The relationship among E/I imbalance and face processing in ASD

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Introduction

- A promising neural marker associated with impaired face processing for individuals with autism spectrum disorder (ASD) is the N170 event-related potential (ERP).
- Individuals with ASD exhibit longer N170 latencies to faces compared to typically developing (TD) individuals (McPartland et al., 2004).
- In addition to face processing, cortical excitation/inhibition (E/I) imbalances contribute to behavioral symptoms in ASD (Masuda et al., 2019).
- Electroencephalographic (EEG) studies of E/I imbalance reveal increased spontaneous gamma oscillations (30-50 Hz) at rest in ASD (Cornew et al., 2012; Orekhova et al., 2007).
- Attenuation of P100 amplitude in visual evoked potential (VEP) tasks (Siper et al., 2016).
- Very few EEG studies have examined the relationship between E/I imbalance and neural indices of face processing in children with ASD.

Central Questions

Is temporal processing of upright faces delayed in individuals with ASD?
Do neural indices of E/I imbalance associate with abnormal face processing?

Behavioral Methods

Cognitive assessments were conducted, and final diagnosis was determined by licensed clinical psychologists.

Standard Psychometric Measures of Social and Cognitive Functioning

- Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-II)
- Differential Ability Scales, 2nd Edition (DAS-II)
- A Developmental Neuropsychological Assessment (NEPSY-II)

Exclusion Criteria

- Children with sensory or motor impairments, epilepsy, and genetic or neurological conditions

Participant Demographics

<table>
<thead>
<tr>
<th>Clinical Diagnosis</th>
<th>N</th>
<th>Sex (M,F)</th>
<th>Age (SD)</th>
<th>IQ (SD)</th>
<th>NEPSY-II: Affect Recognition Scaled Score (SD)</th>
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<tbody>
<tr>
<td>TD</td>
<td>54</td>
<td>35, 19</td>
<td>8.53 (1.74)</td>
<td>116.30 (13.44)</td>
<td>11 (4)</td>
</tr>
<tr>
<td>ASD</td>
<td>106</td>
<td>85, 21</td>
<td>8.94 (1.60)</td>
<td>101.14 (17.53)</td>
<td>8 (4)</td>
</tr>
</tbody>
</table>

Figure 1. Clinical Criteria. Groups were matched on age (p>0.05) but differed significantly on Full-scale IQ and NEPSY-II Affect Recognition scaled scores (p<0.01).

EEG Methods

Acquisition: EEG was recorded at 1000 Hz with a 128-channel HydroCel Geodesic Sensor Net

**Experimental Paradigm: Resting State**

- Objective: Assess brain activity at rest (eye open) how activity relates to abnormalities of cortical E/I imbalance
- Design: 6 x 30 sec videos of non-social dynamic abstract images
- Inclusion criteria: > 20 seconds of attended and artifact free EEG segments
- Primary dependent variable: Slope of the power spectrum
  - Gamma (30-50 Hz)

**Experimental Paradigm: VEP**

- Objective: Explore possible consequences of an E/I imbalance on the visual system in ASD
- Design: Black and white checkerboards reverse phase every 500ms for a total of 100 trials
- Inclusion criteria: > 20 artifact-free trials
- Primary dependent variable: P1 peak amplitude

**Experimental Paradigm: ABC-CT Faces**

- Objective: Examine neural processing of faces
- Design: 216 total trials of static images of upright faces, inverted faces, and houses
- Inclusion criteria: > 20 artifact-free trials
- Primary dependent variable: N170 latency for upright faces

Results

**Figure 8.** Slower N170 latency for upright faces in individuals with ASD (TD: 207.96 ± 15.08 ms; TD: 197.41 ± 14.89 ms, p=0.037).

**Figure 9.** Resting-state gamma power was correlated with VEP P100 amplitude (r(160)= -0.157, p=0.048).

**Figure 10.** Resting-state gamma and VEP P100 amplitude was not associated with different N170 latencies for upright faces (p=0.05).

Acknowledgments

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References