Relationship between theta-phase gamma-amplitude coupling and attention-deficit/hyperactivity behavior in children

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Abstract
The Continuous Performance Test (CPT) is a valuable tool for assessing behavior in attention-deficit/hyperactivity disorder (ADHD). Quantitative electroencephalography (QEEG) is a promising tool for the diagnosis of ADHD. Recently, theta-phase gamma-amplitude coupling (TGC) measurement has received attention because it is a feasible method of assessing brain function. We investigated the relationship between CPT performance and EEG measures such as TGC and theta and gamma activity. EEGs were recorded from 68 volunteers from a camp for hyperactive children using a 19-electrode system. Their TGC, theta and 40 Hz gamma activity were estimated and compared with results obtained on the Korean ADHD Rating Scale (KARS) and the Intermediate Visual and Auditory (IVA) CPT. The results demonstrated significant negative partial correlations between TGC and the IVA CPT, such as the Response Control Quotient (RCQ) and Attention Quotient (AQ). TGC successfully identified the level of dysfunctional interaction of the attention/arousal system at a multi-scale large network level. It is thought that as the TGC increases, the efficacy of the system is very low or dysfunctional. Compensatory hyper-arousal patterns of the dysfunctional attention/arousal system may account for this effect. TGC is a promising neurophysiological marker for ADHD behavior in children.