

Background

Autism spectrum disorder (ASD) is characterized by social impairments and repetitive behaviors, and comorbid psychiatric conditions are common and exacerbate core symptoms. In ASD¹ and depression,² abnormalities in neural activity have been observed during resting state EEG. Though resting EEG has been proposed as a biomarker to predict treatment response in depression,² its utility in comorbid conditions to ASD is poorly understood. We examined resting state EEG in relation to depressive symptoms in adults with ASD compared to adults with typical development (TD).

Method

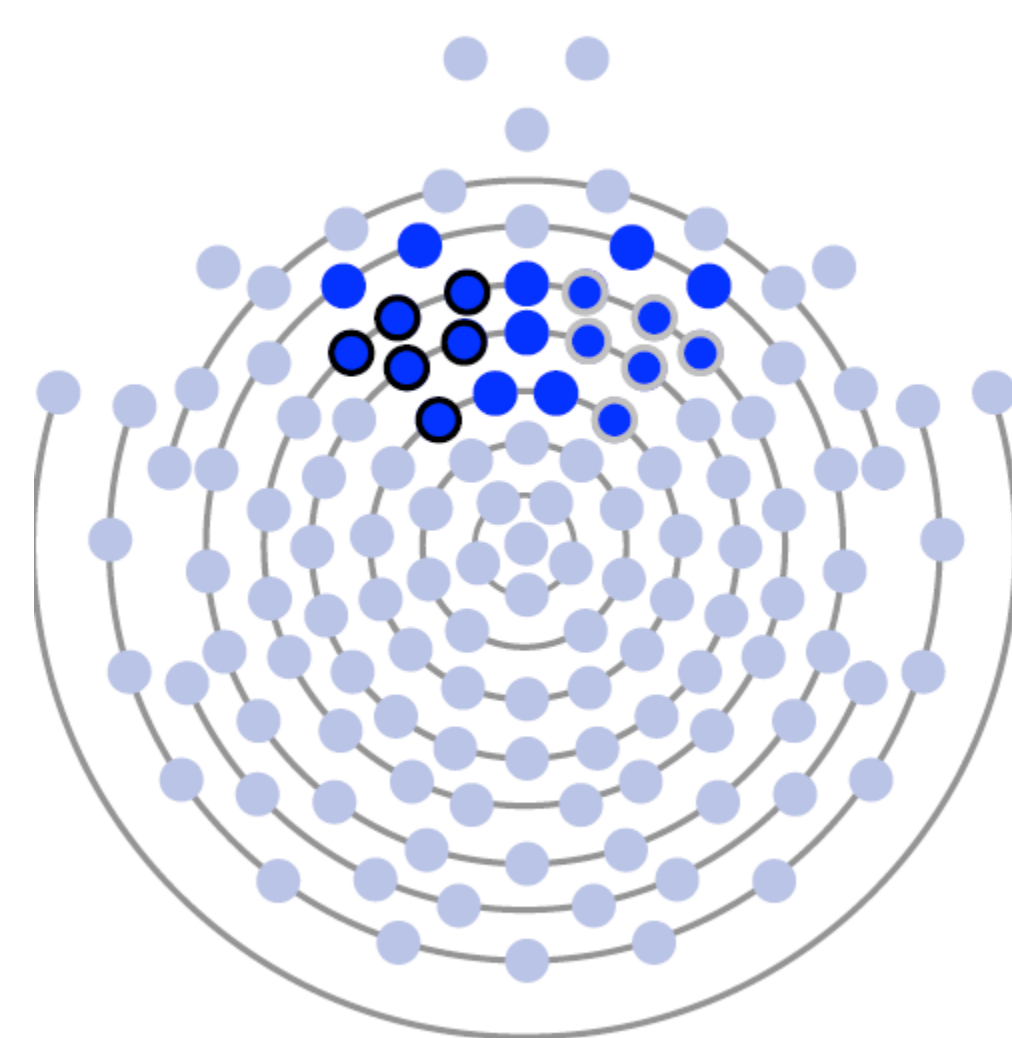
Table 1. Characteristics of the sample population

Group	Total n (% male)	Age m (sd)	IQ m (sd)
ASD	18	23.7 (5.3)	104 (17)
TD	21	24.0 (4.1)	108 (18)

Sample Population

- Participants included adults with ASD ($n=18$) and TD ($n=21$) matched on age ($M=23.9$ years) and performance IQ ($M=106$).
- Medication status and clinician rating of depressive symptoms were collected (Positive and Negative Syndrome Scale (PANSS)).

Figure 1: EEG Electrode Net Montage. Frontal electrodes included 2, 9, 18, 19, 20, 22, 23, 24, 26, 27, 3, 4, 10, 123, 124, 118, 16, 11, 12, 5 (blue). Left frontal electrodes included 18, 19, 20, 23, 24, 27 (outlined in black). Right frontal electrodes included 3, 4, 10, 123, 124, 118 (outlined in gray).



Results

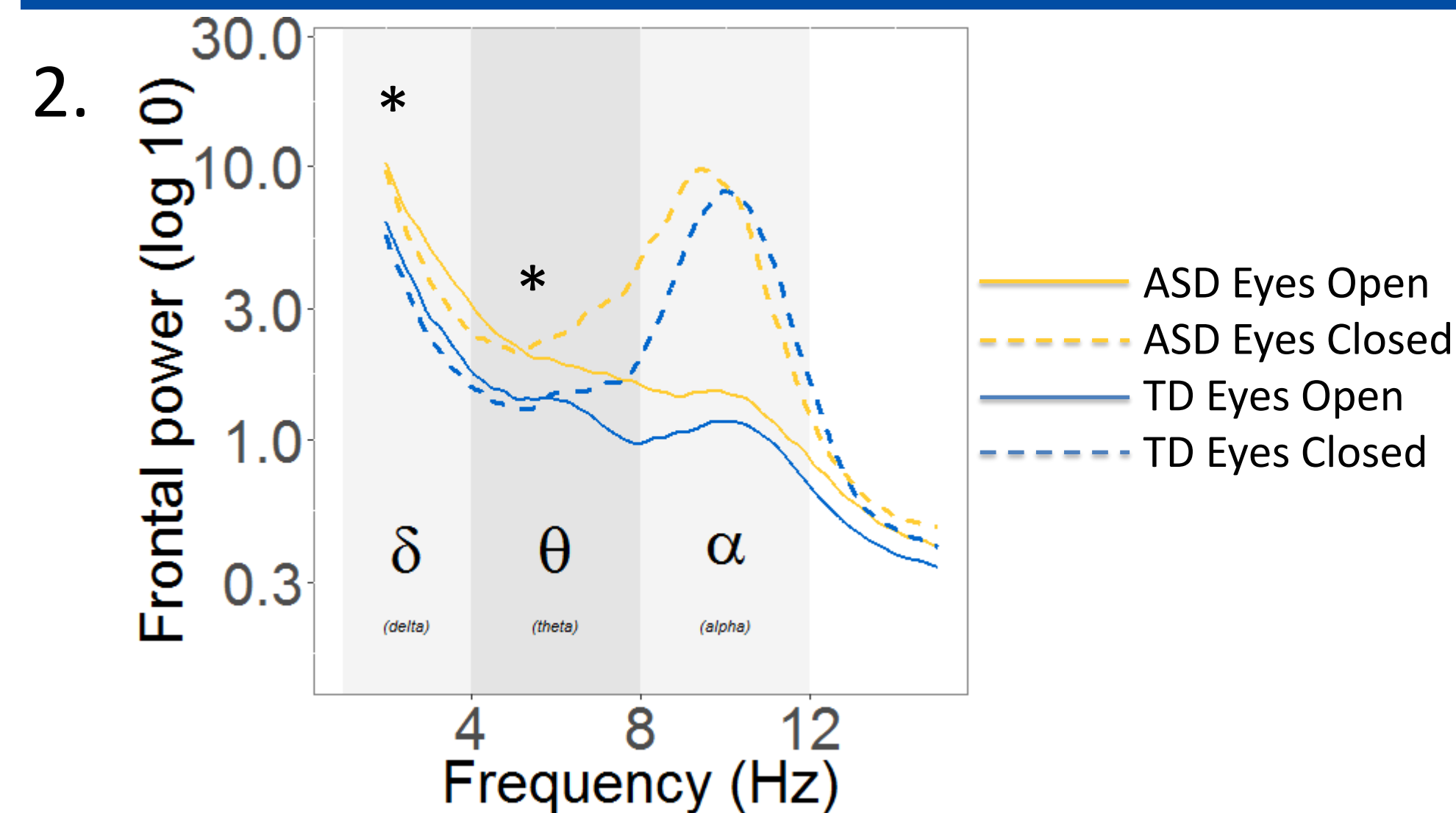


Figure 2: The ASD group had higher absolute frontal delta power than the TD group [$F(1,32)=7.8, p<.01$].

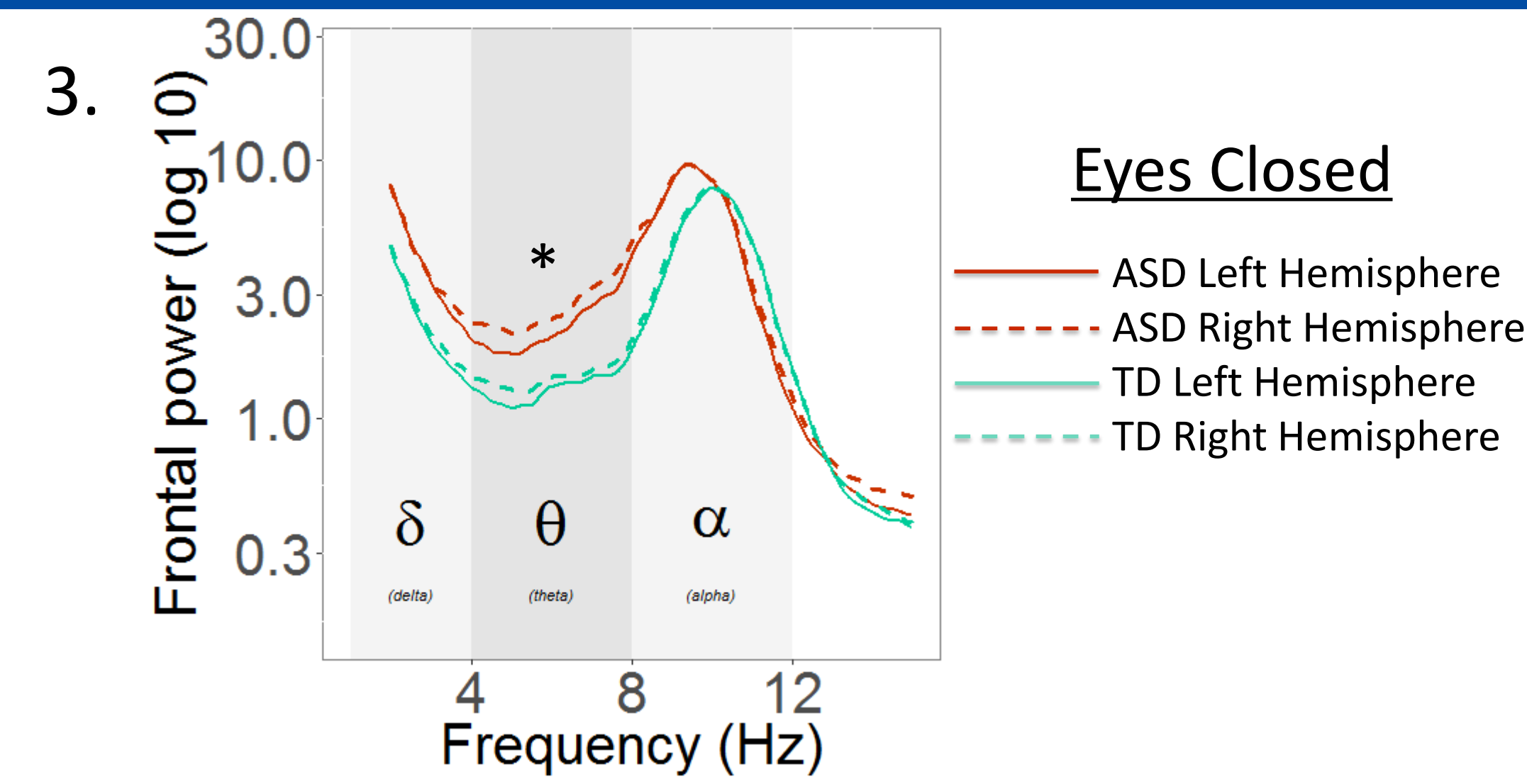


Figure 3: An interaction between diagnosis, condition, and hemisphere emerged [$F(1,32)=4.9, p<.05$] revealing higher theta power in the ASD group in the right hemisphere while eyes were closed [$t(34)=-2.0, p=.05$].

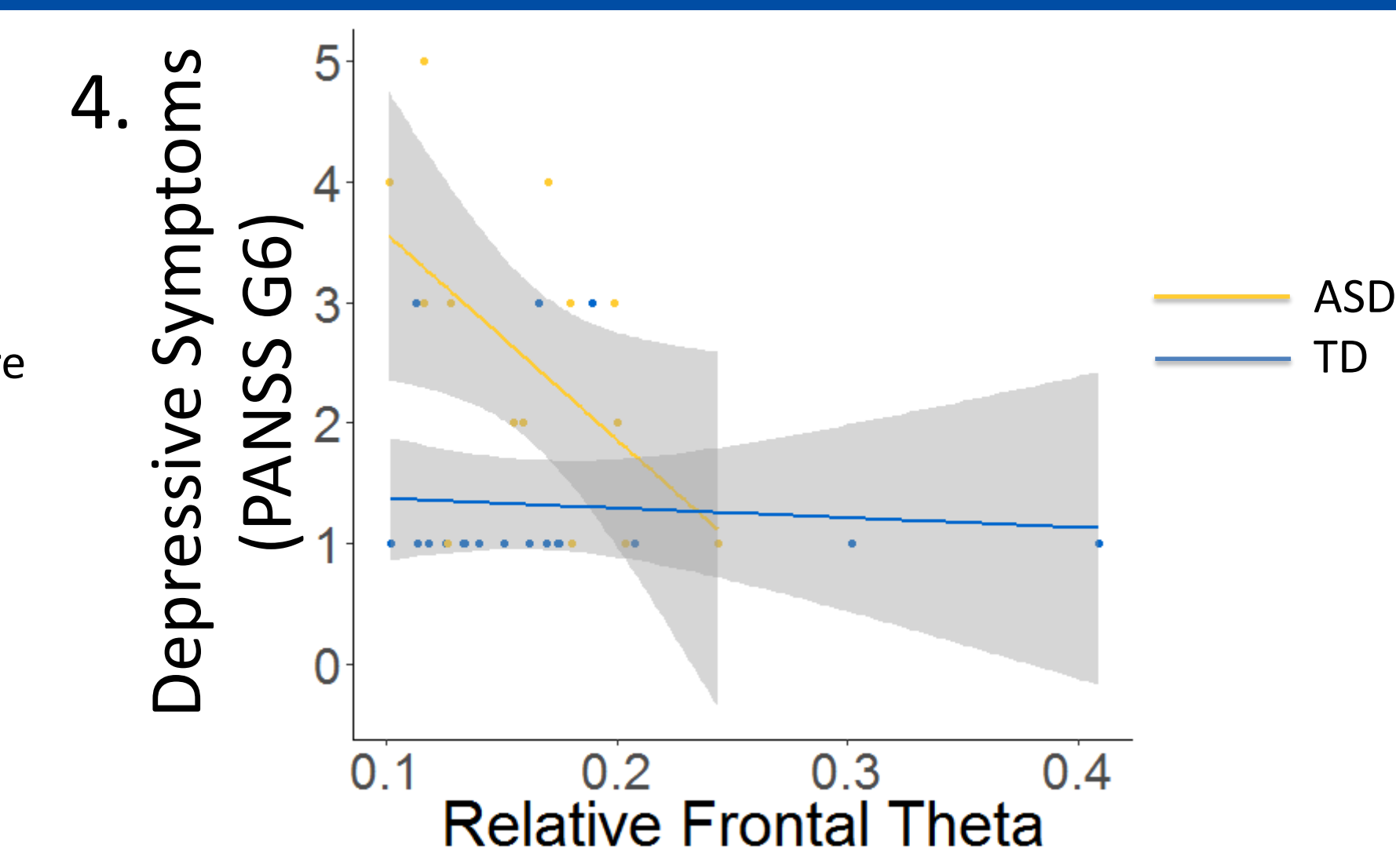


Figure 4: In the ASD group only, lower relative frontal theta power was related to more depressive symptoms while eyes were open [$r(14)=-.58, p<.05$].

EEG Data Acquisition and Processing

- EEG was recorded at 500 Hz with a 128-channel net while participants watched abstract screensavers (eyes open) or closed their eyes (eyes closed).
- EEG data were processed using EEG lab software:
 - Recordings were split by condition (eyes open or closed)
 - Filtered from 0.1 to 100 Hz
 - Re-referenced to common average reference
 - Segmented into 2 second epochs
 - Trials were rejected for movement artifact

- Participants with <20 seconds of artifact free data were excluded from further analysis
- Power spectra were extracted from the frontal region (Figure 1) for Delta (δ ; 1-4 Hz) and Theta (θ ; 4-8 Hz) ranges
- Relative power was calculated for each frequency band

Data Analysis

- Absolute and relative power in the delta and theta frequency bands were examined between groups and in relation to depressive symptoms. Repeated measure ANOVAs with follow-up t -tests and Spearman's rho correlation were utilized to examine differences between groups.

Conclusions

Enhanced absolute delta and theta power was observed in adults with ASD. This finding is consistent with other studies showing excessive power in low-frequency bands in ASD.¹ Interestingly, lower relative frontal theta power was related to more depressive symptoms which differs from previous findings of increased theta power in individuals with depression.³ This highlights the need to consider co-occurring conditions in the identification of ASD biomarkers.

References

- Wang, J., Barstein, J., Ethridge, L. E., Mosconi, M. W., Takarae, Y., & Sweeney, J. A. (2013). Resting state EEG abnormalities in autism spectrum disorders. *Journal of neurodevelopmental disorders*, 5(1), 24.
- Alhaj, H., Wisniewski, G., & McAllister-Williams, R. H. (2011). The use of the EEG in measuring therapeutic drug action: focus on depression and antidepressants. *Journal of Psychopharmacology*, 25(9), 1175-1191.
- Knott, V., Mahoney, C., Kennedy, S., & Evans, K. (2000). Pre-treatment EEG and it's relationship to depression severity and paroxetine treatment outcome. *Pharmacopsychiatry*, 33(06), 201-205.

