



## A DTI Study of Monozygotic Twins Discordant for Obsessive-Compulsive Symptoms

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### Introduction

Obsessive compulsive disorder (OCD) is characterized by recurrent persistent thoughts and repetitive behaviours. Neuroimaging studies indicated brain changes in OCD patients compared to controls that overall point to a deficit in cortico-striatal-thalamo-cortical circuits. Recent diffusion tensor imaging (DTI) studies find white matter abnormalities generally overlapping with this theory. In OCD patients this might reflect the impact of genetic and environmental risk factors. Genetic and environmental risk factors do not necessarily cause white matter abnormalities in the same brain circuits. To highlight white matter changes linked to OC symptoms (OCS) that are particularly susceptible for environmental factors we applied DTI scans in genetically identical (MZ) twin pairs discordant for OCS.

### Methods

Thirty-two MZ twin pairs extremely discordant for OCS (age range 18-60 yrs) were selected from a group of 815 MZ pairs registered with the Netherlands Twin Register (Boomsma et al., 2002) based on a 12-item version of the Padua OCS Inventory (PI) obtained in 2002. Of this group, 20 pairs took part in the study (Figure 1).

OCS-High: PI-score >16

OCS-Low: PI-score < 7

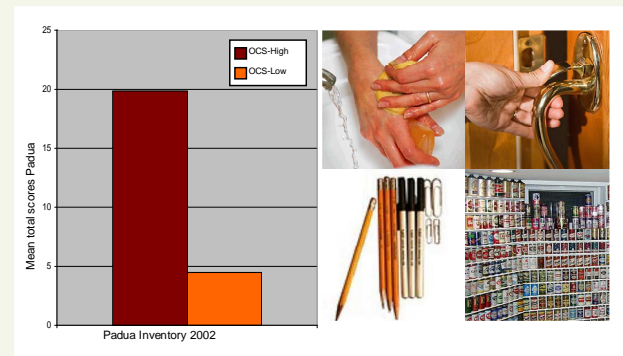


Figure 1. Mean scores on the 12-item PI in discordant twin pairs. Cleaning, checking, ordering, hoarding.

DTI scans were acquired on a Philips 3.0 Tesla Intera MR system. Voxewise comparison, using a paired t-test, was performed to indicate regions of significantly altered fractional anisotropy (FA) in the OCS high-scoring twins compared to their OCS low-scoring co-twins (individual voxel p-value threshold <0.005; clustersize >20 voxels).

### Results

Compared to OCS low-scoring twins, OCS high-scoring twins showed;

#### Increased FA in:

- Left Corpus Callosum, Genu (Figure 2A)
- Left Insula (Figure 2B)

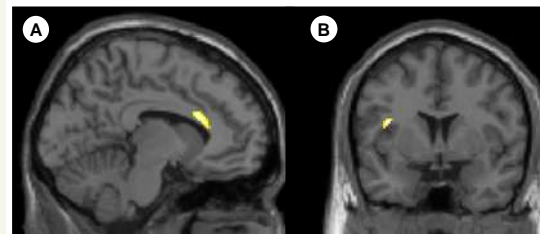


Figure 2. Brain regions showing increased FA in OCS high compared to OCS low-scoring co-twins

#### Decreased FA in:

- Right Temporal lobe (Figure 3C)
- Right Insula (Figure 3C)
- Right Sensory Motor area (Figure 3D)
- Left Occipital lobe (Figure 3E)
- Left Frontal lobe (Figure 3E)

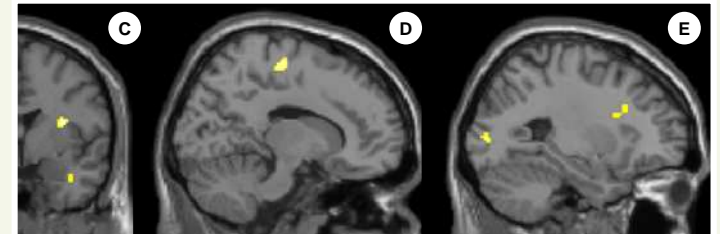


Figure 3. Brain regions showing decreased FA in OCS high compared to OCS low-scoring co-twins

### Conclusions

These results generally overlap with white matter abnormalities reported in previous DTI studies of OCD patients. Increased FA in OCD patients compared to controls in the left anterior Corpus Callosum has been found in a study of Yoo et al., 2007. Furthermore, increased FA in the left Insula and decreased FA in the left Occipital lobe in OCD patients have been reported by Nakamae et al., 2008 and Szeszko et al., 2005

Our findings in the MZ discordant twins suggest that these white matter changes found in OCD patients are caused in part by environmental risk factors acting independently from genetic risk factors.

#### Acknowledgements

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#### References

Boomsma et al., *Twin Research* 2002;5:401-406  
Yoo et al., *Acta Psychiatr Scand* 2007;116:211-219  
Nakamae et al., *Neuro-Psychopharmacology & Biological Psychiatry* 2008;32:1221-1226  
Szeszko et al., *Arch Gen Psychiatry* 2005;62:782-790

