

ASD and ADHD: Differential functioning on a Computerized Performance Test (MOXO-CPT)

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Background

- Attention-deficit hyperactivity disorder (ADHD) and Autism Spectrum Disorder (ASD) are both early onsets, highly heritable, enduring neuro-developmental deficits.
- Both ADHD and ASD share symptomatology as well as pathophysiology, to such an extent that 60% of children with ASD show symptoms of ADHD, and up to 30% of children with ADHD have difficulties in social communication.
- The attentional and perceptual abnormalities seen in ASD are well known (Mottron et al, 2006; Sanders et al, 2008, Ames & Fletcher-Watson, 2010).
- However, results in this area of research are diverse and often conflicting.
- The overlap of these two neurodevelopment disorders requires further elucidation, to understand the common denominator as well as the unique features of both.

Study aim: to test whether performance in the MOXO- continuous performance test (CPT), commonly used as one of the tools in the clinical diagnosis of ADHD, is different in children with ASD versus those with ADHD.

Methods

Participants

- 26 subjects with a primary diagnosis of ASD, [age 6-15 (mean age- 10.46, SD- 2.58), 21 males].
- 25 subjects with ADHD (inattentive, hyperactive/impulsive or combined presentation), without ASD, [age 6-17 years, (mean age- 9.84, SD- 2.61), 15 males].
- Diagnoses of ADHD were established according to DSM-IV-TR/ DSM-5 criteria, and included an interview with the child and parents, medical/neurological examination and assessment by rating scales.
- Subjects with ASD met the criteria for ASD, according to DSM-IV-TR/ DSM-5 criteria, as assessed by a certified pediatric neurologist and a psychologist.
- Subjects with Intellectual disability, genetic syndrome, developmental brain malformation, metabolic disorder, or subjects treated with medications which might alter neurocognitive function were excluded.
- The study was approved by the institutional IRB.
- Written informed consent were obtained.

MOXO

- The MOXO- CPT (NeuroTech Solutions Ltd) is a standardized computerized test designed to diagnose ADHD-related symptoms (Berger & Goldzweig, 2010).
- The test involves the rapid presentation of a target and non-target series of visual or auditory stimuli.
- Response to non-target stimuli is referred to as a "commission error", whereas the absence of response to target stimuli is referred to as an "omission error."
- The test consists of eight levels (each level- 53 trials). The total duration of the test is 15.2minutes.
- Four test items are assessed: Attention, Timing, Hyperactivity, and impulsivity.
- The MOXO-CPT incorporates external interfering stimuli (auditory and visual), which are typical elements in the child environment, that serve as distractors.

Results

- There was no statistically significance difference in the 4 MOXO-CPT measures (Attention, Timing, Hyperactivity and Impulsivity, nor in the MOXO-CPT total score, which integrates all four CPT indices, between the ASD and the ADHD groups.
- Both groups showed decline in overall test performance.
- However, subjects with ASD showed more sustained abilities throughout the MOXO-CPT compared to the ADHD group [-0.66, SD= 4.8 vs -2.72, SD= 5.88, (p=0.04)].
- Although both groups were affected by the incorporation of visual and auditory environmental distractors built-in the MOXO-CPT paradigm, subjects with ASD showed greater resilience to distraction than patients without ASD, but this was not statistically significant (Visual distraction: -1.34, SD=2.88 vs -2.88, SD= 5.17, p=0.07, Auditory distractions: 0.15, SD- 3.88 vs-2.32, SD= 4.4, p= 0.06, respectively).
- Variability in timing parameter was wider in the ADHD group versus the ASD group, but this was not statistically significant (p=0.07).

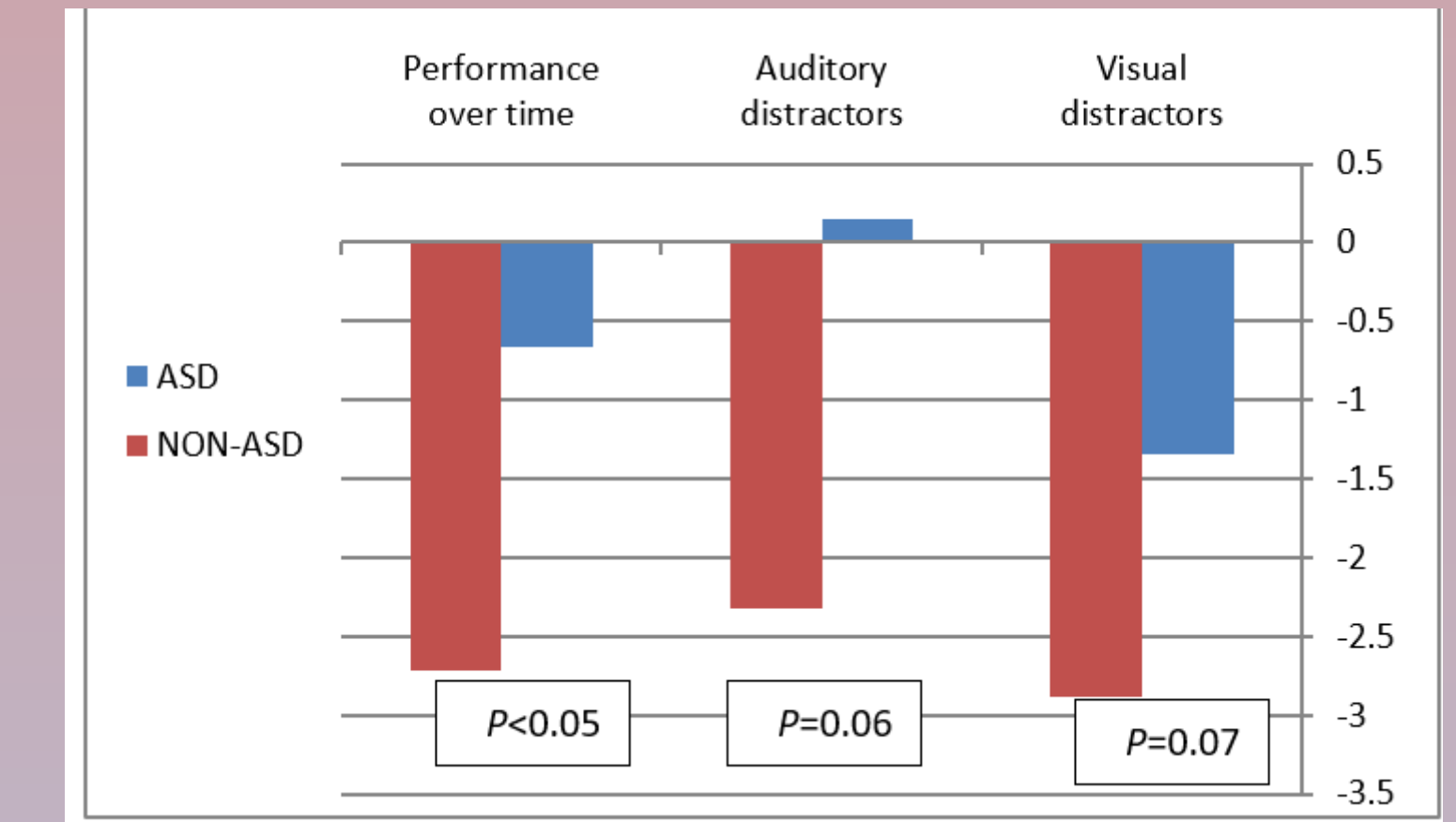


Figure 1: Performance under introduction of a destructive stimuli and performance over time in ASD vs. ADHD patients

Discussion

- Overall, this study did not show difference performance on the MOXO-CPT between subjects with ASD vs ADHD, concurring the similarities and overlap between the 2 syndromes.
- However, Children with ASD show more sustained performance through the test, and tend to be less reactive to distraction stimuli compared to patients with ADHD. This is compatible with other studies showing that sustained attention in patients with ASD is comparable to typically developing individuals, and is deficient in patients with ADHD (Johnson et al. 2007).
- Moreover, the ASD group showed less distractibility following the introduction of a distractive stimuli, but this difference was not statistically significant, plausibly due to the small cohort tested. These findings of a decreased distractibility are in line with the clinical observation as reported by the clinician observing the subjects while taking the MOXO test, which showed a more consistent performance ability of the ASD group whereas the ADHD subjects tended to get easily bored.
- Differences in selective attention, altered in ADHD patients, could explain this performance difference.
- Abnormalities in Sensory processing including sensory hypo-responsiveness, as well as differences in perceptual capacity, may alter the neurophysiological responses to auditory and visual stimuli and could also contribute to the decreased distractibility (Remington et al, 2009, 2011).
- This study has several limitations including small number of participants, as well as lack of a neurotypical control group.