**Children with Dyslexia/Dysgraphia and DTI parameter Correlations with Reading/Language Scores**

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**Introduction**

Diffusion tensor imaging (DTI) was used to test the hypothesis that white matter parameters would correlate with behavioral writing measures in children who were diagnosed with dysgraphia (impaired handwriting) and dyslexia (impaired word decoding and word-spelling) using evidence-based diagnostic procedures that included a standardized measure of oral reading.

**Methods**

DTI scanning was performed on a Philips 3T Achieva scanner (version 3.2.2) on 8 children with dysgraphia and 6 children with dyslexia who were 11 to 12 years old and in the 6th grade. DTI acquisition parameters were: spin-echo/echoplanar pulse sequence, 32 channel Philips rf coil, matrix size 128x128x64, pixel size 1.7x1.7x2mm, diffusion encoded directions 32, non-diffusion measure 1, averages 1, b-value strength 1000, TR/TE 8592/78 milliseconds, SENSE ParallelReductionFactorInPlane 1.9. DTI data were processed with DTIprep/GTRACT software to quality control the data and generate the tensors (http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/TBSS/UserGuide). The software (GFORTRAN) was used to calculate the DTI parameters from the tensors (1,2). Then custom software (GFORTRAN) was used to perform a voxel by voxel correlation of the DTI data with the demeaned behavioral measures. The final statistical maps were generated using FSL’s Randomise software, which robustly corrects for multiple comparisons using the "Threshold-Free Cluster Enhancement" (TFCE) option using permutation methods (http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/TBSS/UserGuide). The group analysis correlation was calculated separately for the dyslexic and dysgraphic groups. Diagnostic procedures included standardized measures of reading and writing psychometrics.

**Results**

The table below shows all the significant correlations between language scores and DTI parameters for the dysgraphic group. As an example, there was a significant correlation of the DTI Volume Ratio with the Single Word Reading score in the left cerebellum as shown in Figure 1 (MNI coordinates: -16, -49, -41 mm, p<.01 corrected, Spearman correlation coefficient 0.98). Figure 2 is a scatter plot illustrating the correlation between Single Word reading with the DTI volume ratio value from this region of brain. The group with dyslexia did not have any significant correlations with this DTI measure, but did have a significant correlation of DTI FA parameter in the fornix white matter (MNI coordinates 1, -14, 20 mm).

**Conclusions**

Several DTI parameters were found to be correlated with reading and writing behavior in children with dysgraphia. Research has shown that oral reading of single words draws on word-specific spellings for specific pronunciations and meanings. Work in progress is investigating whether the differences in patterns of significant correlation between white matter connectivity and word-specific reading are associated with orthographic coding in children with dysgraphia, but with phonological coding for children with dyslexia.

**References**


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**Acknowledgements**

We gratefully acknowledge funding from the NIH- The Eunice Kennedy Shriver National Institute Of Child Health and Human Development grant no. P50HD071764 (PI Virginia Berninger). We also thank Liza Young for administrative support and Karl Woefler for IT support.