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Neurophysiological Markers of ASD: Examining the Relationship Between

Electroencephalography and ADOS Scores in High-Risk Toddlers

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Introduction

- The Spring Into Action Together (SIAT) study is a collaborate project between the Els For Autism Foundation and the Seaver Autism Center (The Seaver Els Institute) centered around a caregiver-implemented intervention program for toddlers with autism spectrum disorder (ASD).
- Resting-state electroencephalography (EEG) has shown to be a useful tool for studying the relationship between neurophysiological and behavioral functioning in early child development, particularly for toddlers with ASD given the lack of task specific demands for recording data (Gabard-Durnam et al., 2015).
- Preliminary work has indicated that various EEG power and asymmetry measures are predictive of autism diagnosis at 18-months on the Autism Diagnostic Observation Schedule-Second Edition (ADOS-2) in toddlers at elevated familial risk for developing ASD (Lord et al., 2012; Tierney et al., 2012).
- Depleted frontal, temporal, and parietal alpha power and cortical right asymmetry have emerged as indicative markers thus far.
- The U-Shaped power distribution theory has suggested increased low-range (theta) and high-range (beta) frequency power but reduced mid-range (alpha) power in individuals with ASD (Wang et al., 2013).
- We sought to expand on this work by examining the association between power and asymmetry measures with ADOS-2 domain sub scores in 18-45-month-olds at high risk for ASD.

Method

- Participants (N = 7) were between the ages of 18 and 45 months and screened positive on the Modified Checklist for Autism in Toddlers-Revised (M-CHAT-R).

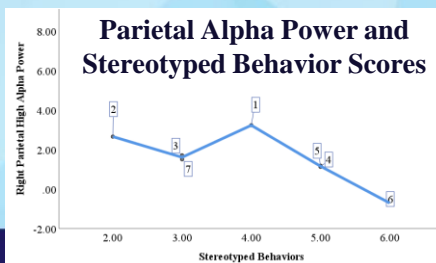
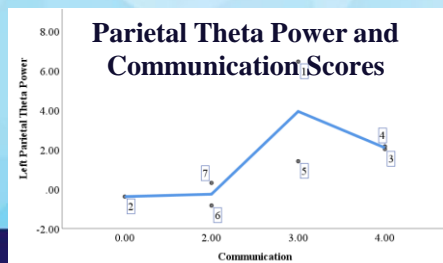
Sample	Age (Months)	Sex
N = 7	M=28.6 SD = 7.02	5 male (71 percent) 2 female (29 percent)

Materials & Procedure

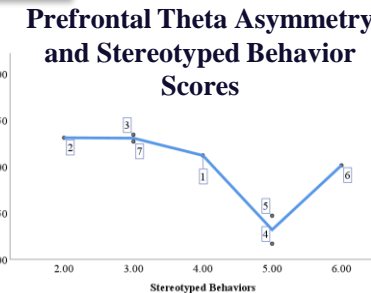
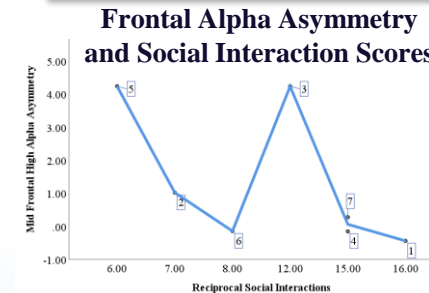
- EEG data was collected using a 128-channel net. Data were referenced to the vertex (CZ) and edited using the artifact subspace reconstruction function (EEGLAB).
- Here, we examined the associations between power and asymmetry at prefrontal (FP1, FP2), mid frontal (F3, F4), lateral frontal (F7-F8), temporal (T7, T8), and parietal (P3, P4, P7, P8) sites with ADOS-2 domain scores (communication, reciprocal social interaction, play, and stereotyped behaviors) using Kendall's rank correlations.
- EEG measures were examined in theta (4 to 6 Hz), low alpha (6 to 9 Hz), high alpha (9 to 13 Hz), and beta (13 to 30 Hz) frequency bands, and asymmetry scores were calculated by subtracting right hemispheric power from left (i.e. F4-F3).

Results

- There was a significant correlation between right lateral parietal alpha power (P8) and stereotyped behavior risk scores ($\tau b = -.65, p = .046$).
- Mid frontal alpha asymmetry was significantly correlated with reciprocal social interaction risk scores ($\tau b = -.68, p = .033$).
- There was a moderate correlation between left mid parietal theta power (P3) and communication risk scores ($\tau b = .62, p = .062$).
- There were significant correlations between prefrontal theta asymmetry and stereotyped behavior risk scores ($\tau b = -.65, p = .046$), as well as mid frontal theta asymmetry and reciprocal social interaction risk scores ($\tau b = -.68, p = .033$).



Results (Continued)



Conclusions

- Correlations indicated a pattern of increased right frontal asymmetry coinciding with higher reciprocal social interaction and stereotyped behavior risk scores on the ADOS-2 in-line with prior investigations in this developmental time-period (Gabbard-Dunham et al., 2015)
- Parietal alpha power was decreased in relation to increased stereotyped behavior risk scores in line with the U-shaped power distribution theory of ASD (Wang et al., 2013).
- The association of increased parietal theta power with increased communication risk scores also supported the U-shaped theory.
- This preliminary study highlights the utility of resting-state EEG measures for assessing ASD risk; these metrics should be further explored using larger sample sizes and a low-risk control group.

References

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