

Frontal Lobe and Subcortical / Cortical Inhibitory Deficits and Neuropsychological Performance in ADHD Children

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Background: Current procedures for diagnosing Attention-Deficit/Hyperactivity Disorder (ADHD) in children involve using subjective clinical criteria. An ongoing debate is whether the use of specific neuropsychological tasks or measures can reliably indicate ADHD severity. Our objective was to evaluate two executive function tasks and compare them to parent rated symptom severity and a quantitative measure of brain inhibition.

Methods: ADHD children ages 8 to 12 were recruited by advertisement and excluded if other significant psychiatric illnesses were present. All subjects were off medication for greater than 24 hours. Symptom severity was assessed independently using the DuPaul ADHD Rating Scale: Home Version. We administered computerized versions of the Stroop task and the Mental Chronometry task (Life Science Assoc., Bayport NY). Transcranial Magnetic Stimulation was performed using two Magstim 200® stimulators (Magstim Co., New York, NY, USA) connected through a Bistim® module to a double 70 mm figure of 8 coil to measure motor cortex inhibition. Correlational analyses were performed using SPSS (Student version 16).

Results: 12 ADHD children were enrolled (mean age 9.75, 3 females, 6 qualified for TMS), mean ADHD rating (38.1 range: 11 to 52). Two versions of the Stroop were compared, and both showed lower accuracy and longer reaction times in the incongruent color-word condition. Longer Stroop reaction times correlated with greater ADHD severity (Color $r = 0.78$ $p = 0.041$; Congruent $r = 0.81$ $p = 0.027$; Incongruent $r = 0.90$ $p = 0.006$); and longer Mental Chronometry Simple and Choice Reaction Times correlated with ADHD severity (Simple $r = 0.85$ $p = 0.007$; Choice $r = 0.83$ $p = 0.011$). TMS-evoked cortical inhibition and facilitation correlated with Stroop Color Word and Interference Scores. (all $r = 0.77$ to 0.94 ; $p = 0.005$ to 0.08).

Conclusions: In ADHD children, parent-rated symptom severity correlates with poor performance on Stroop and Mental Chronometry tasks. TMS measures in motor cortex suggest a biological basis for poorer Stroop performance. These measures merit further investigation as biomarkers and clinical tools for evaluating ADHD. Acknowledgment: This research was supported by MSSRP: T35 DK 60444.