STOP-TIC: Strengthening Tourette Treatment Options Using TMS to Improve CBIT

An Open Label Study

Presented By:

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Background

- Up to 20% of patients with Tourette Syndrome (TS) have persistent tics into adulthood
- Tics lead to dysfunction in daily life and in extreme cases can cause injury
- Pharmacologic treatments are limited due to side effect profile
- Deep brain stimulation is invasive and not all patients are candidates
- Comprehensive behavioral intervention for tics (CBIT) is effective and safe but may only lead to 40% reduction in tics

Transcranial Magnetic Stimulation

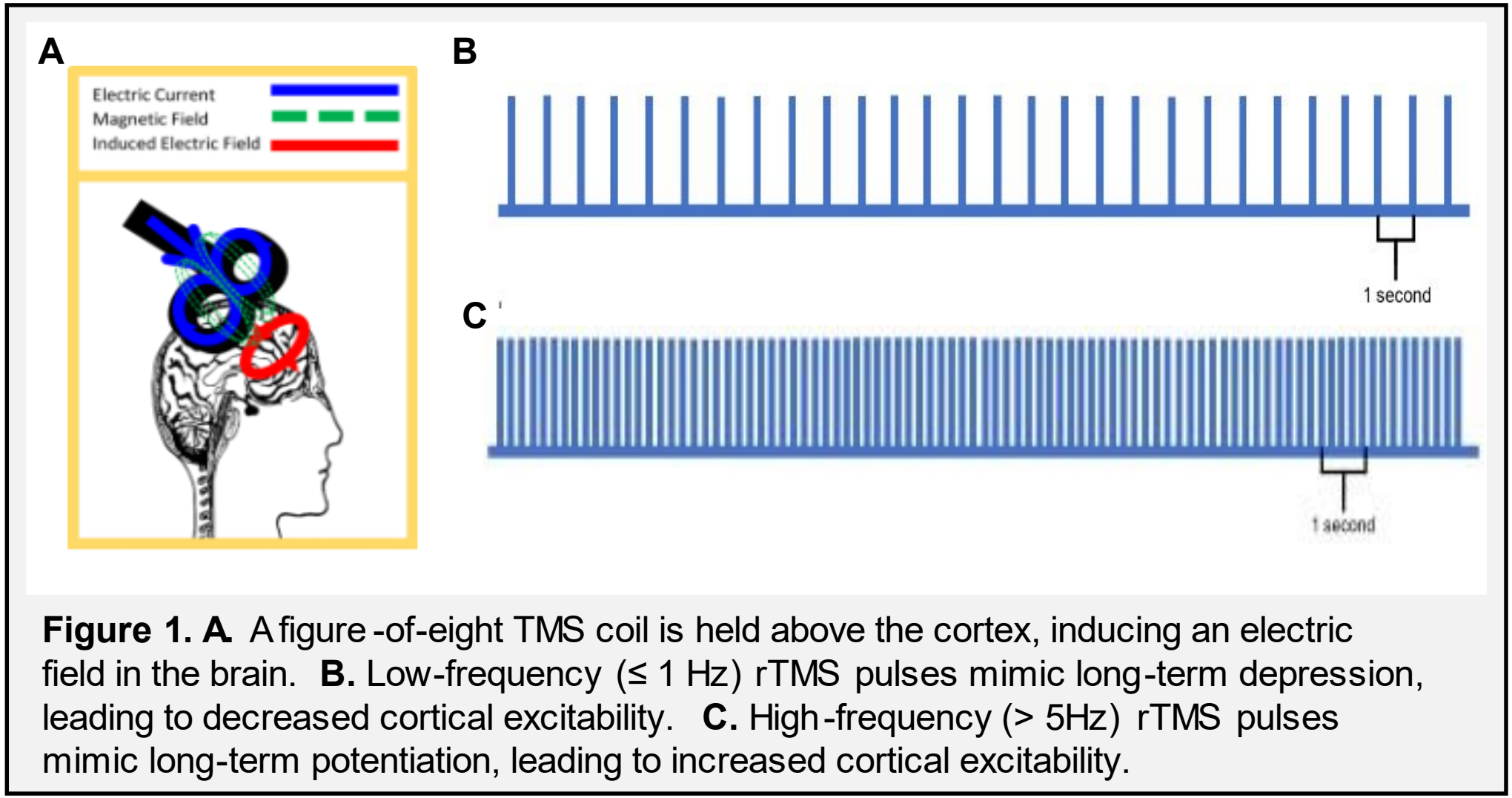


Figure 1. A. A figure-of-eight TMS coil is held above the cortex, inducing an electric field in the brain. **B.** Low-frequency (≤ 1 Hz) rTMS pulses mimic long-term depression, leading to decreased cortical excitability. **C.** High-frequency (> 5Hz) rTMS pulses mimic long-term potentiation, leading to increased cortical excitability.

Novel TMS Protocol

- Neurostimulation Protocol:
  - 1-Hz rTMS over the SMA at 110% RMT
  - Each session consisted of 6 trains lasting 5 minutes each (300 pulses per train) with an intertrain interval of 1 minute for a total duration of 35 minutes (1800 pulses)
  - Patients received 4 sessions each day on 4 consecutive days for a total of 16 sessions

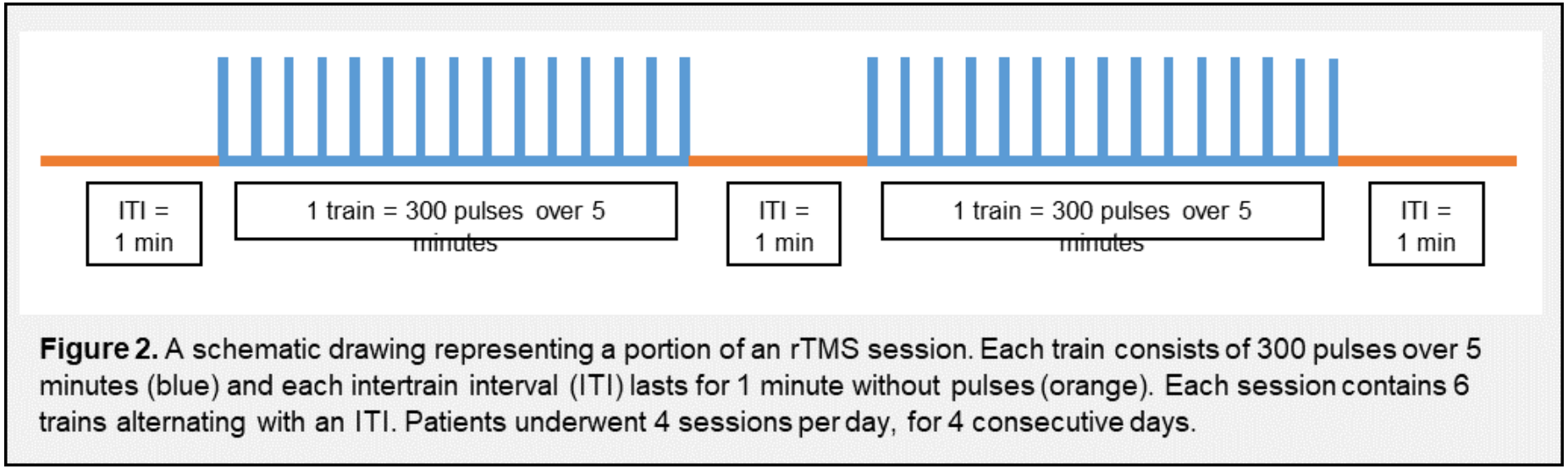


Figure 2. A schematic drawing representing a portion of an rTMS session. Each train consists of 300 pulses over 5 minutes (blue) and each intertrain interval (ITI) lasts for 1 minute without pulses (orange). Each session contains 6 trains alternating with an ITI. Patients underwent 4 sessions per day, for 4 consecutive days.

Research Protocol

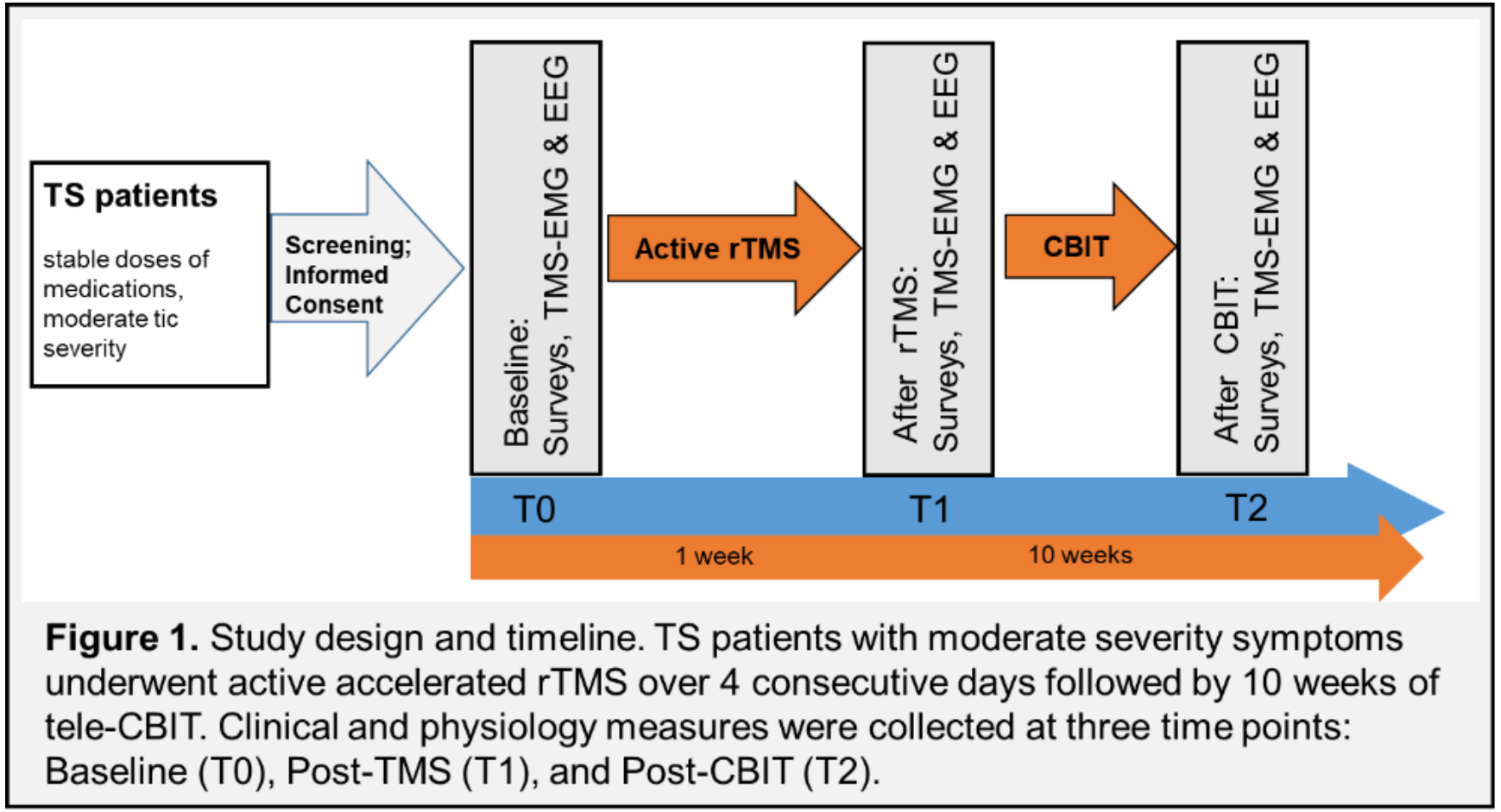


Figure 1. Study design and timeline. TS patients with moderate severity symptoms underwent active accelerated rTMS over 4 consecutive days followed by 10 weeks of tele-CBIT. Clinical and physiology measures were collected at three time points: Baseline (T0), Post-TMS (T1), and Post-CBIT (T2).

Demographics

	Participant 1	Participant 2	Participant 3
Gender	M	M	F
Age (years)	30	26	18
Age of Tic Onset (years)	8	6	15
Co-morbid diagnoses:			
ADHD	Y	Y	Y
OCD	Y	Y	Y
Anxiety	Y	Y	Y
Depression	Y	Y	Y
Learning Disability	N	Dysgraphia	N
Medication Regimen	Deutetrabenazine 36 mg Diazepam 2-5 mg PRN	Botulinum toxin for facial tics	Methylphenidate 60 mg qd Guanfacine 4 mg qd Aripiprazole 5 mg qd Trazadone 75 mg qd

Table 1. Demographic information of the three participants including presence of co-morbid diagnoses and relevant medication regimen throughout the duration of the study.

Safety

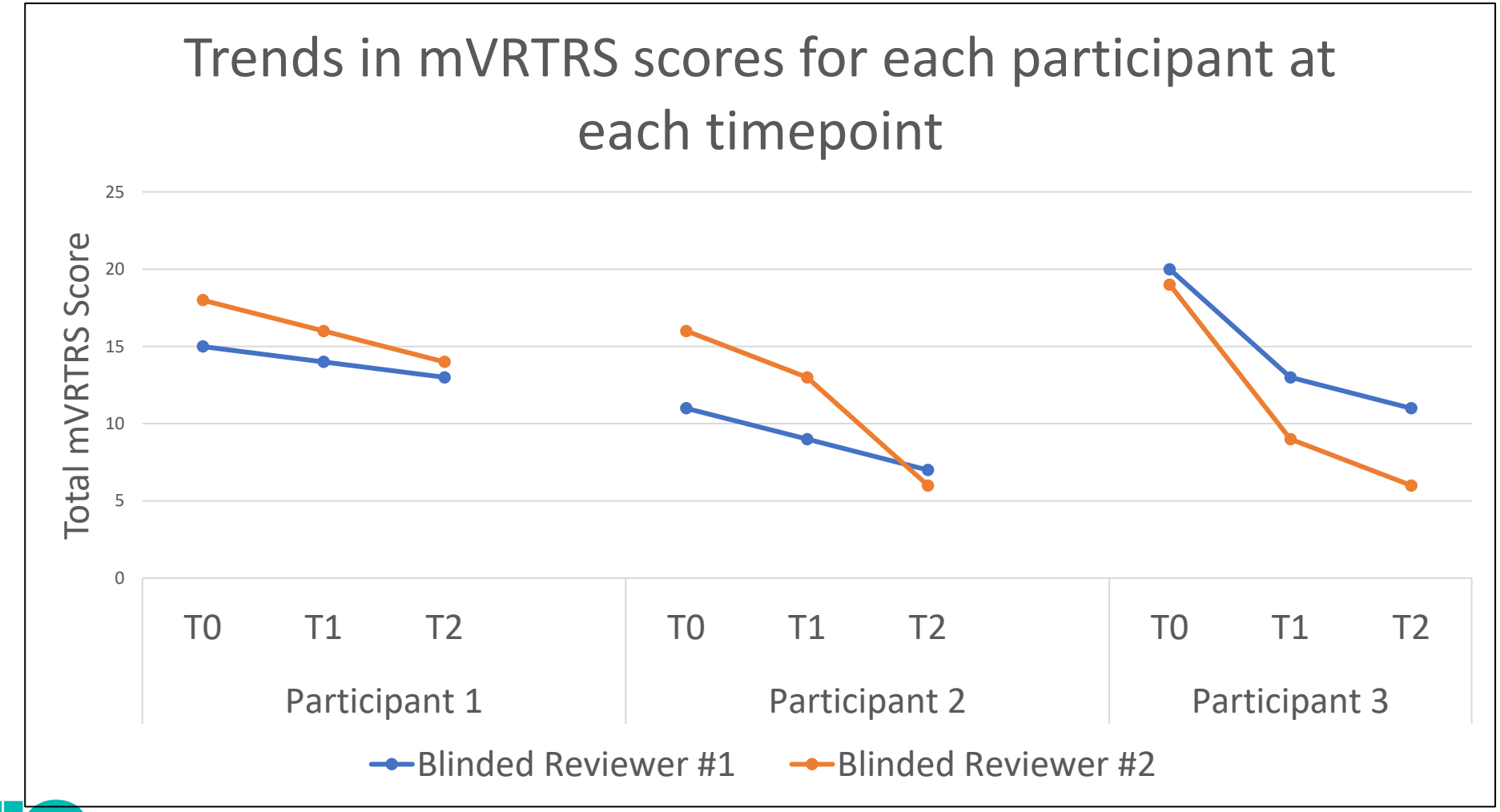
- All 3 patients tolerated the TMS sessions well and completed the full study protocol
- 2/3 patients had mild transient headaches
- 1 patient had a migraine (history of migraines)
- All adverse events were mild, resolved without further intervention, and are within the realm of typical, expected side effects for standard TMS protocols

Results

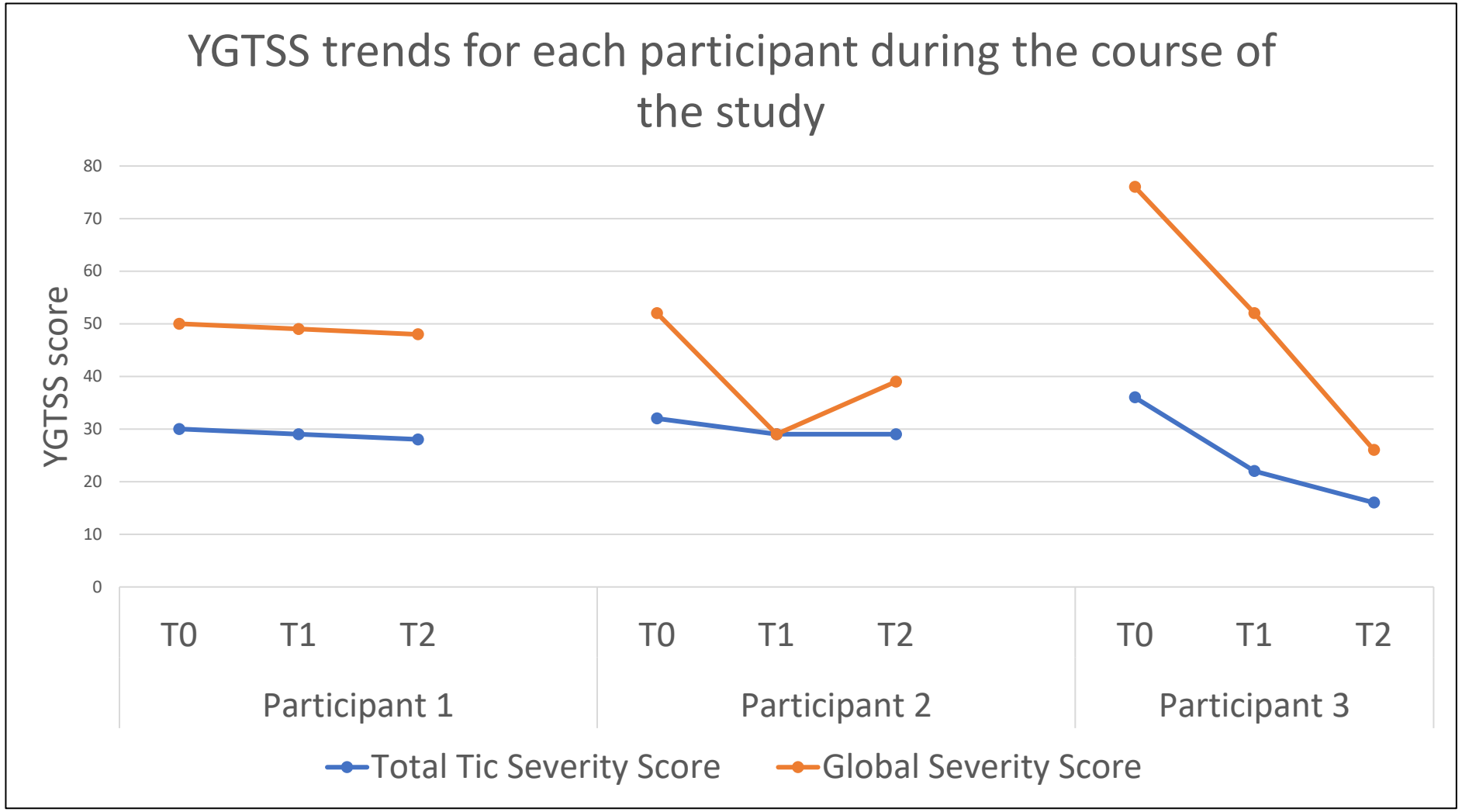
Clinical Measure	F-statistic	P-value
BDI	F(2) = 0.5219	0.6228
BAI	F(2) = 0.1090	0.8984
Y-BOCS	F(2) = 0.2068	0.8188
ASRS	F(2) = 6.7875	0.0288
GTS-QOL: well-being	F(2) = 4.8381	0.0561
GTS-QOL: life satisfaction	F(2) = 0.3369	0.7267

Table 2. One-way ANOVA results for comorbid clinical results. BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory; Y-BOCS = Yale-Brown Obsessive Compulsive Scale; ASRS = Adult ADHD Self-Report Scale; GTS-QOL = Gilles de la Tourette Syndrome – Quality of Life scale

Results


Trends in mVRTRS scores for each participant at each timepoint
Total mVRTRS Score
25
20
15
10
5
0
T0
T1
T2
T0
T1
T2
T0
T1
T2
Participant 1
Participant 2
Participant 3
Blinded Reviewer #1
Blinded Reviewer #2

Results


YGTSS trends for each participant during the course of the study
YGTSS score
80
70
60
50
40
30
20
10
0
T0
T1
T2
Participant 1
T0
T1
T2
Participant 2
T0
T1
T2
Participant 3
Total Tic Severity Score
Global Severity Score

Conclusion

- The STOP-TIC accelerated rTMS protocol followed by tele-CBIT is a safe, well-tolerated, and feasible treatment for adults with tics
- May offer a unique and novel approach to improve and prolong the benefits of CBIT
- A randomized controlled trial is currently being developed at WVU to study efficacy in a larger cohort

Thank You!

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TIC CON

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