

# Diffusion Tensor Tractography of the Internal Capsule in Depressed and Anxious Patients with Parkinson's Disease

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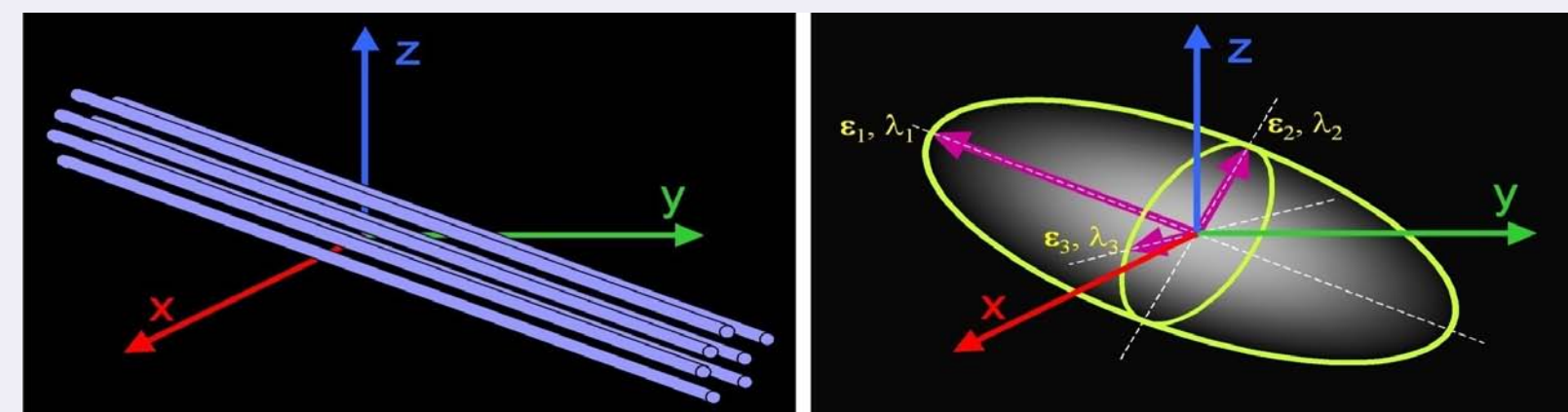
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## BACKGROUND

- ❖ Depression and anxiety are prominent non-motor features of Parkinson's disease (PD); yet little is known about the underlying neural circuitry of these neurobehavioral symptoms.
- ❖ Diffusion tensor imaging (DTI), which allows us to detect changes in white matter microstructure via water molecule diffusion in brain tissue, may be used to detect changes in the neural circuitry that are associated with PD-related neurobehavioral changes.
- ❖ Altered anisotropy in white matter tracts leading from the thalamus to the prefrontal and parietal cortices in PD are associated with changes in other PD related non-motor symptoms (e.g., cognition) but have not been evaluated in neurobehavioral symptoms of PD.

Figure 1: Schematic representation of the concept of the diffusion tensor ellipsoid and of the main diffusion directions derived from the tensor analysis.



- ❖ Fractional anisotropy (FA) is a measure of the degree and organization of fibers in the white matter tracts and hence is an indicator of integrity. Mean diffusivity (MD) is the average magnitude of the diffusion. Radial diffusivity (RD) is the mean of secondary and tertiary eigen values.

## OBJECTIVE

To investigate the integrity of white matter tracts associated with depression and anxiety in patients with PD using Diffusion Tensor Imaging (DTI) tractography analysis. We hypothesize that decreased integrity of the anterior internal capsule will be associated with higher levels of depression and anxiety in patients with PD.

## METHODS

PD patients were classified as:

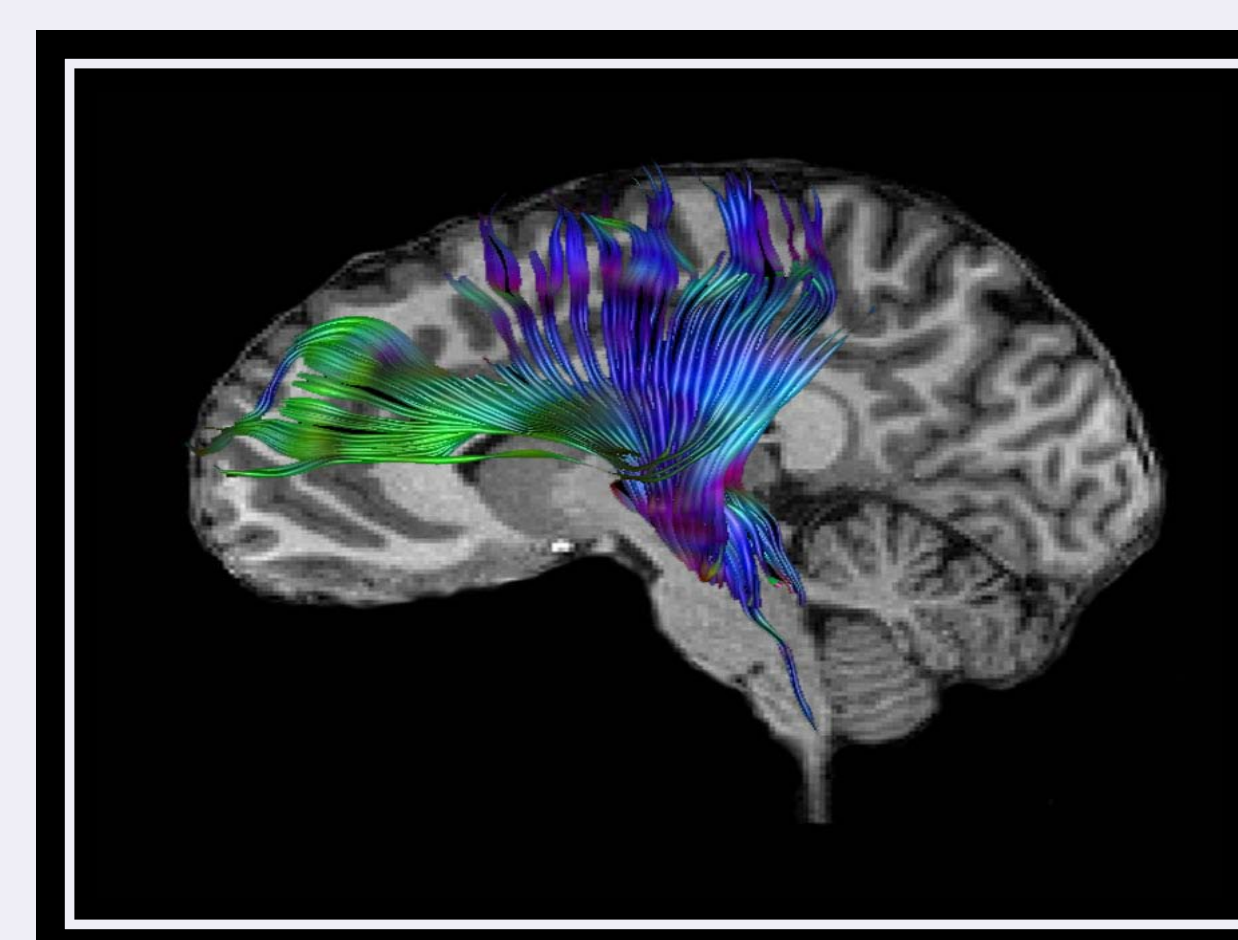
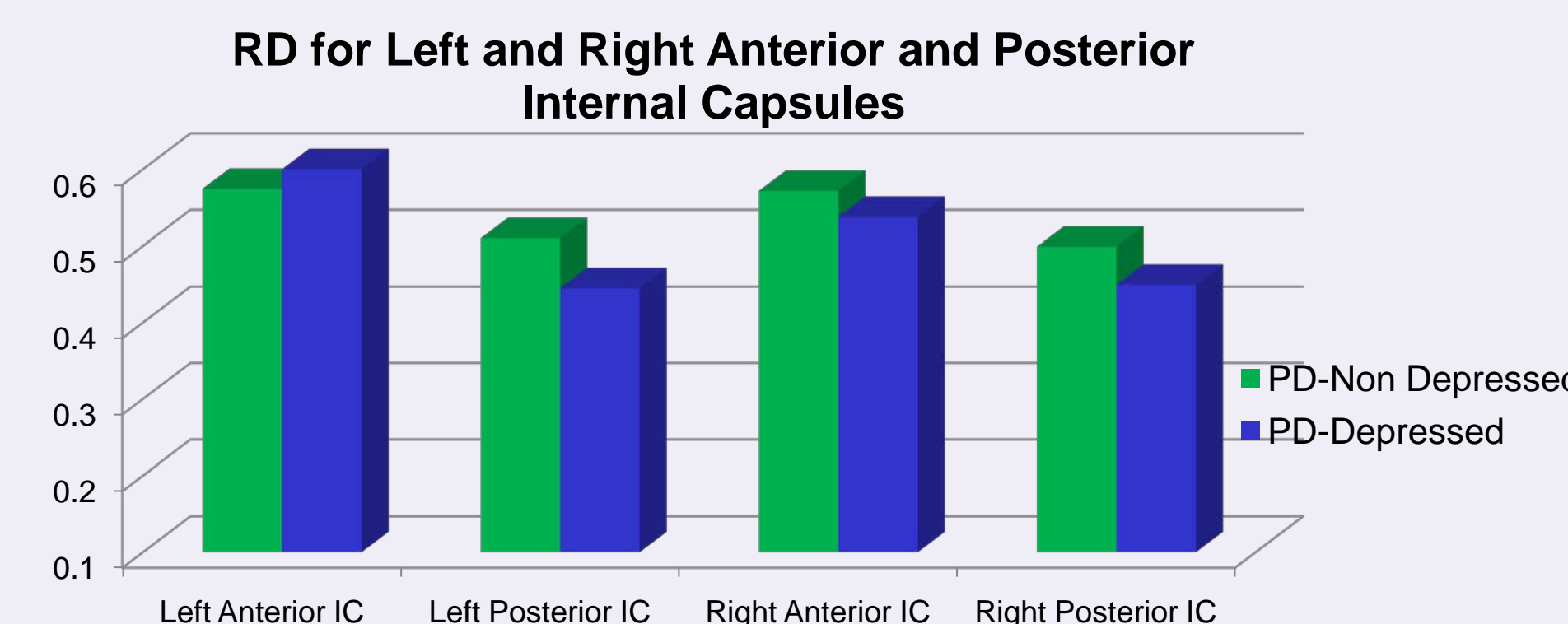
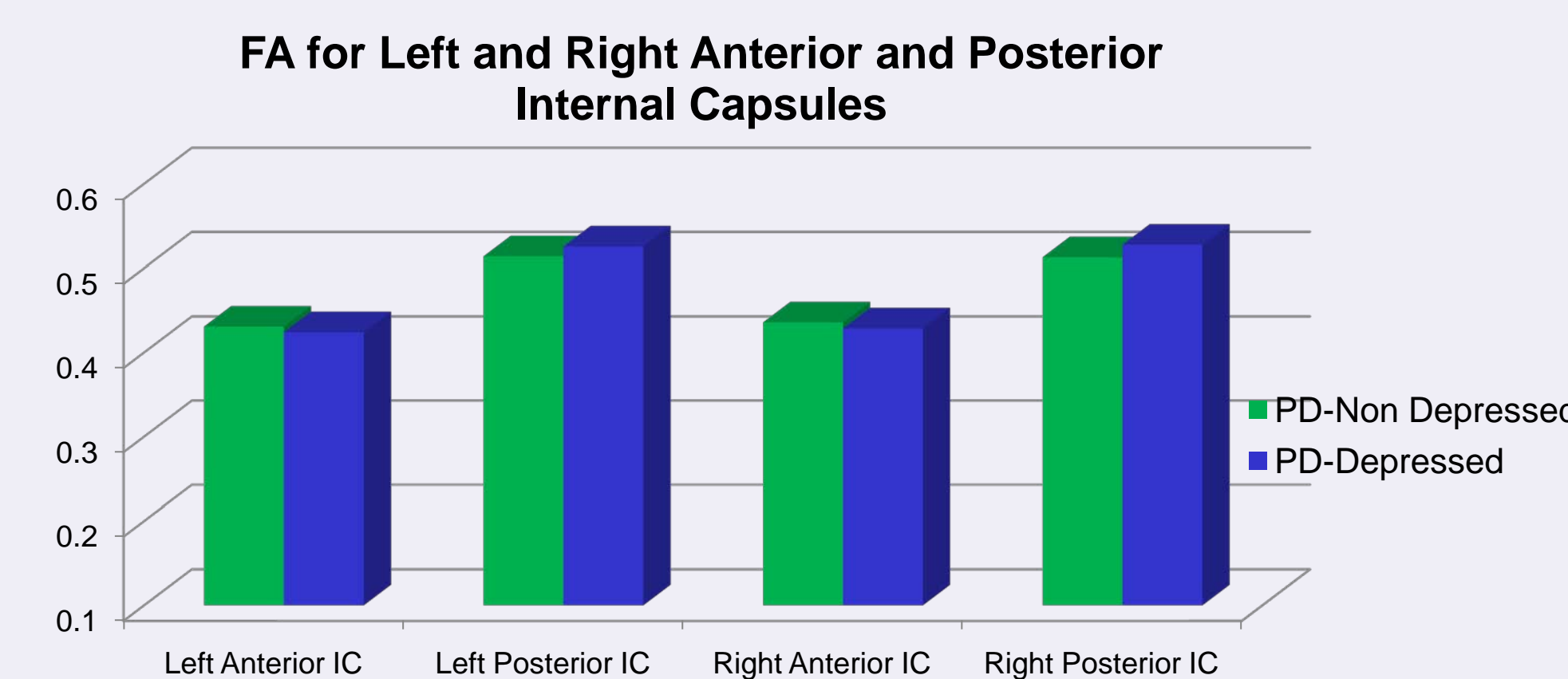
- ❖ Depressed (PD-Dep; n=10) versus non-depressed (PD-ND; n=20) based on a cut-off total score of 14 on the Beck Depression Inventory-II, and
- ❖ Anxious (PD-Anx; n=13) versus non-anxious (PD-NA; n=13) based on a median split on the State Trait Anxiety Inventory Trait scales.

Group differences for FA, MD, and RD were analyzed bilaterally for the anterior and posterior limbs of the internal capsule.

## RESULTS-Depression

	PD-ND (n=20)	PD-Dep (n=10)	P-value
Gender (M/F)	14/6	8/2	0.56
Age	71.5 (7.2)	64.8 (6.5)	0.02
Education	15.1 (1.9)	14.4 (3.2)	0.46
MMSE	26.8 (5.0)	25.7 (3.3)	0.53

- ❖ The groups differed on age; therefore, age was entered as a covariate in the analyses.
- ❖ The PD patients with higher depression scores demonstrated decreased integrity of the right and left anterior internal capsules (lower FA and higher RD) as compared to the PD patients who were not depressed.

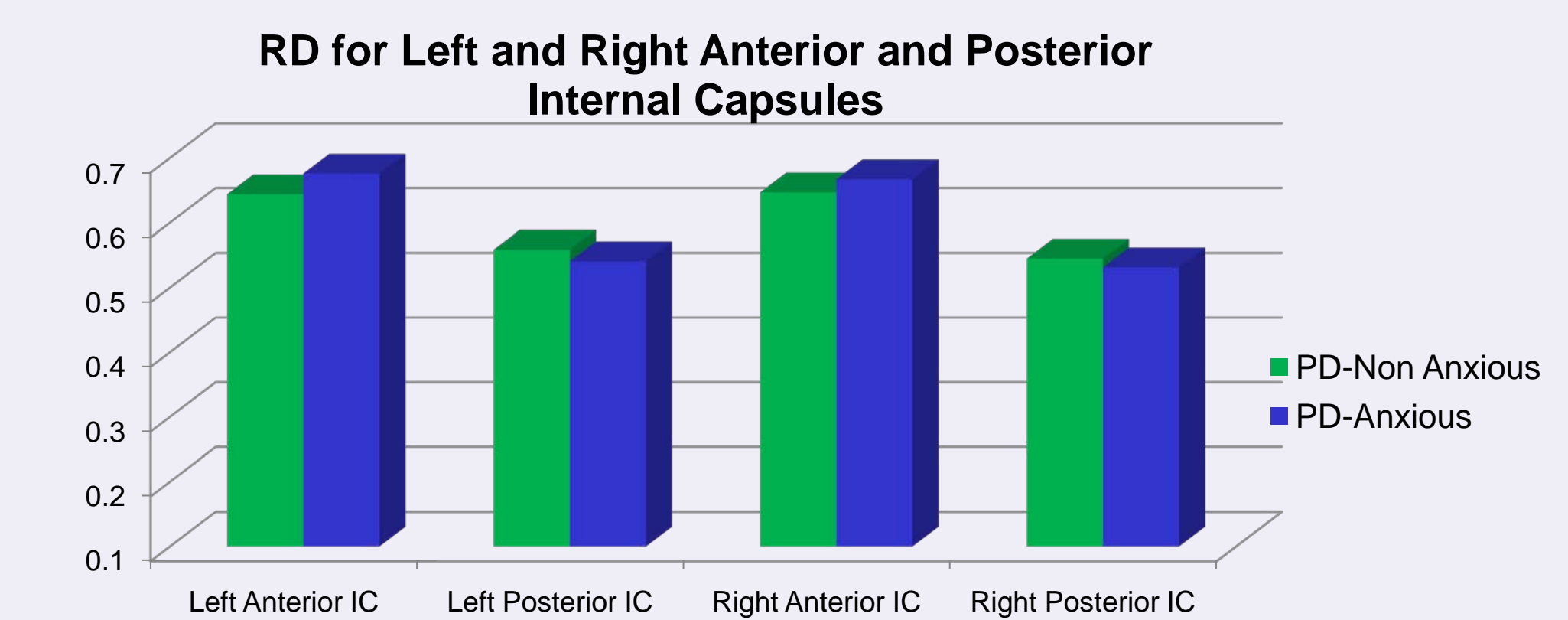
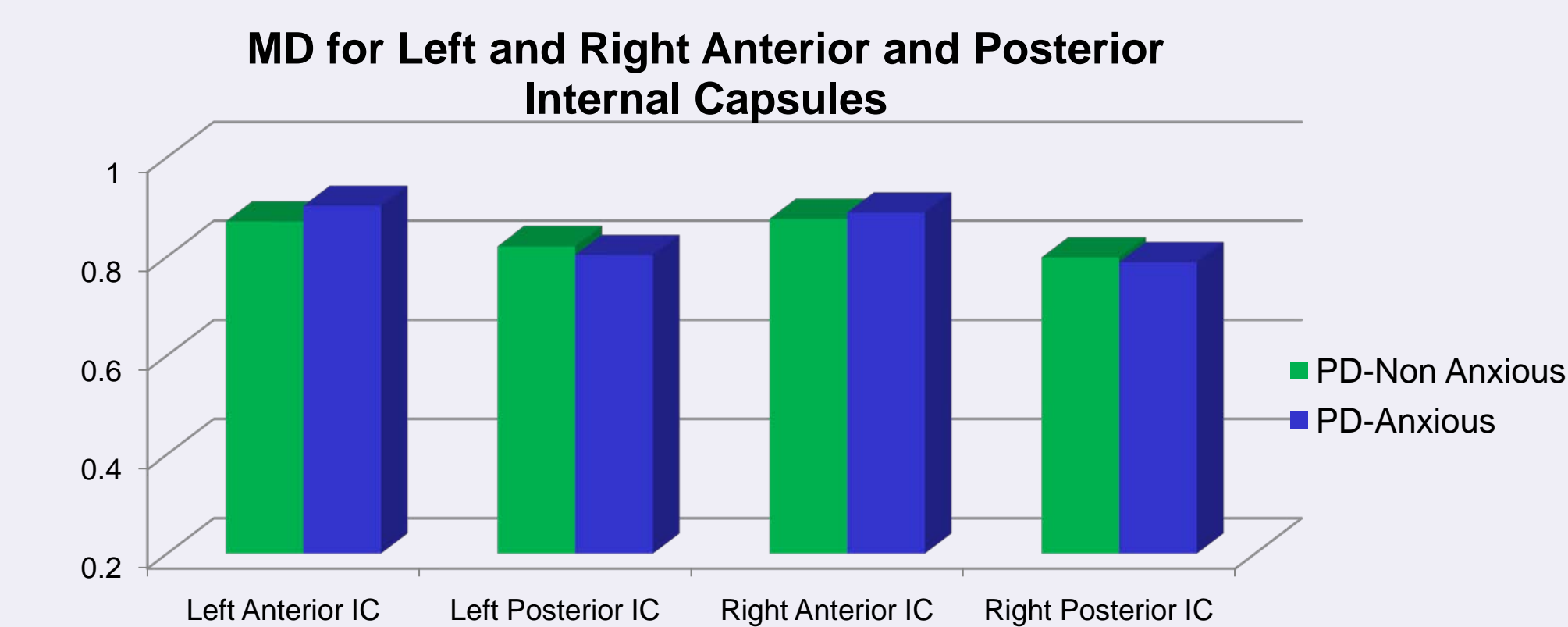


DTI Tractography of Anterior and Posterior Internal Capsules

## RESULTS-Anxiety

	PD-NA (n=13)	PD-Anx (n=13)	P-value
Gender (M/F)	6/2	4/2	0.66
Age	68.8 (7.0)	66.5 (6.6)	0.39
Education	14.8 (1.7)	14.5 (3.0)	0.81
MMSE	28.6 (1.1)	25.8 (3.2)	0.007

- ❖ The groups differed on MMSE score, therefore MMSE scores were entered as a covariate in the analyses.
- ❖ The PD patients with higher trait anxiety scores demonstrated decreased integrity of the left anterior internal capsule (higher MD and RD) compared to the PD patients who were not anxious.



## CONCLUSIONS

- ❖ Changes in the integrity of the white matter tracts for DTI indices connecting the thalamus to the prefrontal cortices were associated with higher depression scores (left and right hemispheres) and higher anxiety scores (left hemisphere) for patients with PD.
- ❖ These findings suggest that interruption of the left and to a lesser degree the right frontostriatal circuitry is related to the neurobehavioral symptoms of PD.
- ❖ Future research will incorporate larger sample sizes with more closely matched groups.