Neural Response to Eye Gaze Differentiates ASD Diagnostic Status Among Adults Meeting ADOS-2 Criteria


Yale School of Medicine, New Haven, CT

Background

- Individuals with autism spectrum disorder (ASD) process social information differently from typically developing (TD) individuals.
- These differences include significantly longer latencies of the N170 event-related potential, a marker of face-sensitive processing (McPartland et al., 2004).
- The N170 has not yet been characterized in individuals who were clinically referred for disorders involving social communication (such as ASD and schizophrenia (SCZ)) and received non-ASD diagnoses compared to those receiving ASD diagnoses.
- The objective was to examine the relationship between N170 response to faces and social communication symptoms in a clinically heterogeneous population of individuals with TD, ASD, SCZ, and other diagnoses.

Method

- Participants received an ADOS-2 Module 4. ‘Met ASD’ is used to describe individuals who met ‘autism spectrum’ or ‘autism’ criteria on the original algorithm (Lord et al., 1990).
- Participants also received the Mini-International Neuropsychiatric Interview (MINI), and selected portions of the Structured Clinical Interview for DSM-IV to determine diagnosis.
- Eight participants met criteria for current substance abuse or substance dependence on the MINI, but results did not change when these participants were excluded.

Event-related potential analysis

- EEG was recorded at 250 Hz with a 128-channel Hydrogel Geodesic Sensor net.
- N170 (120-270ms) was extracted from electrodes over left and right occipitotemporal regions (see Fig. 1). Data were filtered at 0.1 to 30Hz and segmented from -100 to 500ms relative to presentation of the face or house.
- Peak amplitude and latency were analyzed for response to faces and houses in repeated measures ANOVAs (with diagnostic group as a between-subject factor and stimulus type and hemisphere as within-subject factors). Follow-up t-tests were used to determine between-group differences.

Results

- Groups were matched on age and nonverbal IQ (p<0.05) but did differ significantly on full scale IQ (p<0.05).
- The “Other” diagnostic category includes individuals who received primary diagnoses of anxiety disorders (n=4), depressive disorders (n=4), and obsessive-compulsive and related disorders (n=3).

Clinical characterization

- All participants received the MINI-International Neuropsychiatric Interview (MINI), and selected portions of the Structured Clinical Interview for DSM-IV to determine diagnosis.
- Eight participants met criteria for current substance abuse or substance dependence on the MINI, but results did not change when these participants were excluded.

Experimental Paradigm

- Participants viewed black-and-white faces and houses preceded by a single crosshair in either the upper, middle, or lower portion of the screen. Gaze was thus directed to the eyes, nose, or mouth region of the face, and upper, middle, or lower region of the house. For analysis of the brain response to houses, all viewing positions were collapsed.

Figure 1. Selection of electrodes for analysis.

Figure 2. Participants viewed black-and-white faces and houses preceded by a single crosshair in either the upper, middle, or lower portion of the screen. Gaze was thus directed to the eyes, nose, or mouth region of the face, and upper, middle, or lower region of the house. For analysis of the brain response to houses, all viewing positions were collapsed.

Figure 3. Grand average waveforms of (A) left hemisphere and (B) right hemisphere N170 response to eyes and houses. All individuals included in waveforms met criteria on the ADOS for autism or autism spectrum, and received either an ASD diagnosis or another diagnosis.

Figure 4. Differences in N170 latency for individuals who met and did not meet ASD criteria. * = different from both groups that did not receive an ASD DX (p<0.05).

Figure 5. Differences in N170 amplitude in response to faces and houses for individuals who met and did not meet criteria on the ADOS.

Figure 6. ADOS total scores for participants that met and did not meet ADOS criteria. A+B Total = Communication + Social Interaction Total, A Total = Communication Total, B Total = Social Interaction Total, D Total = Stereotyped Behaviors and Restricted Interests Total. * = different from other two groups (p<0.01).

Conclusions

- Among individuals who met ADOS criteria, N170 latency to the eyes and nose of the face distinguished those who received an ASD DX from those who received a non-ASD DX.
- Brain-based measures of social functioning provide complementary information to commonly used clinical assessments such as the ADOS.
- As the current sample was comprised largely of individuals with ASD and SCZ, future research will examine N170 latency to faces in other diagnoses such as anxiety to confirm the specificity of this biomarker to ASD.

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References:


mcp.lab@yale.edu mcp-lab.org