Neural network topology in ADHD; evidence for maturational delay and default-mode network alterations.


Abstract

OBJECTIVE:
Attention-deficit/hyperactivity disorder (ADHD) has been associated with widespread brain abnormalities in white and grey matter, affecting not only local, but global functional networks as well. In this study, we explored these functional networks using source-reconstructed electroencephalography in ADHD and typically developing (TD) children. We expected evidence for maturational delay, with underlying abnormalities in the default mode network.

METHODS:
Electroencephalograms were recorded in ADHD (n=42) and TD (n=43) during rest, and functional connectivity (phase lag index) and graph (minimum spanning tree) parameters were derived. Dependent variables were global and local network metrics in theta, alpha and beta bands.

RESULTS:
We found evidence for a more centralized functional network in ADHD compared to TD children, with decreased diameter in the alpha band ($\eta_p^2=0.06$) and increased leaf fraction ($\eta_p^2=0.11$ and 0.08) in the alpha and beta bands, with underlying abnormalities in hub regions of the brain, including default mode network.

CONCLUSIONS:
The finding of a more centralized network is in line with maturational delay models of ADHD and should be replicated in longitudinal designs.

SIGNIFICANCE:
This study contributes to the literature by combining high temporal and spatial resolution to construct EEG network topology, and associates maturational-delay and default-mode interference hypotheses of ADHD.