Atypical brainstem responses to repeated amplitude-modulated sounds in children diagnosed with Autism Spectrum Disorders

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INTRODUCTION

Autism spectrum disorders are a set of neurodevelopmental disorders that are characterized by deficits in social communication, narrow interests and engagement in repetitive behaviours. Children diagnosed with ASD often display atypical processing of auditory information, to both simple and complex (e.g. speech) stimuli. Recent studies have shown that the human auditory brainstem can encode context-dependent information and extract auditory regularities from the recent past in order to detect novel events. Therefore, any disruption in the low level processing of the auditory regularities might propagate to higher levels and underlie auditory deficits as observed in autism.

The sustained frequency following response (FFR) of the auditory brainstem reflects the neural phase-locking of brainstem neurons to the continuous acoustic features of a sound.

Aim of the study:

To examine the encoding of acoustic regularities in children diagnosed with ASD at the level of the auditory brainstem. More specifically, we focused on how the FFR is modulated by stimulus repetitions.

METHODS

Experimental design

Roving standard paradigm with amplitude modulated tones

SOA: 333 ms

Trains of 8, 10 or 12 tones

10 carrier frequencies used ranging from 1075 until 2514 Hz

EEG recordings: 18 scalp electrodes/A2 reference

Sampling rate: 20 kHz. Filter: 80 Hz highpass

Spectral domain: Multi-tapered FFT 20-90 ms from the start of the FFR. Analysis was conducted for the first 8 stimulus presentations of a train. For each participant, data were normalized for SNR (mean amplitude was divided by the mean of a 100 Hz window before 360 and after 400 ms). Repetition effects: FFR responses were collapsed for each position of the train. Only the peak corresponding to the 380 Hz frequency of the amplitude modulation was analyzed for each position (Cz electrode). Individual mean power amplitudes were taken from a 10 Hz window centered at 380 Hz.

RESULTS

CONCLUSION

> Our findings suggest that regularity encoding (based on stimulus repetitions) in the auditory brainstem is altered in children with ASD.

> Increased FFR amplitude in ASD children suggests a higher neuronal activation by each repetition.

> Impaired top down modulation from cortical areas might account for the atypical responses observed in the ASD group.

REFERENCES