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Abstracts of Presented Papers

Quantitative EEG Profiles of Children with Attention and Learning Disorders and the Role of QEEG in Predicting Medication Response and Outcome

Robert J. Chabot, Ph.D.

New York University School of Medicine

This presentation will focus on two recently completed studies involving the role of Quantitative EEG in the diagnosis and treatment of children with attention and learning disorders.

The goal of the first study was to document patterns of neurophysiological abnormality in children with attention deficit disorders. To this end, QEEG was collected during an eyes-closed resting period, from 407 children with possible attention deficit and learning disorders. Clinical measures documenting IQ, reading achievement, memory problems, hyperactivity, inattention, and impulsivity were also obtained. The QEEGs from this sample were compared to a data base of 310 normal children. Discriminant analysis using a small subset of QEEG features resulted in a specificity of 88% and a sensitivity of 93.7% for distinguishing normal children from those with attention problems. As a group, children with attention disorders could be easily separated from normal children as 92.6% had abnormal QEEG evaluations.

Two major neurophysiological subtypes were evident within the abnormal QEEG profiles encountered. The first was characterized by varying degrees of EEG slowing, especially in frontal regions, whereas, the second was characterized by an increase in EEG activity, especially in frontal regions. These QEEG findings indicate deviation from normal development rather than maturational lag as the source of the neurophysiological abnormality in the majority of these children. When taken in conjunction with recent MRI, PET, and regional cerebral blood flow studies, these results indicate neurophysiological dysfunction within the cortical and subcortical structures which serve the frontal/striatal system. Models suggesting both hypo- or hyper-arousal of these structures as possible causes of attention disorders are supported.

The goal of the second study was to use behavioral and QEEG indices to evaluate and predict treatment response to stimulant therapy in children with attention disorders. A sample of 132 children were

evaluated. This sample included 65 children with attention deficit hyperactivity disorder (49.2%), 48 children with attention deficit disorder without hyperactivity (36.3%), and 19 children with minor attention and memory problems (14.5%). Paired associate learning tasks were used to evaluate a test trial of stimulant medication. Connor's, DSM III rating scales, and Neurometric QEEG was obtained before the stimulant trial and 6-14 months after treatment with the selected stimulant.

Significant QEEG differences were found between the normal control population (N=310) and the children with attention problems, with the degree of abnormality greatest in those children reaching criteria for attention deficit disorder with or without hyperactivity. QEEG abnormalities involved increased theta power greatest in frontal regions, frontal theta hypercoherence, and posterior interhemispheric power asymmetry and were similar to the abnormalities described above. QEEG abnormalities in short-term responders (increased paired associate learning) to dexamphetamine or methylphenidate differed, and a QEEG based discriminant function resulted in a sensitivity of 68.7% and a specificity of 67.5% for distinguishing the dexamphetamine and methylphenidate responders. Of greater importance, was the finding that 20.4% of the children in this sample had previously exhibited an adverse reaction to either dexamphetamine or methylphenidate, with 83.9% of these children correctly classified by the QEEG discriminant function. Children who showed a favorable response to treatment had a greater likelihood of QEEG normalization, and those with an adverse behavioral response to treatment an increase in QEEG abnormality. Pre-treatment clinical and QEEG features could predict treatment response with a sensitivity of 87.1% and a specificity of 91.3%. We conclude that a combined behavioral and QEEG approach can be useful for following and predicting treatment response to stimulants in children with attention disorders.

Relevant references:

Chabot, R.J., and Serfontein, G. Quantitative EEG Profiles of Children with Attention Deficit Disorder. *Biological Psychiatry*, 40, 951-963, 1996.

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