DIFFUSION TENSOR IMAGING AND TRACTOGRAPHY IN NEURODEVELOPMENTAL DISORDERS

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Background
Diffusion tensor imaging (DTI) is one of the most powerful tools for investigating brain anatomical connectivity. The aim of our study was to compare brain connectivity among children with autism spectrum disorders (ASD), developmental dysphasia (DD), and healthy controls (HC) in a single study.

Methods
Our sample included 113 children aged 5–12 years (77 boys, 36 girls) divided into three subgroups: ASD (n=40), DD (n=36), and HC (n=37). We focused on the weighted average of fractional anisotropy (FA) in four tracts: the arcuate fasciculus (AF), inferior frontal occipital fasciculus (IFOF), inferior longitudinal fasciculus (ILF), and uncinate fasciculus (UF). Descriptive statistics and the Kruskal-Wallis test were used for comparing DTI groups, followed by the Tukey correction for multiple testing. For post-hoc analyses, the Nemenyi test was used.

Results
Detailed analyses of FA revealed significant differences among the ASD, DD, and HC groups in the left AF (p=0.014) and right AF (p=0.001), the left IFOF (p<0.001) and right IFOF (p<0.001), the left ILF (p<0.001) and right ILF (p<0.001), but not in the UF (see **Table 1**). Post-hoc analyses revealed that in right-sided tracts of AF, IFOF, and ILF, the FA in DD was more similar to HC than to ASD. In the equivalent left-sided tracts, there was no uniform trend.

TBSS statistics focused on the left ILF, the only tract where the FA findings in the ASD and DD groups were similar, and both differed from controls in the general statistics. The TBSS results confirmed that the differences between the ASD and control group included the whole ILF. The differences between the DD and HC groups were mostly localized to the anterior and central parts of the ILF, while the differences between the ASD and DD group were most prominent in the posterior part of the tract (see **Figure 1**).

Conclusions
The connectivity pattern in ASD differed from connectivity patterns in DD and HC. The tract where impairments in ASD and DD subjects were the most similar was the left ILF.

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Fig.1: Tract-Based Spatial Statistics for the left inferior frontal fasciculus

Voxels without differences between the two groups are in green. Voxels with the most significant differences between the two groups are coded using a red to yellow color map.
Abbreviations: FA, fractional anisotropy; A, autism spectrum disorders; D, developmental dysphasia; C, healthy controls

Table 1: Fractional anisotropy of the investigated tracts

Tract	Median values			Statistics (df=2)		Post-hoc tests (p-values)			
	A	D	C	chi ²	p	A vs. C	D vs. C	A vs. D	Summary
AF left	0.499980	0.513026	0.517157	8.5539	0.014*	0.011	0.545	0.171	A<C; D=C; A=D
AF right	0.4702670	0.4924285	0.4928265	13.169	0.001*	0.001	0.569	0.037	A<(D=C)
IFOF left	0.5113870	0.5197265	0.5350990	14.561	<0.001*	<0.001	0.155	0.137	A<C; D=C; A=D
IFOF right	0.4869060	0.4998625	0.5091060	19.059	<0.001*	<0.001	0.671	0.004	A<(D=C)
ILF left	0.4815450	0.4919865	0.5093540	20.725	<0.001*	<0.001	0.022	0.169	(A=D)<C
ILF right	0.467203	0.483447	0.485701	20.38	<0.001*	<0.001	0.848	0.001	A<(D=C)
UF left	0.4452510	0.4483685	0.4623040	7.1919	0.027	n/a	n/a	n/a	n/a
UF right	0.4142090	0.4291455	0.4347800	6.5562	0.038	n/a	n/a	n/a	n/a

Notes: * Indicates values that survive Tukey correction for multiple comparisons (p<0.01797).
Abbreviations: A, autism spectrum disorders; D, developmental dysphasia; C, healthy controls; AF, arcuate fasciculus; IFOF, inferior frontal occipital fasciculus; ILF, inferior longitudinal fasciculus; UF, uncinate fasciculus; n/a, not applicable