Transcranial Direct Current Stimulation Improves Executive Dysfunctions in ADHD: Implications for Inhibitory Control, Interference Control, Working Memory, and Cognitive Flexibility

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Abstract

Objective:
This study examined effects of transcranial direct current stimulation (tDCS) over the dorsolateral prefrontal cortex (DLPFC) and orbitofrontal cortex (OFC) on major executive functions (EFs), including response inhibition, executive control, working memory (WM), and cognitive flexibility/task switching in ADHD.

Method:
ADHD children received (a) left anodal/right cathodal DLPFC tDCS and (b) sham stimulation in Experiment 1 and (a) left anodal DLPFC/right cathodal OFC tDCS, (b) left cathodal DLPFC/right anodal OFC tDCS, and (c) sham stimulation in Experiment 2. The current intensity was 1 mA for 15 min with a 72-hr interval between sessions. Participants underwent Go/No-Go task, N-back test, Wisconsin Card Sorting Test (WCST), and Stroop task after each tDCS condition.

Results:
Anodal left DLPFC tDCS most clearly affected executive control functions (e.g., WM, interference inhibition), while cathodal left DLPFC tDCS improved inhibitory control. Cognitive flexibility/task switching benefited from combined DLPFC-OFC, but not DLPFC stimulation alone.

Conclusion:
Task-specific stimulation protocols can improve EFs in ADHD.