

Associations Between Brain Microstructural And Dopaminergic Integrity In Parkinson's Disease: A Joint Diffusion Tensor and DAT Imaging Study

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Introduction

- Several diffusion tensor imaging (DTI) studies in PD patients have reported distributed white matter damage.
- Whether these white matter alterations are associated with dopaminergic deficits in PD has been unclear.
- We studied the relationship between distributed DTI alterations and striatal dopamine deficits as measured with dopamine transporter (DAT) imaging.

Methods

- This study was conducted as part of the international multicenter Parkinson Progression Marker Initiative (PPMI). <http://www.ppmi-info.org/>.
- As of March 2012, 49 de-novo PD patients and 35 controls had baseline data of both DTI and DAT completely processed.
- DTI and DAT were each processed centrally. Specifically, processing of DTI included corrections for head motion and geometrical distortions before computing diffusion tensors voxel by voxel. Raw and processed data are shared at <http://www.loni.ucla.edu/>.
- A regionally unbiased analysis of DTI was performed using statistical parametric mapping (SPM).

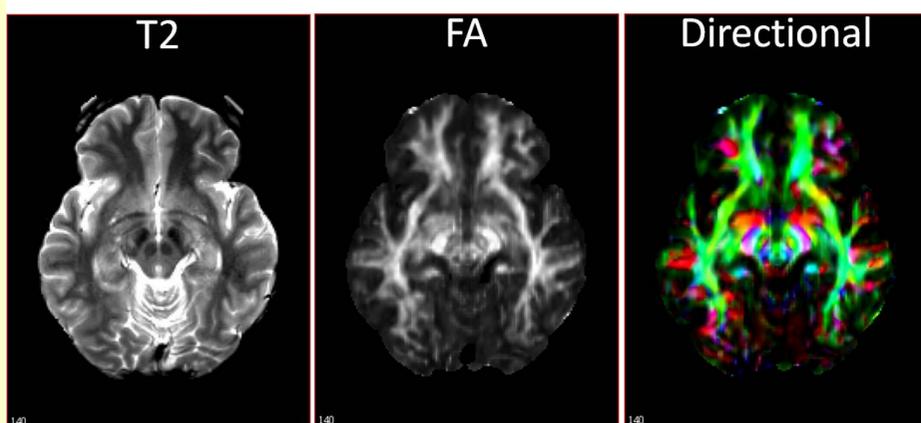


Table 1: Population Demographics

	PD	Control	P-value
N	49	35	
%Male	71	69	n.s
Age [years]	62 ± 9	57 ± 12	0.09
H & Y *	1.7 ± 0.5	0	< 0.001
UPDRS			
Part III	21 ± 9	0	< 0.001
Total	33 ± 14	3 ± 3	< 0.001
DAT ratio			
Min. Caudate	1.40 ± 0.35	1.91 ± 0.33	< 0.001
Min. Putamen	0.70 ± 0.26	1.29 ± 0.35	< 0.001

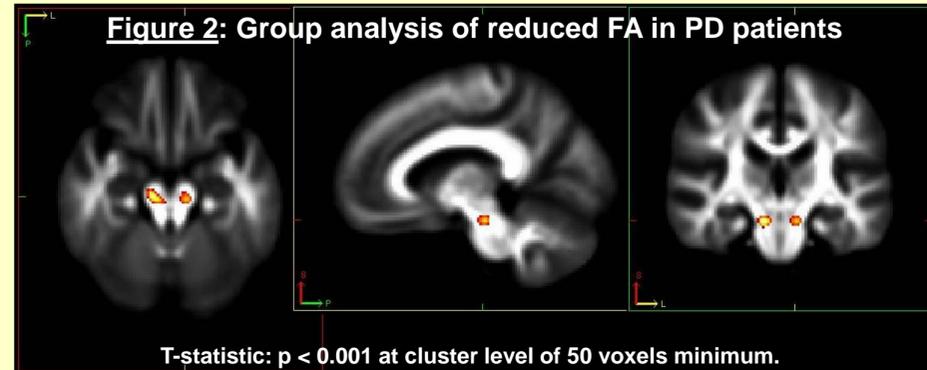
*Hoehn & Yahr scale

Acknowledgements:

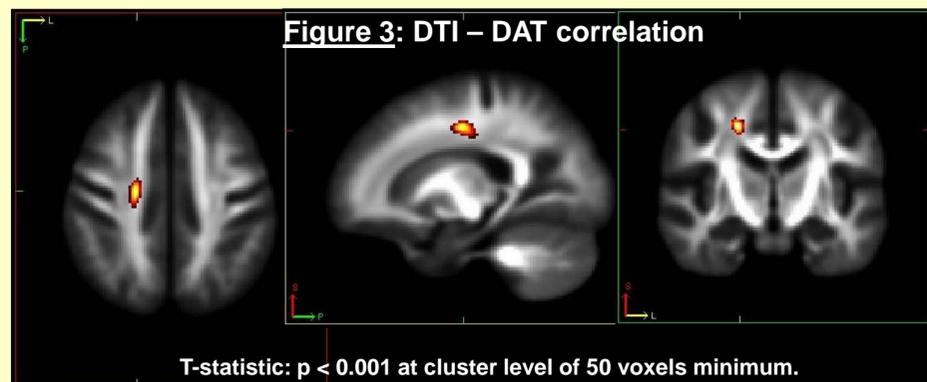
PPMI is sponsored by the M.J. Fox Foundation and is funded by a consortium of industry partners, non-profit organizations and private individuals.

Results

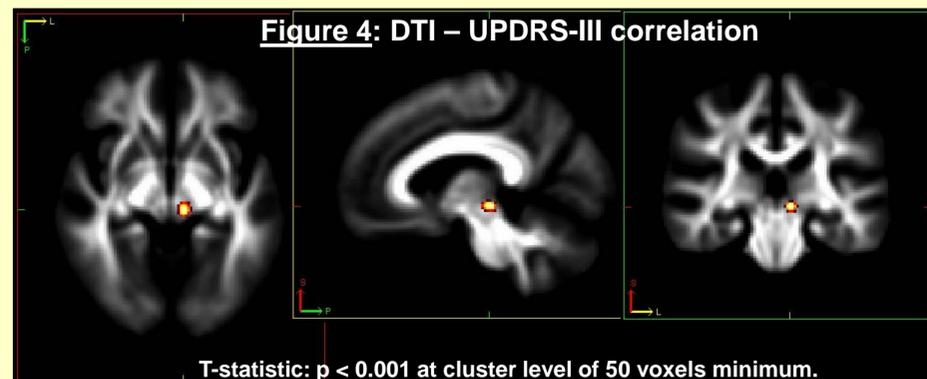
Group Analysis: A regionally unbiased analysis of DTI revealed the most prominent reduction of fractional anisotropy (FA) in PD patients relative to controls is bilateral in the vicinity of the substantia nigra, regardless of age and gender.



DTI - DAT Correlation: The most prominent correlation between reduced FA and minimum striatal DAT count in the PD patients was seen in the right supplementary motor area. The finding remained significant after accounting for severity of PD symptoms based on UPDRS scores.



DTI - UPDRS Correlation: The most prominent correlation between reduced FA and increasing motor deficits in PD patients based on UPDRS-III was seen in the superior section of the substantia nigra. The finding remained significant after accounting for DAT variations.



Conclusions

- This study identifies a significant link between DTI and DAT variations, suggesting that distributed FA reductions in PD are associated with deficits of dopaminergic neurons in the striatum.
- The discordance between the regional pattern of reduced FA in relation to dopamine deficiency and the one in relation to clinical symptomatology suggests that DTI and DAT provide complementary information.
- DTI is feasible an international multicenter setting.

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