

Deficient Multisensory Integration with Concomitant Resting-State Connectivity in Adult Attention Deficit/Hyperactivity Disorder (ADHD)

Authors : Marcel Schulze, Behrem Aslan, Silke Lux, Alexandra Philipsen

Abstract : Objective: Patients with Attention Deficit/Hyperactivity Disorder (ADHD) often report that they are being flooded by sensory impressions. Studies investigating sensory processing show hypersensitivity for sensory inputs across the senses in children and adults with ADHD. Especially the auditory modality is affected by deficient acoustical inhibition and modulation of signals. While studying unimodal signal-processing is relevant and well-suited in a controlled laboratory environment, everyday life situations occur multimodal. A complex interplay of the senses is necessary to form a unified percept. In order to achieve this, the unimodal sensory modalities are bound together in a process called multisensory integration (MI). In the current study we investigate MI in an adult ADHD sample using the McGurk-effect - a well-known illusion where incongruent speech like phonemes lead in case of successful integration to a new perceived phoneme via late top-down attentional allocation . In ADHD neuronal dysregulation at rest e.g., aberrant within or between network functional connectivity may also account for difficulties in integrating across the senses. Therefore, the current study includes resting-state functional connectivity to investigate a possible relation of deficient network connectivity and the ability of stimulus integration. Method: Twenty-five ADHD patients (6 females, age: 30.08 (SD:9,3) years) and twenty-four healthy controls (9 females; age: 26.88 (SD: 6.3) years) were recruited. MI was examined using the McGurk effect, where - in case of successful MI - incongruent speech-like phonemes between visual and auditory modality are leading to a perception of a new phoneme. Mann-Whitney-U test was applied to assess statistical differences between groups. Echo-planar imaging-resting-state functional MRI was acquired on a 3.0 Tesla Siemens Magnetom MR scanner. A seed-to-voxel analysis was realized using the CONN toolbox. Results: Susceptibility to McGurk was significantly lowered for ADHD patients (ADHDMdn:5.83%, ControlsMdn:44.2%, $U=160.5$, $p=0.022$, $r=-0.34$). When ADHD patients integrated phonemes, reaction times were significantly longer (ADHDMdn:1260ms, ControlsMdn:582ms, $U=41.0$, $p<.000$, $r=-0.56$). In functional connectivity medio temporal gyrus (seed) was negatively associated with primary auditory cortex, inferior frontal gyrus, precentral gyrus, and fusiform gyrus. Conclusion: MI seems to be deficient for ADHD patients for stimuli that need top-down attentional allocation. This finding is supported by stronger functional connectivity from unimodal sensory areas to polymodal, MI convergence zones for complex stimuli in ADHD patients.

Keywords : attention-deficit hyperactivity disorder, audiovisual integration, McGurk-effect, resting-state functional connectivity

Conference Title : ICMICSI 2021 : International Conference on Multisensory Integration and Cortical-Subcortical Interactions

Conference Location : Vancouver, Canada

Conference Dates : September 23-24, 2021