RESEARCH QUESTIONS

Do young children at-risk for developing reading difficulties recruit compensatory pathways in the frontal cortex and right hemisphere during reading at the earliest stages of learning to read?

Children with dyslexia show reduced neural activation in the left-lateralized network of frontal, temporoparietal, and occipitotemporal regions and increased right hemispheric and prefrontal activation when reading, which may reflect more effortful processing and function as a compensatory pathway for reading.

To understand the development of a compensatory frontal and right hemispheric reading circuitry for poor readers, we examined neural activation during a language and reading task in typically-developing and at-risk readers. This study defines at-risk children as having poor phonological awareness (PA) because PA influences reading acquisition success and is a strong predictor of later reading outcome.

HYPOTHESES

At-risk children are predicted to exhibit a compensatory reading circuitry while performing language and reading tasks.

Typically-developing children are predicted to show greater activation in left-lateralized reading pathways during the same tasks.

METHODS

Tasks
Near Infrared Spectroscopy (NIRS) Neuroimaging Auditory language and Print Word Reading Task

Analysis
Hemodynamic responses were preprocessed and analyzed using Statistical Parametric Mapping (NIRS-SPM, Ver. 4).

RESULTS

Typically-developing Children
Auditory Word>Baseline
L-IFG (p < 0.05)

At-Risk Children
Auditory Word>Baseline
R-IFG (p < 0.01)

CONCLUSION

At-risk children showed a compensatory reading circuitry even before they become readers. This was observed when reading words and processing (auditory) language.

The results suggest that the compensatory pathways and reduced activation in left hemisphere reading circuitry are associated with reading ability, and also with PA.

Translational Impact: Reading interventions with an emphasis on PA that start before reading acquisition may allow a more typical development of reading circuitry and reading ability.

Future Directions: Does the compensatory reading circuitry emerge in at-risk children even earlier, before they begin to learn reading or acquire PA skills?

REFERENCES

1. Haskins Laboratories
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5. University of California, Merced