Delineation of the Inferior Longitudinal Fasciculus in Subjects with 22q11.2 Deletion Syndrome

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BACKGROUND

- 22q11.2 Deletion Syndrome (22q11DS) represents a population at high risk for developing schizophrenia in adulthood. Learning disabilities and deficits in visual memory have been reported in children with 22q11DS.
- The Inferior Longitudinal Fasciculus (ILF) is a white matter tract of the ventral visual stream associated with visual memory. Additionally, macrostructural changes of the ILF have been reported in schizophrenia patients.
- We explore the integrity of ILF in 22q11DS patients in comparison to siblings and controls using tractography.

MATERIALS AND METHODS

- Subjects: 18 young adult 22q11DS patients were matched on age, gender and handedness to 9 control subjects and 9 siblings (mean age patients 18.9 +/-2.7 years; controls 18.3+/-.1.8; siblings18.3 +/-1.9 years). No subject was diagnosed with schizophrenia at the time of the scan.
- Diffusion weighted images were acquired on a 1.5 Tesla Philips Scanner. Images were post processed to generate DTI images.
- Streamline tractography was based on manual drawn Region of interest (ROI) and performed using 3DSlicer software.

RESULTS

- The ILF is shown in red in Figure 1.
- Between group analyses comparing patients, siblings and controls demonstrate a significant difference in the DTI measures in ILF (Kruskal-Wallis test, nonparametric 3-way ANOVA for each DTI measure, Figure 2).
- We followed up by post hoc test (Tukey HSD):
  - left ILF: significant differences between siblings and patients groups were present (p=0.017 for Trace and p=0.018 for RD); right ILF: significant differences between siblings and patients groups were present (p=0.025 for Trace; p=0.04 for AD and p=0.04 for RD); and significant differences between control and patient groups were present (p=0.015 for Trace; p= 0.02 for AD and p=0.03 for RD).

CONCLUSIONS

We delineated the ILF in 22q11DS using tractography and extracted DTI measures that allow quantification of changes between the patients, control subjects and siblings groups. The differences observed suggest changes in axonal integrity and myelination in young adults with 22q11DS.

Figure 1. Tractography of the Inferior Longitudinal Fasciculus (ILF)
ILF of the left hemisphere is presented in red. ILF connects the gray matter of the occipital and the temporal lobe. Tractography of the white matter tracts of the entire brain is presented in black.

Figure 2. DTI measurement of the left and right ILF and group comparisons
DTI measures, such Fractional Anisotropy, Trace, Axial Diffusivity (AD) and Radial Diffusivity (RD) describe the microstructure of the white matter tract. Statistically significant reductions in Trace and in RD of the left ILF in the patients group suggest changes in axonal myelination. Statistically significant reductions in Trace, AD and RD of the right ILF in the patients group suggest changes in axonal integrity and myelination.