Desynchronization of Theta-Phase Gamma-Amplitude Coupling during a Mental Arithmetic Task in Children with Attention Deficit/Hyperactivity Disorder.

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Abstract

INTRODUCTION:
Theta-phase gamma-amplitude coupling (TGC) measurement has recently received attention as a feasible method of assessing brain functions such as neuronal interactions. The purpose of this electroencephalographic (EEG) study is to understand the mechanisms underlying the deficits in attentional control in children with attention deficit/hyperactivity disorder (ADHD) by comparing the power spectra and TGC at rest and during a mental arithmetic task.

METHODS:
Nineteen-channel EEGs were recorded from 97 volunteers (including 53 subjects with ADHD) from a camp for hyperactive children under two conditions (rest and task performance). The EEG power spectra and the TGC data were analyzed. Correlation analyses between the Intermediate Visual and Auditory (IVA) continuous performance test (CPT) scores and EEG parameters were performed.

RESULTS:
No significant difference in the power spectra was detected between the groups at rest and during task performance. However, TGC was reduced during the arithmetic task in the ADHD group compared with the normal group (F = 16.70, p < 0.001). The TGC values positively correlated with the IVA CPT scores but negatively correlated with theta power.

CONCLUSIONS:
Our findings suggest that desynchronization of TGC occurred during the arithmetic task in ADHD children. TGC in ADHD children is expected to serve as a promising neurophysiological marker of network deactivation during attention-demanding tasks.