

Safety and Efficacy of Repetitive Transcranial Magnetic Stimulation (rTMS) for Depression in Mild to Moderate Traumatic Brain Injury (TBI): a case series



Mohammed Ahmed, M.D.^{1,2,3}, Kristoffer Nissinen, M.D.^{1, 2, 3}, Shan Siddiqi, M.D.⁴, Samreen Haque¹, Alex Richardson¹

¹ Kaizen Brain Center, San Diego, CA, ² UC San Diego, School of Medicine, Shiley-Marcos Alzheimer's Disease Research Center, ³ UC San Diego, Department of Neurosciences, San Diego, ⁴McLean Hospital, Harvard Medical School

Background

- Repetitive Transcranial Magnetic Stimulation (rTMS) is an FDA-cleared treatment for treatment-resistant depression (TRD)
- Traumatic Brain Injury (TBI)/Concussion can lead to significant depression as part of the post-concussive syndrome (PCS) spectrum
- Psychopharmacological treatment can be challenging due to side effects, particularly migraine headaches, which are also present after TBI
- While TMS for TRD is an option, safety data is limited due to concerns of an increased risk for seizures in patients with TBI

Methods

We present a case series of four patients with TBI (two mild and two moderate) who were treated with rTMS. Magstim, an FDA-cleared device, was used for treatment. Brainsight Neuronavigation system was used to maximize motor-mapping precision.

- Safety was measured by lack of adverse effects, specifically seizures
- Self-reported efficacy measures were used for, depression (PHQ-9), anxiety (GAD-7), and quality of life (WHOQOL-BREF)
- The physician-administered HAM-D was also used for depression, and patients underwent three clinical evaluations: baseline, 3 weeks and 6 weeks
- A self-report headache diary was maintained by patients with migraine history

All patients received treatments to the right and/or left dorso-lateral prefrontal cortex (DLPFC). Treatments to the left DLPFC were high frequency (HF), or excitatory while those to the right were low frequency (LF) or inhibitory.

Case	Description	Diagnoses	Contraindications	rTMS Protocol
1	47-year-old female	Recurrent MDD Migraine disorder	Moderate TBI	HF to left DLPFC
2	21-year-old male	Recurrent MDD Anxiety	Mild TBI Tumor resection Seizure history	LF to right DLPFC
3	47-year-old male	Recurrent MDD	Moderate TBI	Bilateral: HF to left DLPFC, LF to right DLPFC
4	61-year-old female	Recurrent MDD Bipolar disorder Upper motor neuron disorder	Mild TBI	Bilateral: HF to left DLPFC, LF to right DLPFC

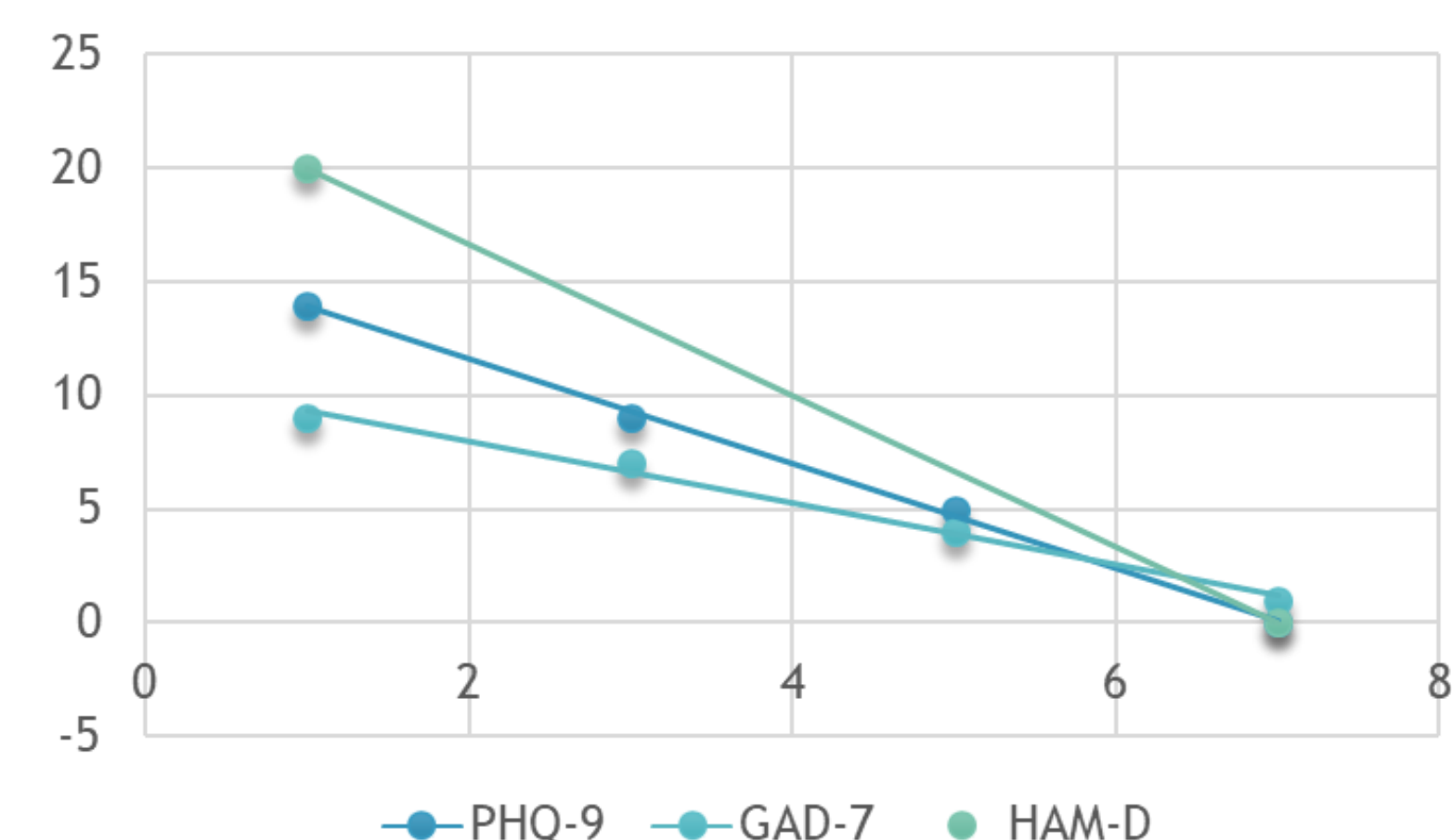
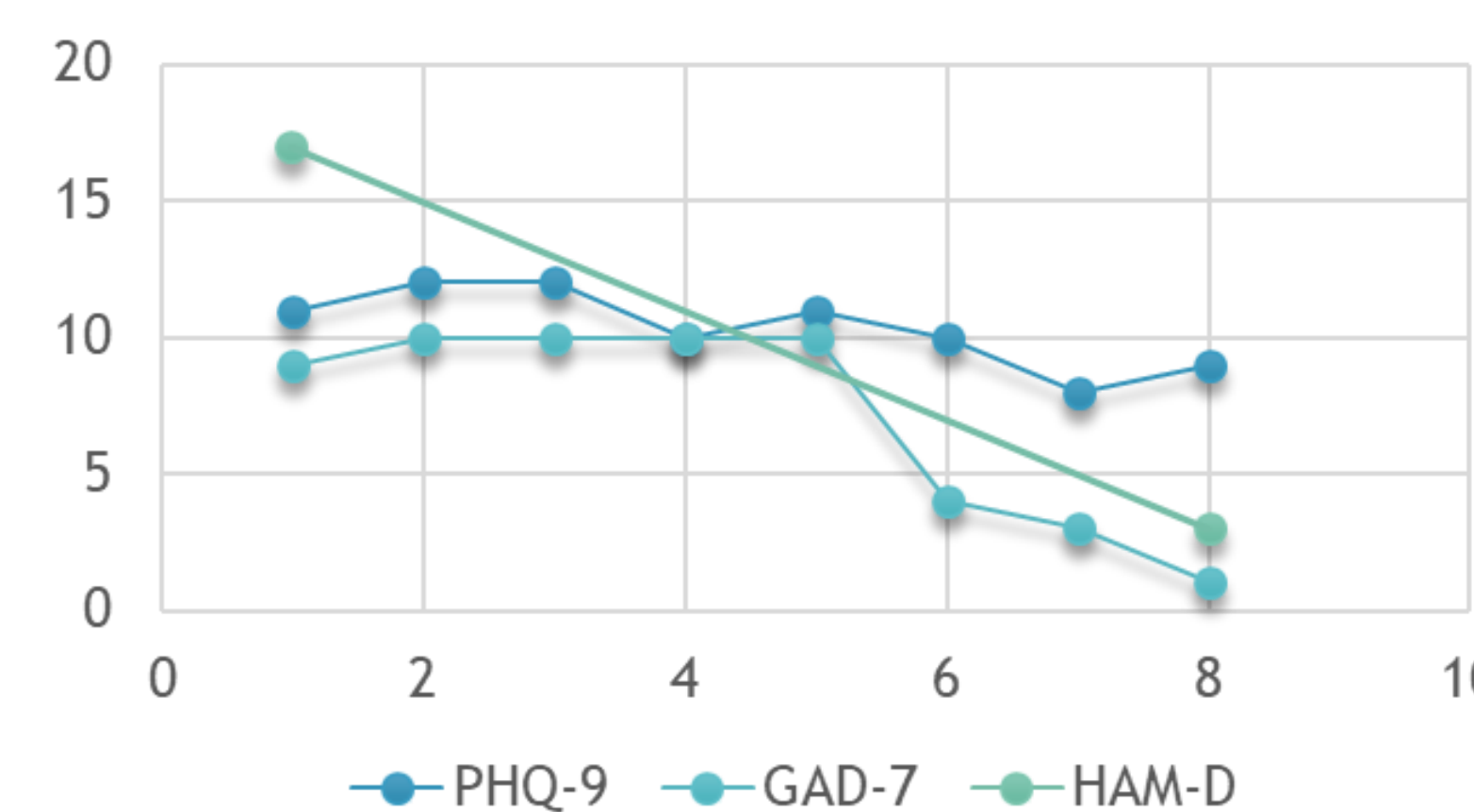
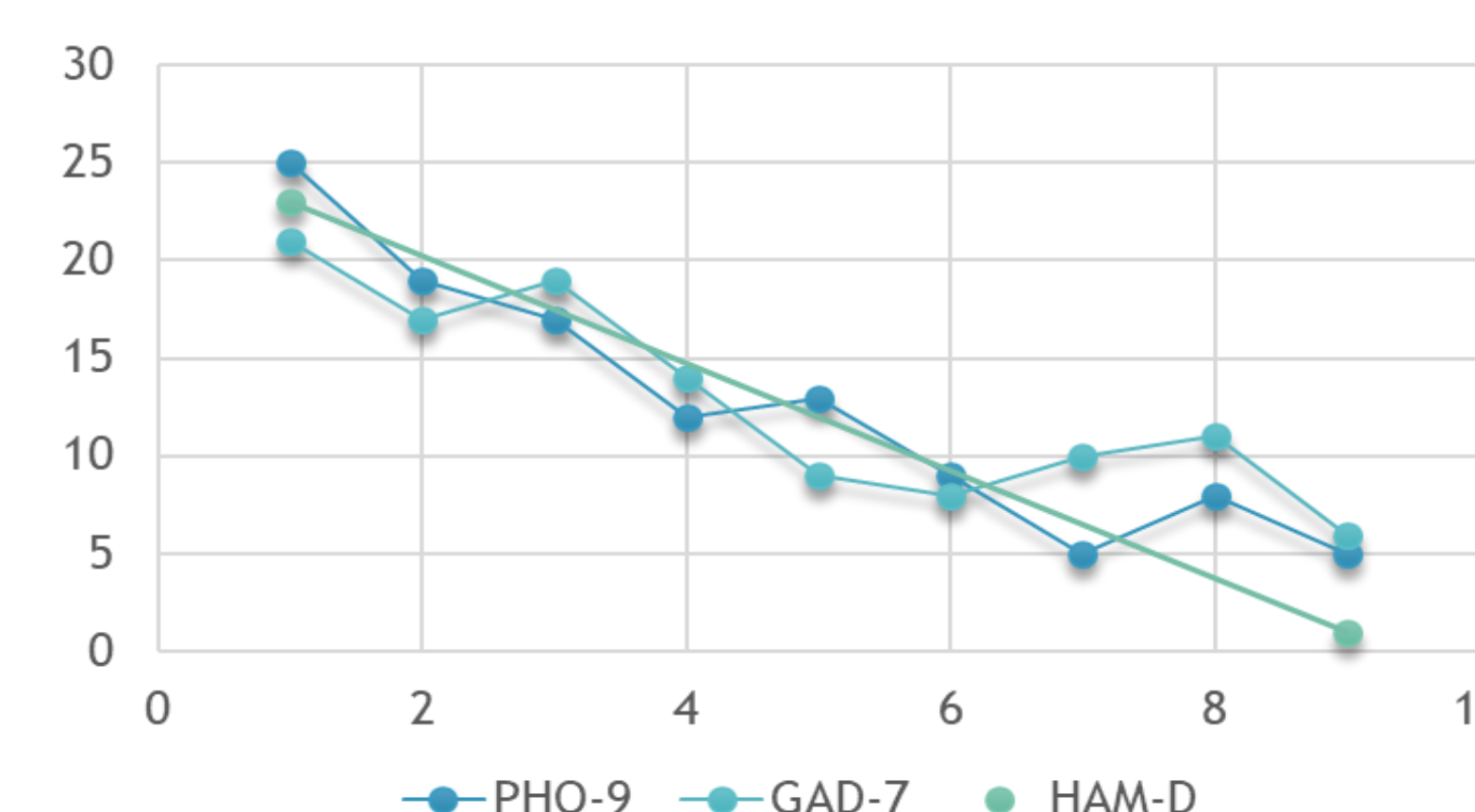
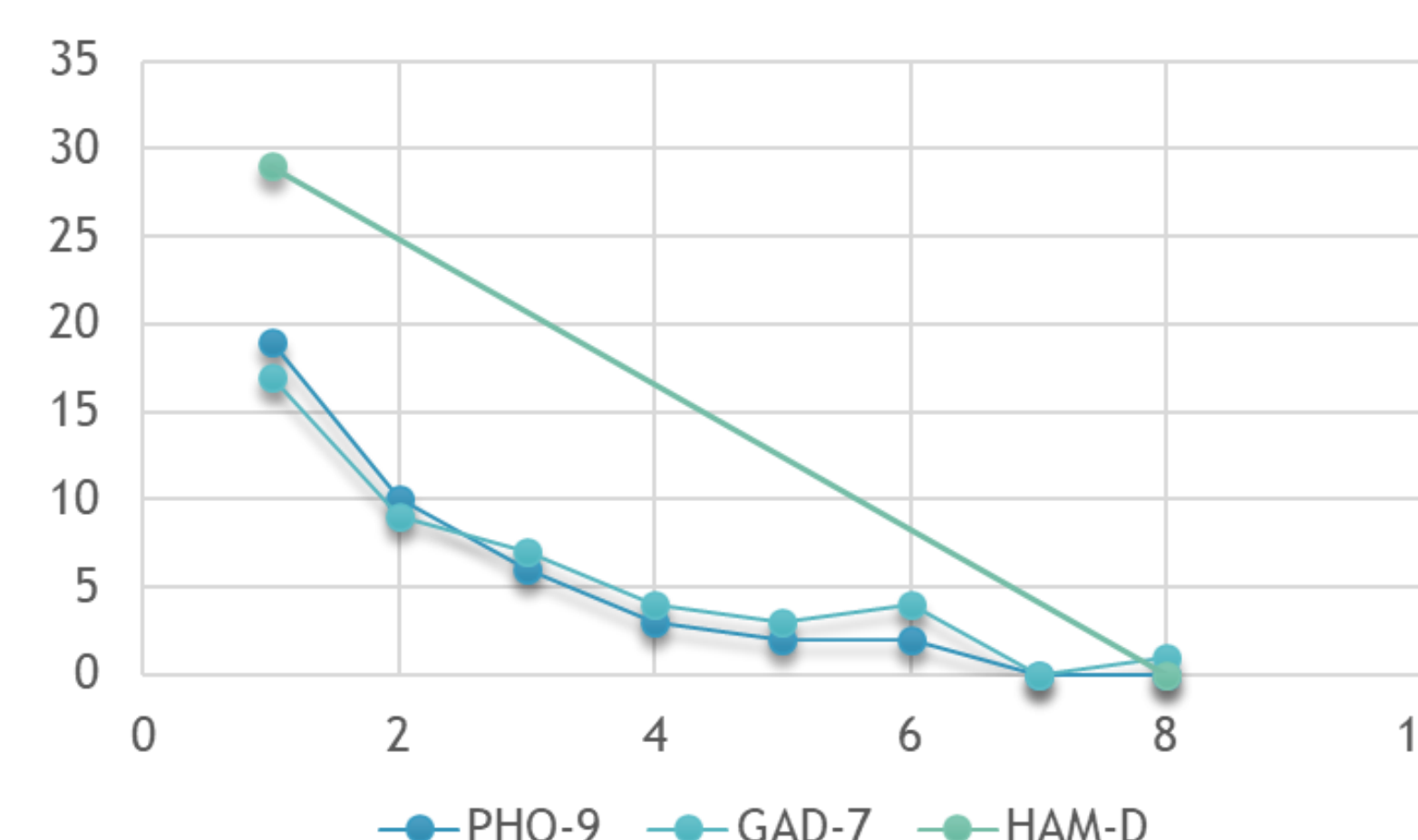
Results

Safety:

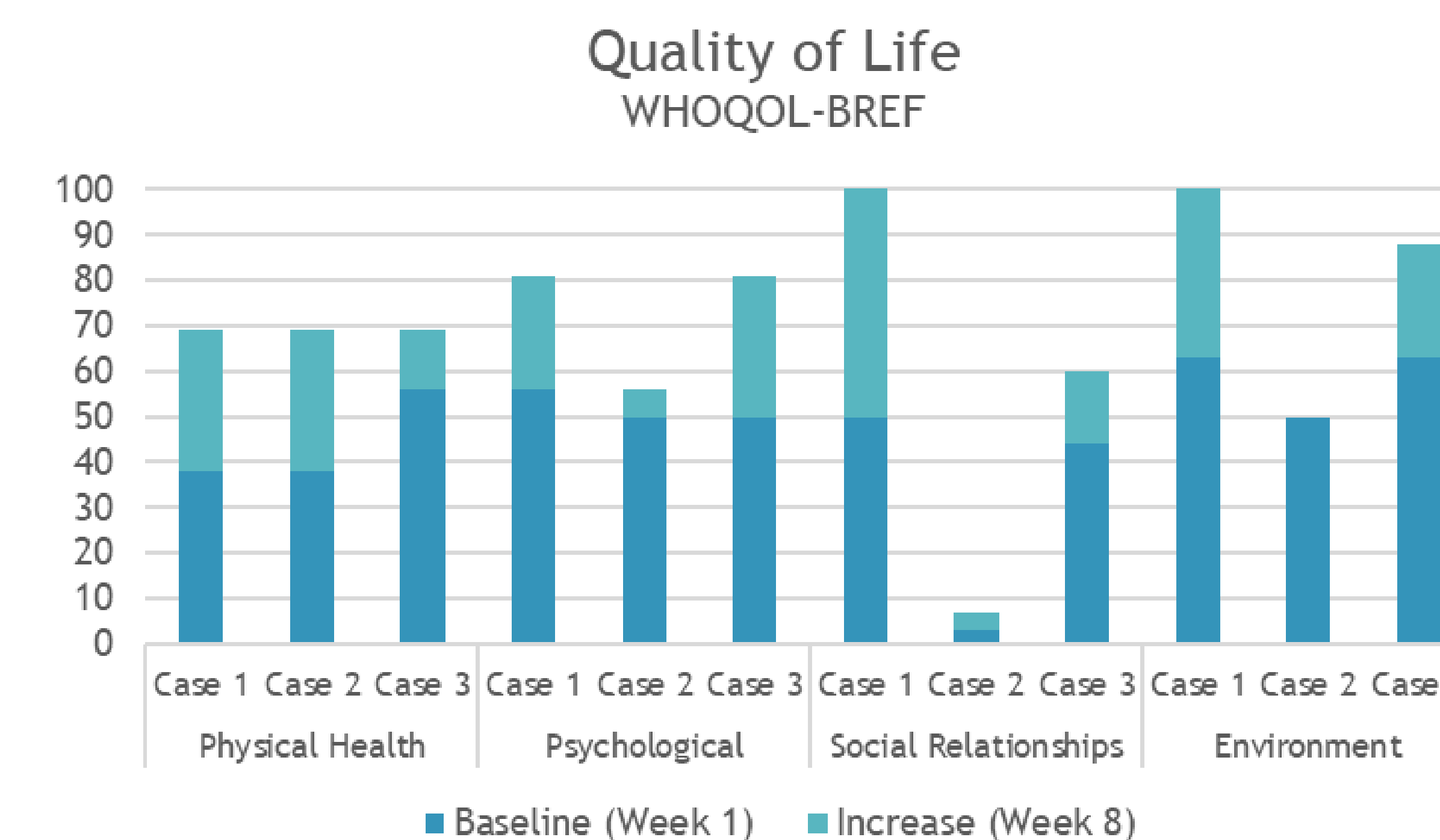
- All four patients experienced little to no side effects
- No patients had any seizure activity

Efficacy:

- Substantial clinical improvement was noted in depression, anxiety, and quality of life scales
- PHQ-9 and HAM-D scores for all patients went from the moderately-severe/severe range to the minimal-to-none range by the end of the treatment course
- Patients with migraine history also noted significant reduction in migraine episodes
- Increases on the WHOQOL-BREF quality of life index were observed across all four domains for Cases 1 and 3, while Case 2 saw increases in physical and psychological health



Scores from the depression and anxiety indexes administered to each patient over 8 weeks of rTMS treatment



Conclusions

- TMS can be a safe and effective option for treating depression secondary to TBI
- Further studies are warranted to understand the relative efficacies of different rTMS protocols in treating depression within the context of post-concussive syndrome