

## Introduction

Post-traumatic stress disorder (PTSD) is a debilitating psychiatric syndrome characterized by long-term emotional, cognitive, and social dysfunction following a traumatic event. The mechanistic underpinnings are poorly understood and PTSD often displays chronicity and resistance to standard pharmacotherapy.

National Veterans Fdn & American Legion



PTSD in military combat veterans is common and especially refractory due to frequent physical comorbidities, such as traumatic brain injury, pain, and psychiatric comorbidities, which include substance abuse, anxiety and panic disorders, and major depressive disorder.

There is some evidence that rTMS has benefit in PTSD but a relatively recent veterans study reported a mean drop of 5.2 PTSD PCL-M questionnaire points with rTMS, and 8.1 points with Sham rTMS. (Yesavage et al, 2018).



Our previous work in anxiety and depression with civilians and veterans suggested marked positive therapeutic effects stemming from the personalization of rTMS stimulus frequency (PrTMS®) along a cortical gradient beginning with each patient's dominant EEG alpha frequency. Despite prefrontal cortical dysfunction this dominant endogenous frequency persists in the brainstem and visual cortex (Taghva et al, 2015).

**We sought to improve PTSD outcomes in combat veterans by supplementing pharmacotherapy with stimulation of multiple cortical sites including the dorsolateral prefrontal cortex (DLPFC) via personalized repetitive transcranial magnetic stimulation (PrTMS®).**

## Methodology

### SUBJECTS

Combat veterans of any sex and all ethnicities with PTSD (N = 203, PCL-5 score >31) received PrTMS, while remaining on PTSD treatment, i.e., psychotherapy plus medication(s). Subjects provided informed consent and standard rTMS exclusion criteria screened prospective subjects. During the treatment course clinical personnel evaluated the patients daily for adverse events.

### TREATMENT

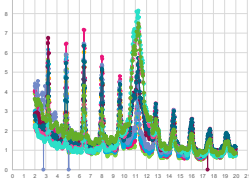
**STEP 1:** EEG acquired using a CGX high impedance dry electrode headset – The EEG was recorded for each patient prior to the treatment course and once weekly.

**STEP 2:** Quantitative 'qEEG' - Welch's FFT power spectrum of amplitude versus frequency.

**STEP 3:** After qEEG and frequency selection, PrTMS® was delivered by a trained technician using a MagPro R30 stimulator and B-65 transducer. Treatments were 30 minutes per day, 5 days per week for 4-12 weeks. Patients were seated in a quiet room with the eyes closed. No sedation was administered. Stimulus frequency aligned with the qEEG alpha band peak and magnetic field amplitude was 20-30% of machine power which equated to 50-60% of individual motor threshold.



STEP 1: EEG acquired - CGX Headset



STEP 2: qEEG - FFT Power Spectrum



STEP 3: PeakLogic PrTMS® Treatment - MagVenture B65

Personalized repetitive transcranial magnetic stimulation (PrTMS®) to multiple cortical sites may yield therapeutic benefit in treatment resistant post-traumatic stress disorder (PTSD) in military combat veterans

PrTMS® stimulation frequency is matched to the patient's dominant EEG alpha band frequency



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## Results

- PCL-5 scores dropped by one week of PrTMS® and continued to decline until 30-50 treatments (6-9 weeks) had been given, as shown in **Fig. 1**. 84% of patients responded, and their mean PCL-5 score reduction was quite substantial, on average 23 PCL-5 points (SD=15.3).
- Concomitantly, the EEG power spectrum dominant alpha peak typically migrated by up to 1 Hz towards the visual cortex dominant alpha frequency (**Fig 2**). **Fig. 3** chronicles the improvement in PCL-5 score, and the ratio of the integrated alpha band area (9.5-11.5 Hz) to the total EEG power spectrum. The pattern shown is typical for EEG occipital leads O1 and O2, and the Fz lead.
- These data justify a full prospective study in veterans with direct PrTMS®/rTMS comparisons.

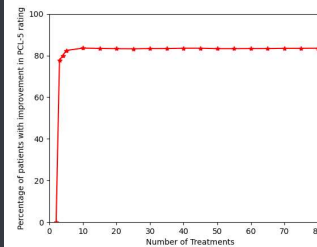


Fig. 1.

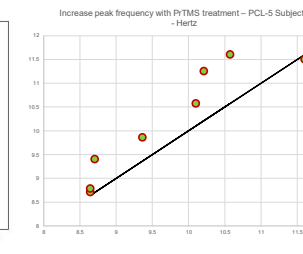


Fig. 2

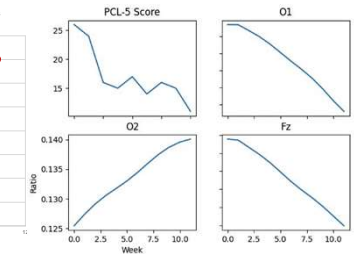


Fig 3

**REFERENCES.** Taghva A, Silvetz R, Ring A, et al. Magnetic Resonance Therapy Improves Clinical Phenotype and EEG Alpha Power in Posttraumatic Stress Disorder. *Trauma Mon.* 2015;20(4):e27360. doi:10.5812/traumamon.27360  
Yesavage JA, Fairchild JK, Mi Z, et al. Effect of Repetitive Transcranial Magnetic Stimulation on Treatment-Resistant Major Depression in US Veterans: A Randomized Clinical Trial. *JAMA Psychiatry.* 2018;75(9):884–893. doi:10.1001/jamapsychiatry.2018.1483

## A Retrospective Review of Patients with Post-Traumatic Stress Disorder (PTSD) Treated by Personalized Repetitive Transcranial Magnetic Stimulation (PrTMS®)

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