Reduction of tics after CBIT is not associated with change in EEG alpha coherence during a Go/No-Go task in children with Tourette syndrome

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INTRODUCTION

- Comprehensive Behavioral Intervention for Tics (CBIT) is a first-line treatment for Tourette syndrome (TS). However, the brain mechanisms involved in successful reduction in tic symptoms following CBIT are poorly understood.

- Enhanced EEG coherence in the alpha frequency band (8-13 Hz) over frontomesial electrodes during a response inhibition task has been suggested as a mechanism by which adults with TS may gain control over their tics (Serrien et al., 2005).

OBJECTIVES AND HYPOTHESES

- In this study, we tested whether alpha coherence during a Go/NoGo task represented a possible mechanism of tic reduction after CBIT.

- We hypothesized that alpha coherence would increase from baseline to endpoint in children undergoing CBIT relative to a Treatment-as-Usual (TAU) control condition. We also hypothesized that children with larger baseline alpha coherence would be those showing larger decreases in tic severity after CBIT.

METHODS

- Randomized controlled trial of CBIT vs TAU.

Table 1. Characteristics at baseline	CBIT (n = 16)	TAU (n = 16)
Age in years, mean (SD)	11.4 (1.8)	11.3 (1.5)
Sex (% male)	87.5	81.3
Handedness (% right-handed)	81.3	87.5
YGTSS total tic score	23.8 (6.0)	24.4 (5.1)
SNAP-IV	14.6 (12.5)	19.2 (14.3)
Comorbid diagnoses, number (%)	12 (75)	10 (62.5)
Concomitant medication, number (%)	11 (68.8)	7 (43.8)

- 16 children assigned to CBIT; 16 assigned to TAU.

- Outcomes measures: YGTSS & CGI-I.

- Task: Cued Go/NoGo with 3s foreperiod between cue and target. 120 Go & 40 NoGo trials.

Figure 1: Go/NoGo task

- EEG recorded with 128-electrode geodesic sensor nets.
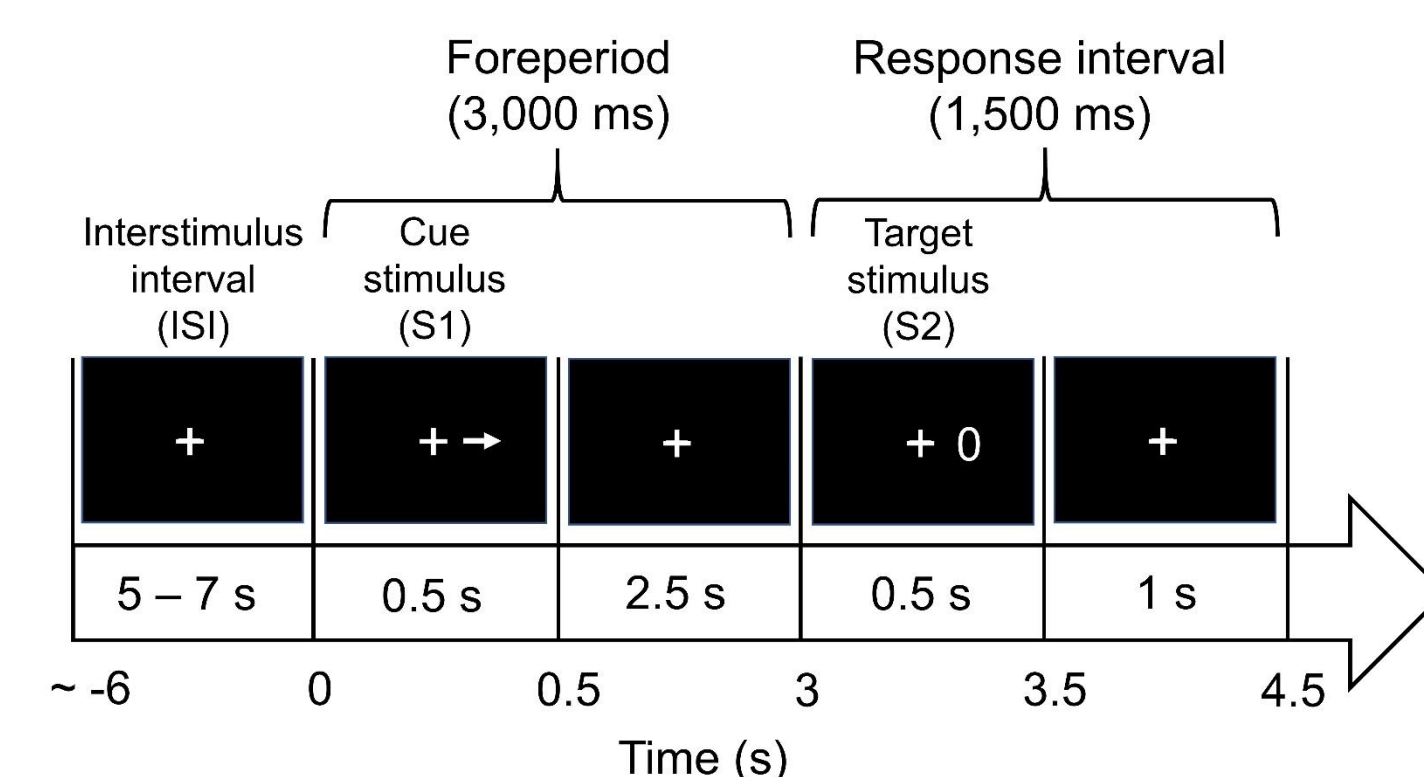
- EEG alpha (8-13 Hz) coherence assessed between 4 channel pairs (F3-C3, FCz-C3, F4-C4 & FCz-C4). Computed during NoGo trials as a percentage score ((post-target – pre-cue) / pre-cue), indicating coherence increase from pre-cue to post-target.

- Effect sizes were computed by subtracting the baseline-to-endpoint change in the TAU group from that of the CBIT group and dividing by the pooled SD at baseline.
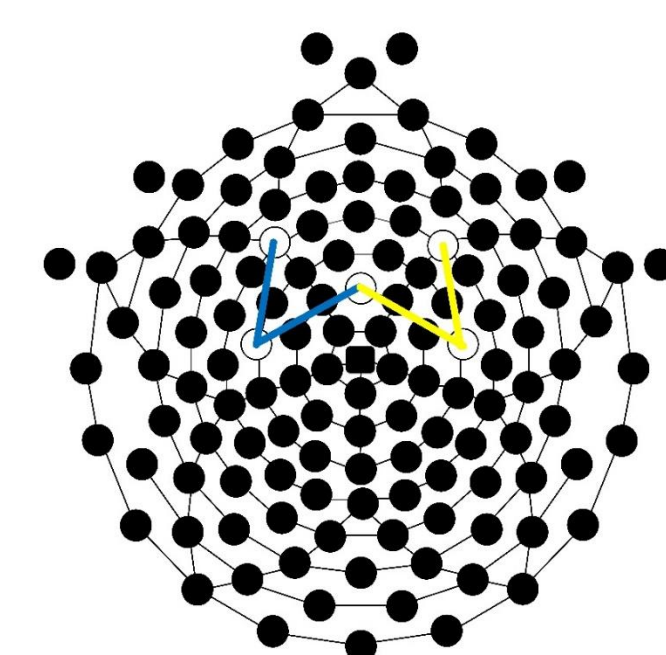

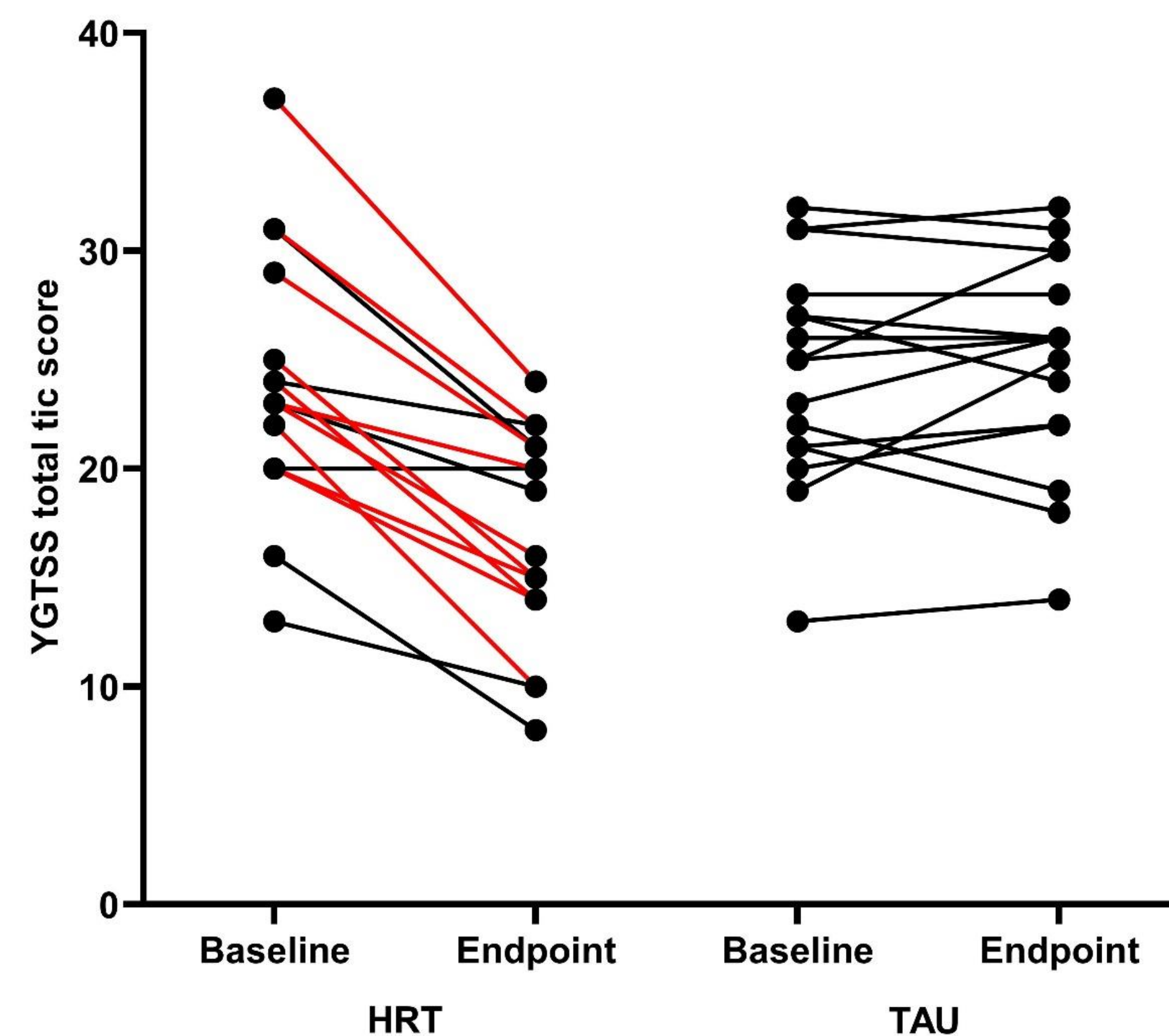*Figure 2 Electrodes used in data analyses*

RESULTS

Figure 3: Clinical outcome

- Tic severity decreased from 23.8 ± 6.0 at baseline to 16.9 ± 4.9 at endpoint in the CBIT group and it increased from 24.4 ± 5.0 to 24.9 ± 5.0 in the TAU group (Time X Treatment interaction: $F_{(1,30)} = 41.08$, $p < .001$, d: 1.34).

- Ten children (62.5%; red lines in Figure 3) in the CBIT group and none in the TAU group were rated as responders on the CGI-I (Fisher's exact test: $p < .001$).
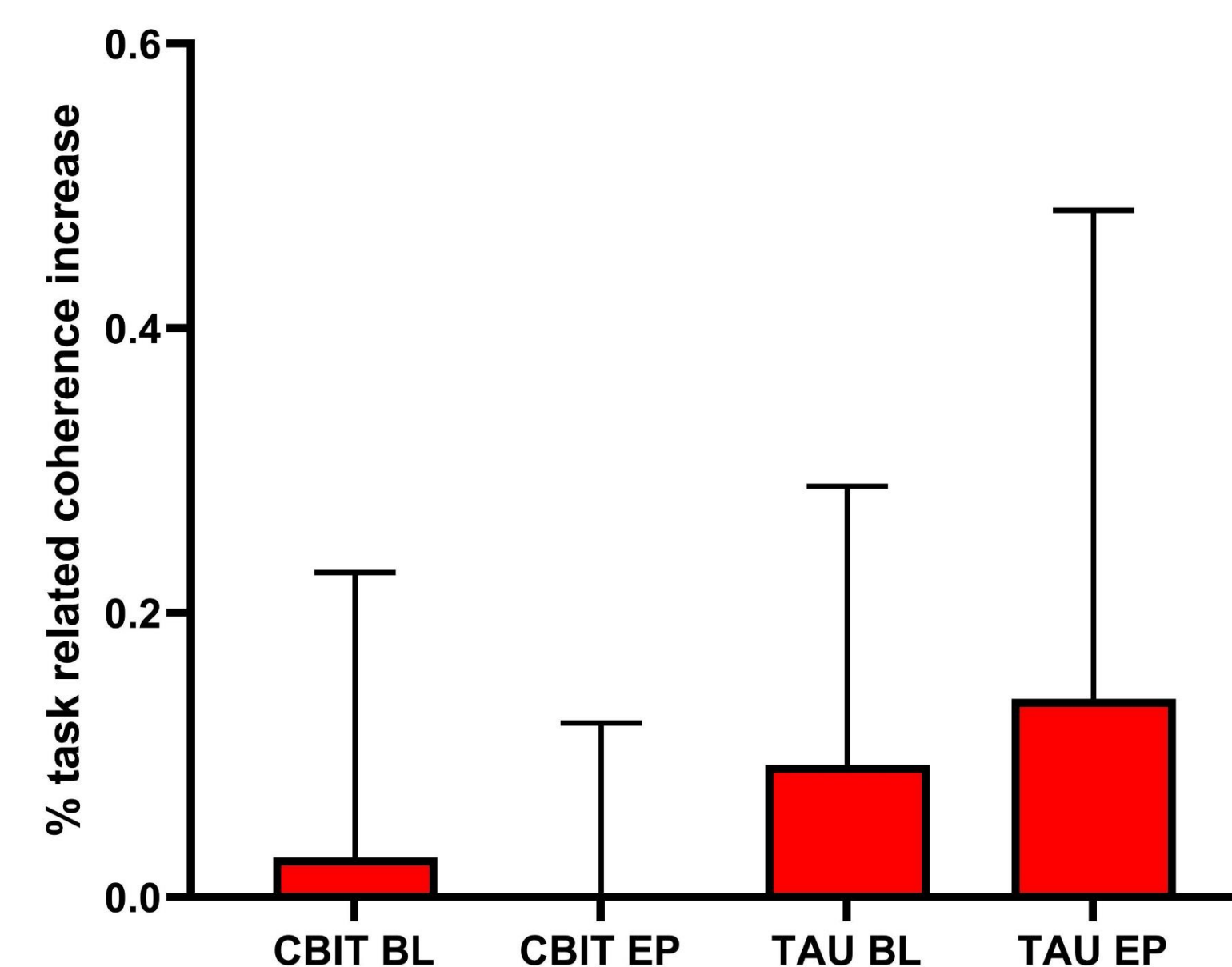

Figure 4: CBIT impact on EEG alpha coherence

- CBIT had no impact on alpha coherence. Mean ± SD values for NoGo alpha coherence changed from 0.03 ± 0.20 at baseline to 0.00 ± 0.12 at endpoint in CBIT condition, and from 0.09 ± 0.20 to 0.14 ± 0.24 in the TAU group (Time X treatment interaction: $F_{(1,30)} = 0.59$, $p = .45$, d = .37).
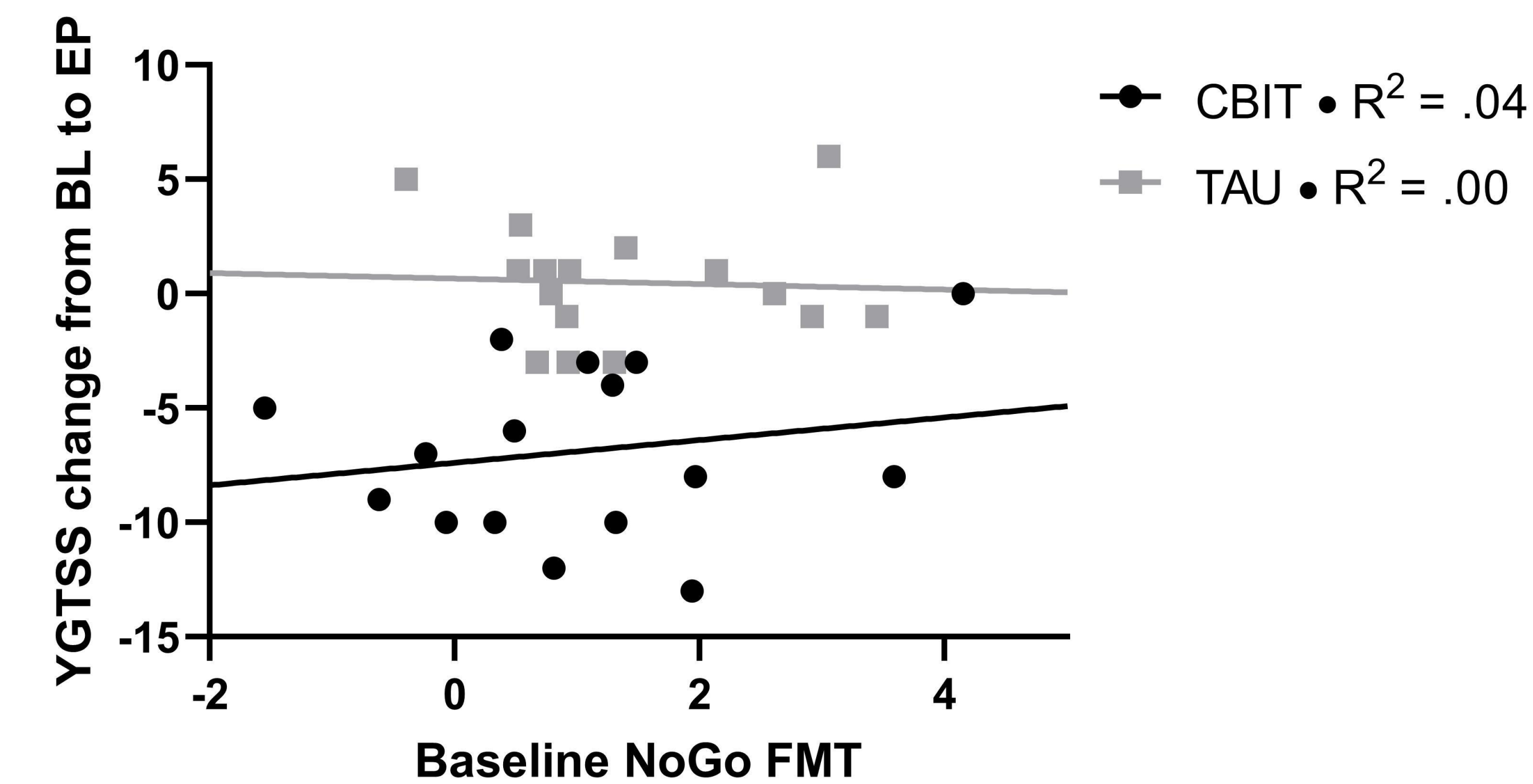

Figure 5: Prediction of treatment outcome

- Also, baseline levels of EEG alpha coherence during NoGo trials did not predict the change in YGTSS scores after CBIT relative to TAU (Treatment by NoGo coherence interaction: $F_{(1,30)} = 2.37$, $p = .14$).

CONCLUSIONS

- Consistent with previous findings (Piacentini et al, 2010), CBIT resulted in significant reduction of tics in children with TS.

- However, contrary to our hypothesis, there was no effect of CBIT on EEG alpha coherence related to response inhibition.

- Also, baseline EEG alpha coherence did not predict CBIT outcome in children with TS.

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