Preliminary Cases of Guided Neuromodulation in Australian Patients with PTSD

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Introduction

Non-invasive neuromodulation is currently under investigation as a therapeutic intervention for Post-traumatic Stress Disorder (PTSD). Repetitive transcranial magnetic stimulation (rTMS) has shown the capability to entrain oscillatory activity in resting cortical networks. Additionally, patients with PTSD and traumatic brain injury history show abnormal disruptions in cortical networks.

A stable EEG activity is easily observable during an eyes-closed, awake state. This activity (8-13Hz) speeds up with age to a critical frequency and slows with further aging. This activity also slows and is disrupted as a result of traumatic brain injury, and is noted to be decreased in PTSD. TMS with therapy parameters informed by individual, objective, patient-specific biometric data (EEG, ECG) may target disruptions in this function and improve clinical state.

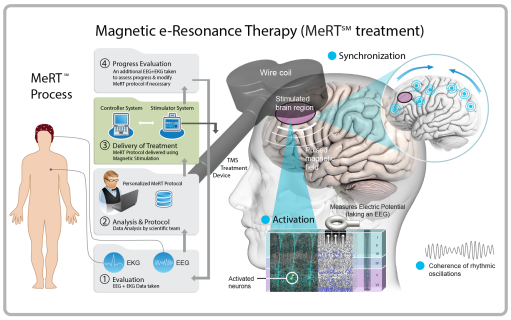

Figure 1: MeRT process.

Methods

Two patients; one military veteran (MV, 41, male) and one civilian first responder (FR, 50, male), both with severe PTSD symptomatology; underwent six weeks of Magnetic e-Resonance Therapy (MeRT). 10 minute eyes-closed EEGs with concurrent ECG were taken at baseline, two weeks, four weeks and six weeks of therapy for readjustment of TMS parameters. MeRT sessions were delivered daily, Monday-Friday. Patients received approximately 1800 TMS pulses per stimulation location, in 5 second trains, with stimulation frequency calculated as the EEG-ECG harmonic. Patients received stimulation sub-motor threshold (MT), with MagPro r30 TMS devices and B65 stimulating coils. Symptom severity scales, PCL-5, PCL-C, PHQ-9, HAM-A, and WHO-DAS 2.0, and patient self-ratings were taken at baseline, two weeks, four weeks and at end of the six week period.

Results

Subject MV reported first traumatic events during service in 1996, with two additional events until military discharge in 2009. He presented with high severity PTSD symptomatology via PCL-M, with a baseline score of 61, and was taking 5 mg melatonin to assist with sleep, 5 mg Valium PRN and Sodium Valproate prior to commencement of therapy. Subject was hospitalised for alcohol abuse and rehabilitation two months prior to baseline. Average sleep was reported to be three hours per week. MV received stimulation at 60% of calculated MT, at Fpz EEG location for first two weeks of therapy, and Pz, and Fpz locations for weeks two to six of therapy.

Subject FR reported witnessing disturbing events, including amputations and crush injuries during work shifts as a first responder. He presented with a baseline PTSD symptom score of 78, and was taking Escitalopram 20mg, Mirtazapine 20mg, Cardiprin, Celebrex, Valium and averaged two hours of sleep per night, with nightmares. Subject was hospitalised for depression, anxiety and suicidal thoughts four months prior to baseline. FT was home-bound and unable to leave for more than one to two hours per day. He would take days to recover from an outing due to panic attacks. FR received stimulation at 80% of calculated MT, at Fpz and Pz EEG locations for the full six weeks of therapy.

Table 1. Clinical Scale Scores

	Baseline		Week 2		Week 4		Week 6	
Scale	Civilian	Veteran	Civilian	Veteran	Civilian	Veteran	Civilian	Veteran
PCL-C	78	-	38	-	28	-	23	-
PCL-5	-	61	-	32	-	36	-	41
PHQ-9	24	21	6	8	11	9	4	10
HAM-A	33	40	6	22	5	24	3	28
WHO-DAS 2.0	115	119	58	115	49	119	43	97

Table 1: Baseline and post-MeRT symptom severity scales. Subjects were administered scales and evaluated by clinicians at baseline, pre-treatment, and following two, four and six weeks of daily MeRT treatment.

Subject MV reduced melatonin use to PRN and averaged two to five hours sleep per night by week six of therapy. He denied use of Valium and Sodium Valproate during the first five weeks of therapy. EtOH use increased in the last week of therapy, due to mutual drinking with a military colleague. At end of six weeks, PCL-5 was reduced from 61 to 41, PHQ-9 from 21 to 10, HAM-A from 40 to 28, and WHO-DAS 2.0 from 119 to 97. MV reported improvements in cognition, emotional regulation and anger severity.

Subject FR reduced Escitalopram to 15mg following two weeks therapy, reduced Mirtazapine to 10mg by week two, and switched to PRN Valium use. At end of six weeks, patient discontinued Cardiprin and Celebrex. By four weeks post-therapy, patient discontinued Mirtazapine. At end of six weeks of therapy, PCL-C was reduced from 78 to 23, PHQ-9 from 24 to 4, HAM-A from 33 to 3, and WHO-DAS 2.0 from 115 to 43. FR's sleep improved to eight to nine hours per night, uninterrupted following week two of therapy. FR reported improvements in cognition, mood regulation, social interaction and sleep.

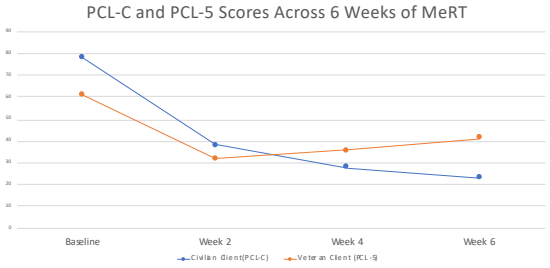

Figure 2: PCL-C and PCL-5 scores at baseline, pre-treatment, and following two, four and six weeks of daily MeRT treatment.

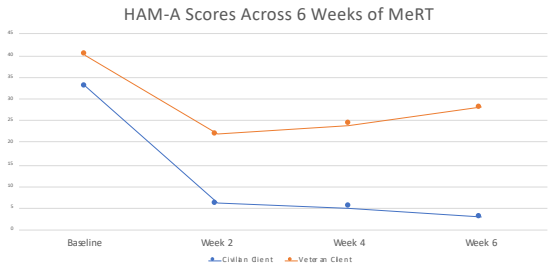

Figure 3: HAM-A scores at baseline, pre-treatment, and following two, four and six weeks of daily MeRT treatment.

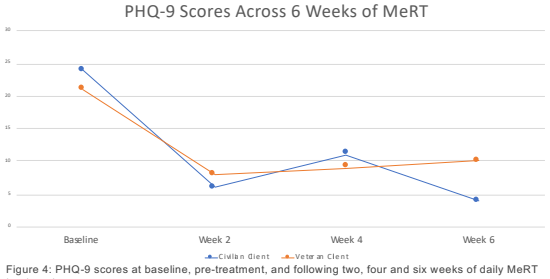

Figure 4: PHQ-9 scores at baseline, pre-treatment, and following two, four and six weeks of daily MeRT treatment.

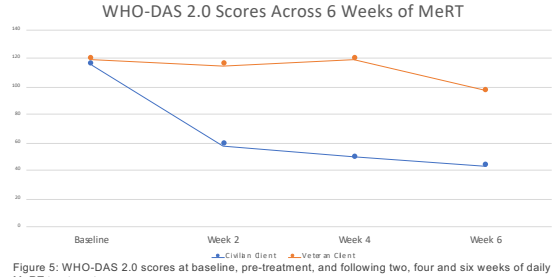

Figure 5: WHO-DAS 2.0 scores at baseline, pre-treatment, and following two, four and six weeks of daily MeRT treatment.

Discussion

Two subjects with severe PTSD symptomatology underwent six weeks of daily EEG-ECG-guided TMS (MeRT). Reductions in PTSD symptom severity is noted for both subjects as measured by the PCL-C and PCL-5. Subjects reported significant reductions in depression and anxiety symptom severity as measured by PHQ-9 and HAM-A, as well as improvements in quality of life as measured by WHO-DAS 2.0. Patients reported improvements in sleep quality, reductions in medications and improvement in overall quality of life. The case reports here further reinforce the growing body of evidence that patient-specific guided neuromodulation needs further research in robust clinical trial settings.