Predicting Clinical Gains and Side Effects of Stimulant Medication in Pediatric Attention-Deficit/Hyperactivity Disorder by Combining Measures From qEEG and ERPs in a Cued GO/NOGO Task

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Abstract

OBJECTIVES:
The study aim was to develop 2 scales: predicting clinical gains and risk of acute side effects of stimulant medication in pediatric attention-deficit/hyperactivity disorder (ADHD), combining measures from EEG spectra, event-related potentials (ERPs), and a cued visual GO/NOGO task.

METHODS:
Based on 4-week systematic medication trials, 87 ADHD patients aged 8 to 17 years were classified as responders (REs, n = 62) or non-REs (n = 25), and belonging to the side effects (SEs, n = 42) or no-SEs (n = 45) groups. Before starting the trial, a 19-channel EEG was registered twice: Test 1 (T1) without medication and T2 on a single dose of stimulant medication a few days before the trial. EEG was registered T1 and T2: 3 minutes eyes-closed, 3 minutes eyes-open, and 20 minutes cued GO/NOGO. EEG spectra, ERPs, omissions, commissions, reaction time (RT), and RT variability were computed. Groups were compared at T1 and T2 on quantitative EEG (qEEG), ERPs and behavioral parameters; effect sizes (d) were estimated. Variables with d > 0.5 were converted to quartiles, multiplied by corresponding d, and summed to obtain 2 global scales.

RESULTS:
Six variables differed significantly between REs and non-REs (T1: theta/alpha ratio, P3NOGO amplitude. Differences T2-T1: Omissions, RT variability, P3NOGO, contingent negative variation [CNV]). The global scale d was 1.86. Accuracy (receiver operating characteristic) was 0.92. SEs and no-SEs differed significantly on 4 variables. (T1: RT, T2: novelty component and alpha peak frequency, and RT changes. Global scale d = 1.08 and accuracy = 0.78.

CONCLUSION:
Gains and side effects of stimulants in pediatric ADHD can be predicted with high accuracy by combining EEG spectra, ERPs, and behavior from baseline and single-dose tests. ClinicalTrials.gov identifier: NCT02695355.