different, but perhaps overlapping neural substrates regulate the AS performance and PPI.

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Symposium B: Understanding ADHD with advanced neuroimaging and neuromapping techniques Symposium Chair: Sirel Karakaş (Turkey) and Robert J. Barry (Australia)

The neuropsychological profile of ADHD and relation to Wechsler intelligence scale performance

E.E. Bakar[a], A.Ş. Soysal[b], Y.I. Taner[c], S. Karakas[d]
[a]Ufuk University, Dept. of Psychology, 06520 Balgat, Ankara, Turkey
[b]Gazi University, Dept. of Pediatrics, 06500 Teknikokullar, Ankara, Turkey
[c]Gazi University, Dept. of Child Psychiatry, 06500 Teknikokullar, Ankara, Turkey
[d]Hacettepe University Technology Development Center, 06800 Beytepe, Ankara, Turkey

Presently, our understanding on the cognitive basis of ADHD is far from complete and clinical science is still in need of nonclinical criteria that can serve as auxiliary tools in diagnosis. The research on auxiliary diagnostic criteria has come up with conflicting results and theorizing on the nature of ADHD have come up with rival explanations. A major reason behind this pertains to methodological issues some of which are insufficient sample sizes, utilization of unstandardized psychometric tools, uncontrolled data collection procedures, disregard of critical exclusion criteria. The present study aims to present a behavior-based neuropsychological profile of ADHD and suggest auxiliary diagnostic criteria under optimally controlled conditions. Diagnosis was made according to DSM-IV and K-SADS-PL was used to check for comorbidities. The ADHD Group consisted of 215 males in the age range of 6–13 years: of this, 72 were in the predominantly inattention (IA) subtype, 41 were in the predominantly hyperactivity/impulsivity subtype and 102 were in the combined subtype. Cases were unmedicated first referrals. There were 142 age-matched males in the healthy control group. Exclusion criteria for both groups were comorbid neurological and/or psychiatric disorders (other than ADHD), medication (including those for ADHD) that have cognitive effects, uncorrected visual and/or auditory defects, being outside the normal category of intelligence (Intelligence Quotients: 80–129). The neuropsychological tests yielded 63 scores and covered a spectrum of cognitive processes that included attention (Stroop Test, Cancellation Test, Visual Auditory Digit Span Test — Revised), visuospatial cognition (Line Orientation Test, Raven Standard Progressive Matrices) learning and working memory (Serial Digit Learning Test, Wisconsin Card Sorting Test). Analysis of Covariance (MANCOVA; covariate: age) showed significant differences between 88.9% of the studied test scores. Principal Component Analysis on the test scores of the control group revealed a factor structure that was consistent with those reported in the literature on Turkish samples (Karakaş and Doğutepe Dinçer, 2011). According to the results on Logistic Regression Analysis, accuracy rates for classifying ADHD cases were between high (Cancellation Test: 83.7 %) and medium (Stroop Test: 74.8). The behavioral data on neuropsychological tests showed that ADHD is characterized by a lower performance on a spectrum of processing that covers various forms of attention, learning, memory and visuospatial cognition. The classification accuracy rates showed that some of the tests can serve as objective criteria in clinical diagnosis. The underlying neural basis of these neuropsychological tests has to be unravelled by brain mapping techniques that use electrophysiological and hemodynamic responses. Among other benefits, such a multitechnological approach would serve to verify the assumed neural correlates of the psychometric tests.

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Time–frequency responses in ADHD to neurocognitive tasks analyzed by time–frequency hermite–gaussian atomizer technique

S. Karakas[a], E.D. Dinçer[a], A.Ö. Ceylan[b], Y.K. Alp[c], O. Arıkan[d]
[a]Hacettepe University Technology Development Center (KOSGEB), Ankara, Turkey
[b]Hacettepe University, Dept. of Psychology, Ankara, Turkey
[c]Military Electronic Industry (ASELSAN), Ankara Turkey
[d]Bilkent University, Dept. of Electric and Electronic Engineering, Ankara, Turkey

Complex time-domain signals, such as the ERPs are composed of oscillations of different frequencies. Since component frequencies occur over time, they have to be analyzed in the time–frequency. The aim of the present study was to analyze the event-related oscillatory response (EROs) components in Attention Deficit Hyperactivity Disorder during inhibition of a prepotent response using a time–frequency analysis technique. Participants were 70 unmedicated ADHD cases and 38 normal controls. All were right-handed males and were within the 6 and 11 years of age (ADHD: 115.46 ± 18.26 months, control: 119.186 ± 17.75 months). Inclusion criteria were being at the typical age of a given grade level and being within the 90 and 130 IQ range. Comorbidity was an exclusion criterion. Stimulation paradigms consisted of computerized Go/No Go and Reversal Tasks. Event-related responses were recorded (prestimulus: 500 ms, poststimulus: 1200 ms; $\Delta t = 1$ ms; cutoff between DC and 100 Hz, 3 dB, 12 dB/c) and preprocessed for baseline shifts, eye movements and muscular movements. ERP epochs were classified into two types of accurate responses (hit, correct rejection) and two types of inaccurate responses (miss/omission error, false alarm/commission error). Multivariate Analysis of Covariance (covariate: age) with Repeated Measures on the last factor showed a significantly longer reaction time in the ADHD group in only the Go/No Go task. In both tasks, the error rate of the ADHD group was significantly higher, with the commission errors being higher than the omission errors. Average ERPs were computed using the bootstrapping procedure. The extraction and identification of the uncontaminated time–frequency oscillatory components were performed using the high resolution time–frequency analysis technique, TFHA. In the Go/No Go Task, delta activity had lower intensities and shorter durations in the ADHD Group for the hit and miss responses. Differentiation of the theta response into early, middle and late components for the miss response of the control group was absent in the ADHD Group. In the Reversal Task, ADHD Group showed short lasting low intensity delta activity for the hit, correct rejection and miss responses. Overall theta responses were also shorter in duration in the ADHD group. These findings show that the ADHD Group suffers not only from attentional processing (as demonstrated in the theta oscillatory component) but also cognitive processing (as demonstrated in the delta response). These occur not only in the context of inhibition of a prepotent response but also of learning to commit or not to commit a response. Very much in line with the nonlinear character of brain activity; findings from EROs were not exactly mapped onto the findings on behavioural responses.

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