The Effects of Auditory Integration Training (AIT) on Mismatch Negativity in Children with Autism

Poster Presentation at International Meeting for Autism Research (IMFAR)
https://imfar.confex.com/imfar/2015/webprogram/Paper18907.html

Friday, May 15, 2015

Imperial Ballroom (Grand America Hotel)

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Background:

Children with autism are featured by sensory over-sensitivity including excessive reactivity to sounds. Reactivity to sound can be measured using auditory evoked potentials recorded during presentation of the sounds of different frequency and recording EEG responses. Mismatch Negativity (MMN) is one of the early auditory potentials reflecting differences of evoked potentials between rare (20%) and frequent (80%) sounds. MMN is typically recorded at the fronto-central EEG sites and represents a difference wave (rare-minus-frequent tone) occurring within 130 – 190 ms post-stimulus.

Objectives:The aims of the study was application of Berard's Auditory Integration Training (AIT) techniques in children in autism and assessment of AIT course outcomes using MMN, frontal P2a and P3a evoked potentials, and behavioral questionnaires (ABC,CPI).

Methods: EEG data were acquired with Electrical Geodesics EEG system. AIT was administered through the Earducator. Children listened to modulated music during 30 minute long sessions, twice a day for 10 days. We investigated evoked potentials before and after AIT in children between the ages of 5 and 21 (N=11 in AIT, mean age 13.6 yrs, SD=4.1). Eleven control subjects were used for evoked potential (MMN, P2a, P3a) measurements in MMN test (mean age 14.8, SD=3.2).

Results:Berard's AIT resulted in significant decrease of Irritability, Hyperactivity and Lethargy scores on the Aberrant Behavior Checklist (ABC), and improved Emotion, Behavior and Receptive Language Scores on the Comprehensive Performance Index (CPI) scales. Auditory evoked potential test conducted at baseline and after AIT showed lower MMN ($F=5.29$, $p=0.035$), and significant decrease of the frontal P2a component ($F=4.71$, $p=0.041$ and longer latency of P2a ($F=5.53$, $p=0.028$), while the frontal and fronto-central P3a component showed amplitude decrease ($F=9.22$, $p=0.006$) without any latency changes. Comparison of auditory MMN test results between typical children and autism groups showed significant differences in MMN amplitude (higher in autism, $F=4.75$, $p=0.043$), P2a amplitude (higher in autism, $F=5.65$, $p=0.03$), P2a latency (shorter in autism, $F=4.98$, $p=0.039$), and amplitude and latency of P3a (smaller and prolonged in autism, $F=5.31$, $p=0.033$).

Conclusions: Our study supports suggestion that Berard's AIT positively affects auditory stimulus processing reflected both in early (MMN) and late (P2,P3a) evoked potentials. The study contributes to the understanding of the neural mechanisms underlying auditory integration training in autism.

(Abstract publ in Journal of Applied Psychophysiology & Biofeedback, Vol 39, No 3-4, Springer/Plenum Publ 2014)