Atypical Within- and Between-Hemisphere Motor Network Functional Connections in Children with Developmental Coordination Disorder and Attention-Deficit/Hyperactivity Disorder

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Abstract

Developmental coordination disorder (DCD) and attention-deficit hyperactivity disorder (ADHD) are highly comorbid neurodevelopmental disorders; however, the neural mechanisms of this comorbidity are poorly understood. Previous research has demonstrated that children with DCD and ADHD have altered brain region communication, particularly within the motor network. The structure and function of the motor network in a typically developing brain exhibits hemispheric dominance. It is plausible that functional deficits observed in children with DCD and ADHD are associated with neurodevelopmental alterations in within- and between-hemisphere motor network functional connection strength that disrupt this hemispheric dominance. We used resting-state functional magnetic resonance imaging to examine functional connections of the left and right primary and sensory motor (SM1) cortices in children with DCD, ADHD and DCD + ADHD, relative to typically developing children. Our findings revealed that children with DCD, ADHD and DCD + ADHD exhibit atypical within- and between-hemisphere functional connection strength between SM1 and regions of the basal ganglia, as well as the cerebellum. Our findings further support the assertion that development of atypical motor network connections represents common and distinct neural mechanisms underlying DCD and ADHD. In children with DCD and DCD + ADHD (but not ADHD), a significant correlation was observed between clinical assessment of motor function and the strength of functional connections between right SM1 and anterior cingulate cortex, supplementary motor area, and regions involved in visuospatial processing. This latter finding suggests that behavioural phenotypes associated with atypical motor network development differ between individuals with DCD and those with ADHD.