An Analysis of Resting EEG Data in Infants at High-Risk for Developing Autism Spectrum Disorder (ASD)

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BACKGROUND

- The resting EEG paradigm is a well-suited neuroscience tool for individuals with developmental disabilities and infants because it is inexpensive, noninvasive, and does not demand an overt response (Cohen, 2009).
- Differences in resting EEG spectral power have successfully discriminated children with ASD from controls and correlate with clinical characteristics (Wang et al., 2013). Resting EEG activity may differentiate high- and normal-risk infants (Boisl et al., 2011).
- Alpha asymmetry is associated with mood reactivity and cognitive functioning (Gotlib, 1998).
- Atypical patterns of alpha asymmetry have been observed in school-age children with autism (Stingoarova et al., 2007).
- Atypical trajectories of alpha asymmetry have been observed in high-risk infants (Gabbard-Durnam et al., 2007), which demonstrates that alpha asymmetry is a promising potential ASD endophenotype.
- Previous resting EEG studies suggest a U-shaped profile of electrophysiological power alterations in ASD, with excessive power in low-frequency, such as theta, and high-frequency power (Wang et al., 2013).

Current Study

- The experiment measured and compared electrophysiological brain activity in infants at high-risk for ASD with activity in infants at normal-risk over the first two years of life using the resting EEG paradigm.
- High-risk infants (HR): infants with an older sibling diagnosed with ASD
- Normal-risk infants (NR): infants with no first-degree relatives with ASD
- We evaluated the hypotheses that, relative to NR infants, HR infants would display:
  - Differing patterns of alpha asymmetry.
  - Differentiated resting EEG activity in theta spectral power.

RESULTS

- Table: # of Segments with Artifact by Age and Risk Status

CONCLUSIONS & FUTURE DIRECTIONS

- Different patterns of alpha asymmetry were observed in the two risk groups:
  - NR infants exhibited trends towards right lateralization across age groups.
  - May indicate differences in emotional reactivity, which is part of the clinical phenotype of ASD and may allow for earlier detection of ASD.
- The larger effect of alpha asymmetry in the younger age group may indicate a relationship between early neural pruning and alpha asymmetry differences through either excessive or insufficient neural pruning that leads to hyperconnective and hypo-communicative neural circuits.
- Excessive low-frequency theta power in HR infants correspond to findings that link excessive theta levels to ASD.

Future Directions

- Compare EEG results in HR infants who develop ASD versus HR infants who do not develop ASD.
- Investigate relationships among EEG and the behavioral phenotype.
- Examine EEG power differences in other frequency bands (gamma and beta).
- Examine the continuous relationship between age and brain activity.
- Explore alternative analytic approaches to resting EEG data, such as coherence and multiscale entropy.