Excessive neural processing of irrelevant sensory stimuli in autistic children

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Introduction

- Children with Autism Spectrum Disorders (ASD) and children with Sensory Processing Disorders (SPD) often exhibit sensory processing difficulties [1,2].
- Although ASD and SPD each exhibit atypical sensory processing, behavioral and neural differences exist [3].
- Understanding the neurological markers of each disorder can lead to better diagnosis and directed interventions.
- To better understand the neurological differences between these groups, a multimodal oddball paradigm was performed to compare auditory processing between these groups and to Typically Developing (TD) children.

Background

- ASD exhibit increased sensory cortical activity compared to TD [4].
- When does this over-processing occur?
- Do SPD differ from ASD?
- Does attention play a role in sensory over-processing?

Methods

- All participants screened with a battery of sensory profile assessments
- Analysis time window (200 – 400 ms) selected as largest ERF activity averaged over groups and conditions during standard auditory / tactile stimulation.
- 2 ROIs selected for analysis (left, right)
  - Left: MLT14, MLT15, MLP56, MLP57
  - Right: MRT14, MRT15, MR57, MR57, MRF67
- ERF from unimodal, passively attended, stimuli subtracted from deviant stimuli ERF
- Root Mean Square (RMS) amplitude averaged over 10 ms around peak activity and submitted to ANOVA
- 3 way ANOVA with factors of Group (ASD, SPD, TD), Hemisphere (Left,Right), and Condition (Attend, Passive)
- Analysis focused on auditory deviant stimuli

Results

- Group x Condition x Hemisphere interaction (F(2,42) = 3.31, p < 0.05)
- Post hoc two way ANOVA on each hemisphere:
  - Right: Group x Condition (F(2,42) = 5.02, p < 0.05)(Displayed below)
  - Left: Group x Condition (F(2,42) = 2.82, p = 0.07)

Conclusions

- When passively listening, ASD children exhibit increased neural activity to deviant stimuli compared to TD children.
- While attending to relevant stimuli, SPD children exhibit decreased neural activity to deviant stimuli.
- Attentional modulation differences between groups were most pronounced in the right hemisphere, consistent with previous reports of lateralization differences in ASD [5].
- The magnitude of attentional modulation is related to sensory profile under-responsivity scores

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References


Total number of participants (boys aged 8-11 years):
ASD: 17  TD: 18  SPD: 10

Experimental Design:
- Recorded MEG data during a multimodal oddball paradigm.
- Participants were presented with simultaneous auditory and tactile stimuli with an ISI of 1 second.

Stimuli:
- 1 sec
- 100 ms Deviant
- Standard
- 500 ms Deviant
- Standard

Conditions:
- Attend and respond to deviant stimulus
- Passively listen to all stimuli