# Motor Cortex Physiology of Movement Preparation in ADHD Children

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**Introduction** In healthy adults, motor cortex physiology, as measured by Transcranial Magnetic Stimulation (TMS), becomes increasingly disinhibited in the time prior to a movement. This relationship has not been evaluated during behavioral response inhibition tasks. As both motor function and response inhibition are often impaired in children with ADHD, a quantitative TMS measure during response inhibition could supplement subjective clinical rating scales and serve as a biomarker of ADHD.

**Hypotheses** The motor cortex physiology of movement preparation differs between ADHD and Healthy Control (HC) children. In children with ADHD, worse symptom severity will correlate with a more disrupted motor physiology.

**Methods** Patient population consisted of 82 right-handed children, (45 ADHD: mean age 10.41 years, 31 males; 37 HC: mean age of 10.31 years, 24 males.) TMS (Magstim Bistim™, Morrisville, NC) single and 3 msec inhibitory paired pulses evoked motor potentials in the first dorsal interosseous muscle during a response inhibition task. This captured multiple time points 0-150 msec prior to finger movement. Symptom severity of children with ADHD was evaluated via the DuPaul ADHD-Rating Scale. Motor physiology trajectories were modeled by diagnosis (ADHD vs. HC) and by symptom severity (within ADHD) using a repeated measures analysis in SAS, and the trajectory was modeled using linear, reciprocal, and quadratic functions.

**Results** Motor cortex inhibition (motor evoked potential amplitudes) diminished closer to time of movement (both linear and reciprocal models $p<.0001$). At 150 msec before movement (rest), ADHD children are less inhibited, and therefore, have larger baseline, 3 msec amplitudes. Approaching movement onset, the trajectory of motor cortex disinhibition was steeper in HC children (model interaction terms, reciprocal $p=.032$; linear $p=.051$). In ADHD children, no significant association was found between symptom severity and the trajectory of disinhibition ($p=0.94$).

**Conclusions** While motor excitation does increase prior to movement during response inhibition in both ADHD and HC children, the resting baseline and trajectory of disinhibition approaching movement appears to differ. This measure may serve as a quantitative, brain-based biomarker for the presence of ADHD.

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