Restricted Repetitive Behaviors Related to Increased Activity at Ends of the Power Spectrum: Results From the ABC-CT Interim Analysis

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Introduction

- Individuals with autism spectrum disorder (ASD) exhibit high variability across symptom domains
- The neural mechanisms behind this clinical heterogeneity are poorly understood
- Motor stereotypies, unusual interests, and repetitive patterns of behavior are common symptoms of ASD. Collectively they are known as restricted repetitive behaviors (RRBs)
- Previous research has found that increased power in the alpha band (8-12 Hz) of the electroencephalography (EEG) signal is correlated with stronger RRBs in typically developing controls
- We investigated the relationship between RRBs and the frequency bands of the EEG power spectrum in a sample containing children with ASD and typically developing controls.

Methods

Participants

- EEG data and clinical information were collected from 153 children with ASD and 63 typically developing (TD) children.
- Participants were recruited from the New Haven, CT, Boston, MA, Los Angeles, CA, Durham, NC, and Seattle, WA metropolitan areas as a part of the Autism Biomarkers Consortium for Clinical Trials (ABC-CT) feasibility study.

Table 1. Sample Characteristics

Group	N (N males)	Mean age (Y)	Min Age (Y)	Max Age (Y)	IQ (SD)
ASD	134 (124)	9.4	6.4	12.2	97 (18.6)
TD	58 (41)	9.4	6.4	12.5	115 (13.5)

Behavioral Assessment:

- RRBs were measured using the RRB subscales of the Autism Diagnostic Observation Schedule 2 (ADOS-2) stereotypy subscale and the Social Responsiveness Scale (SRS).

Rigid and Stereotyped Behaviors

- Summary statistics are presented for measures of rigid and stereotyped behaviors for each group (Table 2).

Table 2. RRB Scores by Group

Group	Mean ADOS 2 RRB Score (SD)	Mean SRS RRB Score (SD)
ASD	8.0 (2.0)	73.3 (12.4)
TD	2.6 (2.4)	43.5 (2.9)

EEG

- Resting EEG data was recorded at rest using an EGI 128 channel net at a sampling rate of 500Hz. While data was being recorded, participants watched abstract screen savers

Results

Group Differences

An ANOVA found no differences between participants with ADOS 2 RRB scores greater than 5 (High RRB) and participants with ADOS 2 RRB scores less than 5 (Low RRB) in alpha (8 to 12 Hz) and beta (13 to 35 Hz) bands. Group differences were found in the theta (4 to 7 Hz), delta (1 to 3Hz), and gamma (>35 Hz) bands.

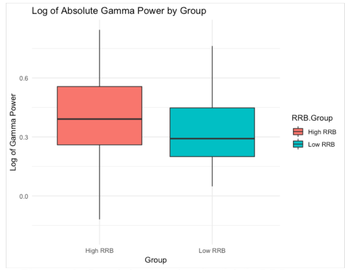

Figure 1. Participants in the high RRB group had greater gamma band power than participants in the low RRB group. F = 4.26, P = 0.040

Figure 2. Participants in the high RRB group had greater theta band power than participants in the low RRB group). F = 5.30, P = 0.024

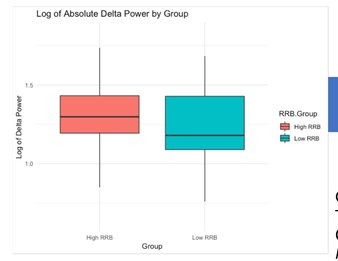

Figure 3. Participants in the high RRB group had greater delta band power than participants in the low RRB group). F = 4.01, P = 0.047

Correlations

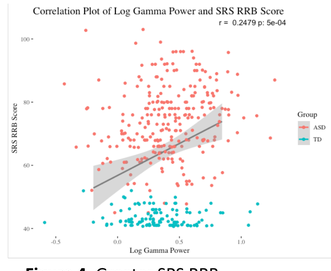

Figure 4. Greater SRS RRB score was associated with greater Log gamma power across participants. *r(192) = 0.25, p = 5.0e-04*

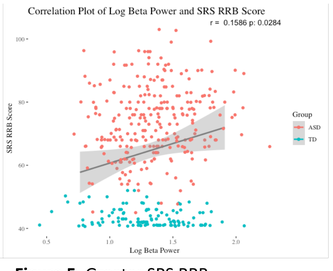

Figure 5. Greater SRS RRB score was associated with greater log beta power across participants. *r(192) = 0.16, p = 0.028*

Conclusions

- While prior research showed that increased alpha activity was associated with RRBs in a TD population, in a sample with participants with ASD, relationships were found with the ends of the power spectrum.
- Other studies have found that the extremes of the power spectrum are increased in ASD while alpha power is reduced, and postulate that this difference is partially related to abnormal GABAergic inhibitory tone in ASD
- GABA is thought to reduce power in the extremes of the spectrum and increase power in the alpha band
- Increased RRBs may indicate increased dysregulation in GABA tone in individuals with ASD
- The SRS is a parent self-report measure. The ADOS 2 RRB scale, while a direct measure of clinical behavior, is not continuous, and may not capture the full variability present in RRBs . Further research into the neural activity associated with RRBs would benefit from more sophisticated latent trait models that model method (parent/clinician report) and trait (RRB) variance uniquely to increase measurement

References

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