



A fNIRS investigation of event-related, Go-No-Go task in children

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Objective

- Near-infrared spectroscopy (NIRS) provides a new direction for developmental cognitive neuroscience research.
- The application of fMRI to children is restricted to periods of tasks, however NIRS can be applied in the natural setting in children of any age, even whilst any task.
- The present study investigated functional brain activation patterns in children using functional Near Infrared Spectroscopy (fNIRS) during an event-related, Go-No-Go task and neuropsychological tests as a more cost-effective tool measuring cortical hemodynamics and a behavioral paradigm.

Neuropsychological Assessment	
Intelligence	Korean Wechsler Intelligence Scale -IV -Working Memory & Processing Speed
Executive function	Color Trails Test (CCTT)



Table 1. Neuropsychological assessment

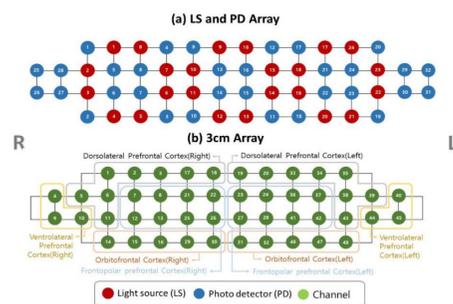
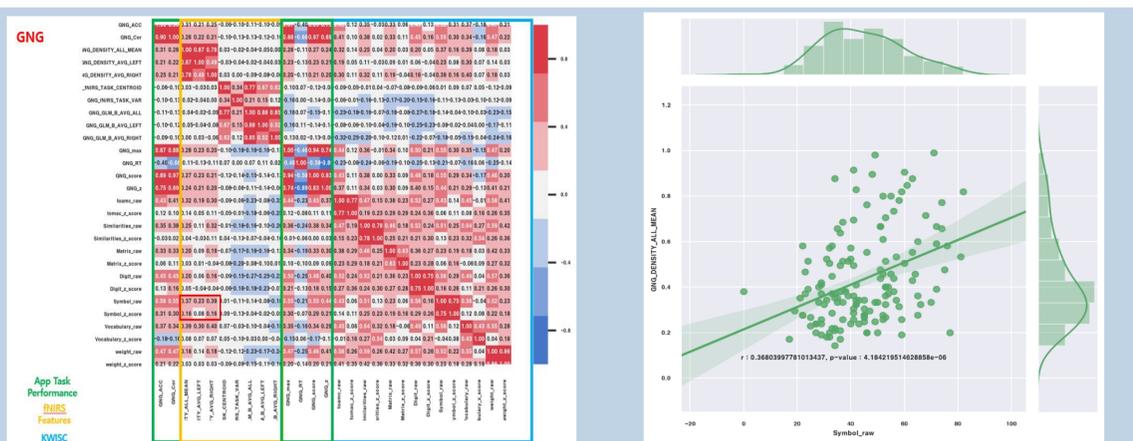


Figure 2. Multi-distance based portable fNIRS device : NIRSIT

Methods

- This study enrolled 148 healthy normal participants (age range of 7.0–12.4 years old, 8.9 ± 1.5 years; 72 boys). Measurements were performed by NIRSIT-Lite (OBELAB Inc, Korea) which utilizes 5 LED sources and 7 photo detectors and it can measure 15 channels at prefrontal area.
- We adapted Go-No-Go task in an event-related version which might suggest executive processes such as interference resolution and response inhibition, and measured prefrontal activity during task performance.
- Relating neuropsychological tests of intelligence of Wechsler Intelligence Scale for Children –Fifth Ed. (WISC-V) including Verbal Comprehension, Visual Spatial, Fluid Reasoning, Working Memory and Processing Speed.

Figure 3. The Results of fNIRS density difference among neuropsychological tests on Go-No-Go task in children



- The fNIRS data analysis was conducted on the concentration associated with the activation of each condition.
- Modified Beer-Lambert law (MBLL) is the main governing equation for NIRS, which extracts the concentrations of oxy- and deoxyhemoglobin by using light signals with two wavelengths.
- For representing individual distance matrix, density parameter is calculated after applying threshold value at the distance matrix.
- fNIRS density, GLM, and task parameters are calculated after applying threshold value at the distance matrix. fNIRS data and behavioral measure were analyzed with repeated measure ANOVA as a within-subjects and an inter-group factor. And correlation analysis was conducted among fNIRS, behavioral and neuropsychological data.



Results

- In terms of development, no significant differences on fNIRS density, GLM, task parameters were shown, suggesting no prominent discrimination.
- However, the accuracy level of Go-No-Go test showed comparatively high correlation with density from fNIRS and showed high correlation with Processing Speed and Working Memory from WISC-V.

Conclusion

- Our results suggest that fNIRS parameters are associated with different functional activation patterns in the frontal subregions based on the characteristics of each task besides developmental aspects.
- fNIRS could be a potential measure as an effective tool to investigate the contributions of developmental prefrontal function of executive functioning in children.

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