statement of Purpose

It was hypothesized that LF TMS would show faster rates of improvement than HF TMS treatments.

Participants

Right Prefrontal SMA	Left Prefrontal
44 patients	13 patients

Treatment for each individual was chosen prior to this present study by the treating psychiatrist depending upon their symptoms and risk factors for TMS. Data were derived from a research registry [IRB#: 10-07-FB-0135].

Measures

Beck Anxiety Inventory (BAI) and **Beck Depression Inventory (BDI)** scores
 ➢ used to determine progress rates through an individual's treatment.
 Scores of assessments were analyzed for the first six weeks of treatment
 ➢ due to the lack of consistent data at further points

Experimental Equipment

NeuroStar, Neuronetics Inc.

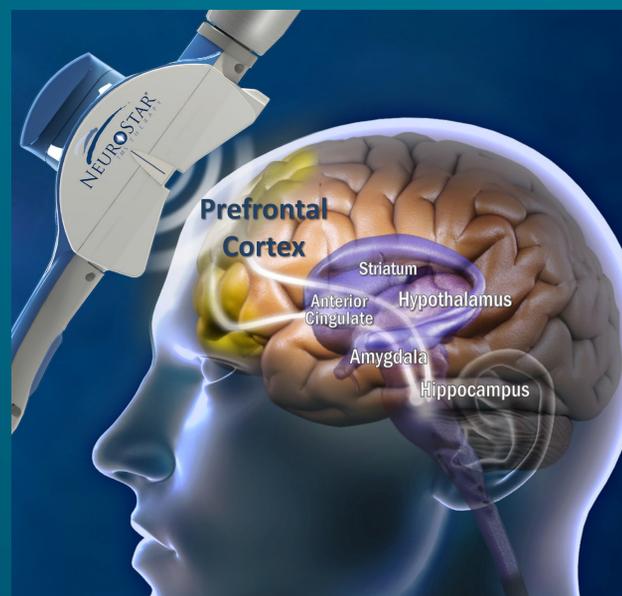
- 4Low frequency (LF) TMS protocol included 1,200 pulses were given at 1 Hz where there was 110% resting motor threshold (RMT) to the right dorsal lateral prefrontal cortex (RDLPFC) for 20 minutes.
- The high frequency (HF) TMS protocol included 3,000 pulses at 20 Hz each, with a 120% RMT to the left dorsal lateral prefrontal cortex (LDLPFC). The HF TMS protocol was conducted with 40 pulses given every 4 seconds, with a 26 second train, or pause, for 37 minutes.

This distribution was needed in order to prevent TMS magnet or coil from overheating, as well as preventing burning on a patient's scalp.

Statistical Analysis Plan

Examined the data for outliers and abnormalities to prepare for main analyses.

➢ Within subjects repeated measures ANOVA (LF vs. HF TMS, Time)



Results

Figure 1. LF and HF protocols over time on BAI scores:

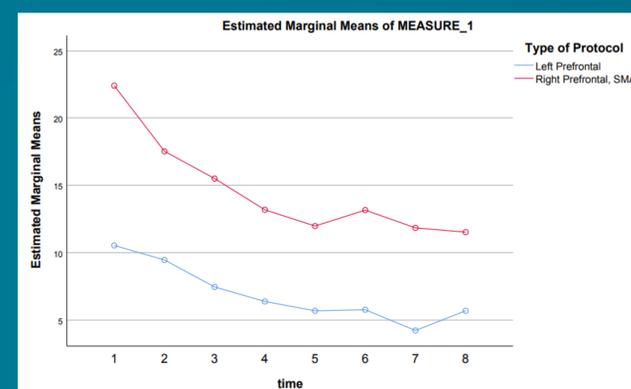
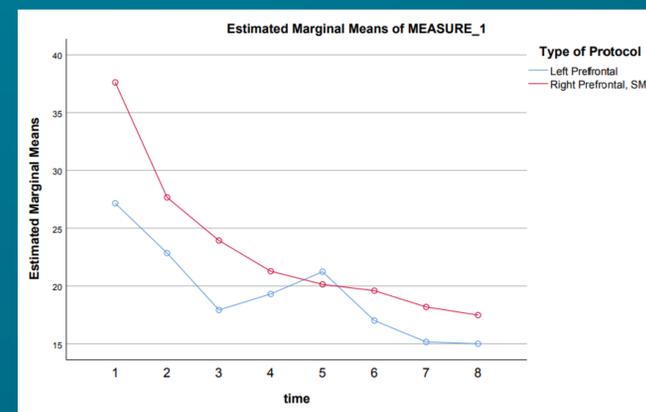


Figure 2. LF and HF protocols over time on BDI scores:



Discussion

Results did not support the stated hypothesis. Data shows that there are significant improvements in patient's treatment over time in both the HF left prefrontal cortex protocol and the LF right prefrontal cortex protocols. There were no significant differences in rate of improvement over time, contrary to the study hypotheses.

Limitations

- Participant size and variety; inconsistency across age, base scores and severity of diagnosis can lead to inaccurate representation of the specified population
- TMS service availability
- Bias in self-reporting

Future Considerations

- Consultation after treatment as well as self-reporting data to decrease bias factors
- Longer time progression analysis, until end of treatment protocols
- More participants
- Participant matching between groups to make groups more equitable
- Compare and compile data from multiple TMS facilities to test overall protocols not specific to EVMS or one facility

Future Projects

- Correlation of diagnosis and comorbidity to rate of change over time
- Rates of depression and anxiety independently in relation to rate of change over time

References

1. Fitzgerald, P. B., & Daskalakis, Z. J. (2011). The effects of repetitive transcranial magnetic stimulation in the treatment of depression. *Expert Review of Medical Devices*, 8(5-9), doi:10.1586/erd.10.57
2. Lefaucheur, J. P., Andre-Obadia, N., Antal, A., & Ayache, S. S. (2014). Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS). *Clinical Neurophysiology*, 125 (11), 2150-2206.
3. Reddy, M. S., & Vijay, M. S. (2017). Repetitive Transcranial Magnetic Stimulation for Depression: State of the Art. *Indian Journal of Psychological Medicine*, 39(1), 1-3. <http://doi.org/10.4103/0253-7176.198951>

Descriptive Statistics^a

	N	Minimum	Maximum	Mean	Std. Deviation
Sex	15	1	2	1.47	.516
Age	15	30	82	51.13	13.912
Valid N (listwise)	15				

a. Type of Protocol = Left Prefrontal

Type of Protocol = Right Prefrontal, SMA

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Sex	71	1	2	1.59	.495
Age	71	18	82	45.56	14.204
Valid N (listwise)	71				

Descriptive Statistics^a

	N	Minimum	Maximum	Mean	Std. Deviation
Sex	56	1	2	1.63	.489
Age	56	18	76	44.07	14.028
Valid N (listwise)	56				

a. Type of Protocol = Right Prefrontal, SMA