5-1-2007

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The Neural Correlates of Inhibitory Control in Preschool Children: Go/No-Go Task Demands Influence ERP Amplitude and Latency

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Introduction

Inhibitory control undergoes rapid developmental change during the preschool years (Espy, 2004; Klenberg et al., 2001). Inhibitory control is a central construct in theories of attentional control and is closely related to many aspects of executive functioning (e.g., working memory, planning, and problem solving). ERP measures have been used to study inhibitory control in children, and have shown that children who are less impulsive (i.e., respond more slowly on Go trials) and perform better on the task overall evidence larger amplitude ERP waveforms and longer latencies (Espy, 2004; Klenberg et al., 2001). Event-related potentials (ERPs) have proven to be a useful tool for studying brain-behavior relations in preschool children, who have difficulty complying with the demands of fMRI (e.g., tolerating noise, keeping still; Nelson & Monk, 2001).

Methods

The sample included 25 preschool children (15 girls, 10 boys) who ranged in age from 5.0 to 6.01 years (mean 5.68 years). Children were fitted with a 128-channel EGI Hydrocel Geodesic Sensor Net, and then completed the Go/No-Go task under a short practice phase. The Go/No-Go task, the child pressed a button to “catch” fish stimuli within a set time (750 ms), and to inhibit the button response for shark stimuli (250 ms). Three sets of analyses were conducted: N200 and P300 peak amplitude and latency were examined separately at anterior midline leads, anterior lateral leads, and posterior lateral leads. For the Slow condition, at anterior midline and lateral leads, the N200 was most negative for No-Go(2) trials, and smaller for Go and No-Go(4) trials, which did not differ: F(2, 26) = 4.13 and 4.17, p < .05.

Results: Behavioral Performance

Children performed better in the Slow than in the Fast condition: F(1, 23) = 11.01, p < .005. There was also a trend toward a Trial Type x Stimulus Rate interaction: F(1, 23) = 2.35, p < .10. In the Slow condition, Go performance was significantly better than either No-Go trial type, which did not differ, F(2, 26) = 4.96, p < .05. In the Fast condition there was no significant Trial Type effect but children responded more quickly in the Fast stimulus rate condition than in the Slow condition: F(2) = 5.53, p < .001.


References


Acknowledgments

This work was funded by NIH grants MH 065668 and DA 014661 to Kimberly Andrews Espy, a Wellcome Trust Senior Research Fellowship to Sandra Wiebe, and an Award from the National Institute for Disability and Developmental Sciences (8304/60) and the National Institute of Child Health and Human Development (5T32 HD007186) to Bess Harris. Funding from the NIH and the National Science Foundation provided additional support. Correspondence regarding this poster may be addressed to Sandra Wiebe (swiebe2@unl.edu).