Pivotal Response Treatment Improves Neural Efficiency for Social Perception in Children with Autism Spectrum Disorder

Max Rolison, Jennifer Foss-Feig, Rachael Tillman, Hannah Reuman, Adam Naples, Kevin Pelphrey, Pamela Ventola & James McPartland
McPartland Lab
Yale Child Study Center, New Haven, CT

Background

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by difficulties in social interaction and communication. Pivotal Response Treatment (PRT) is a naturalistic behavioral intervention with empirical support for effectiveness in teaching social communication skills to children with ASD. PRT directly targets social motivation to address challenges in interpersonal interaction and communication. A 4-month course of PRT results in meaningful improvements in pragmatic language, social engagement, and adaptive functioning (Ventola et al., 2014a). Statistical Analyses showed that children with ASD demonstrated improved social processing efficiency, as reflected in decreased N170 latency, following a 4-month course of PRT.

Method

Participants:
- 7 children 46 years of age with ASD receiving PRT
- Subset of 3 in waitlist control (WLC) group
- Received PRT for 16 weeks
- 8 hours per week (6 hours with the child and 2 hours with the parent)

Experimental Paradigm:
- Participants viewed computer-generated images showing neutral and fearful faces

EEG recorded at 4 time points:
- Waitlist Control
- Pre-Treatment
- Post-Treatment
- Four-Month Follow-Up

EEG Data Acquisition and Collection:
- Recorded at 500 Hz
- 128-channel Hydrocel Geodesic Sensor net

Statistical Analysis:
- Peak amplitude and latency were analyzed using repeated measures ANOVA
- 2 within-subjects factors:
  - Treatment (Pre/Post)
  - Emotion (Fear/Neutral)
- Paired samples t-tests for WLC vs. Pre and Follow-up vs. Post conditions

ERP Analysis:
- P1 and N170 are ERP components associated with early sensory response and face structural encoding, respectively (Rossion et al., 2014b)
- P1 and N170 peak amplitude and latency were compared across fear and neutral stimuli, pre- and post-treatment, as well as four months prior to treatment and four months after treatment termination in a subset of children
- ERPs were segmented to static face stimuli and extracted over the right occipitotemporal region

Results

Post-Treatment N170:
- A main effect of treatment (F(1, 16) = 11.34, p=0.015) indicated a change in face perception efficiency following PRT treatment, indexed by N170 latency
- Significant reduction in N170 latency following treatment for both neutral (p=0.027) and fearful (p=0.028) face stimuli
- There was no significant change in N170 amplitude (F(1, 16) = 2.71, p=0.15)
- There was no significant change in either P1 latency or amplitude as a function of treatment (All Fs < 0.08, ps > .38)

Follow-Up:
- Subset of 5 children
- Reduced N170 latency maintained 16-weeks after end of treatment

Waitlist Control (WLC):
- Subset of 3 children
- No significant change in N170 latency across 16-week period prior to start of treatment

Conclusions

- A 16-week course of PRT for young children with ASD resulted in improved efficiency of neural indicators of social perception (N170), with no effect on low-level sensory processes (P1)
- These findings suggest focal treatment effects on social brain processes
- The waitlist control results suggest observed changes are not simply a function of development, demonstrating the efficacy of PRT intervention
- These findings provide the first evidence of improved neural efficiency resulting from PRT
- In concert with fMRI results following a 16-week course of PRT, these ERP findings inform understanding of brain mechanisms underpinning positive response to behavioral treatment

References


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