

# ALTERED FUNCTIONAL AND STRUCTURAL CONNECTIVITIES IN PATIENTS WITH MULTIPLE SCLEROSIS: AN FMRI AND MR TRACTOGRAPHY STUDY AT 3 T

E. Pagani<sup>1</sup>, M. A. Rocca<sup>1,2</sup>, P. Valsasina<sup>1</sup>, A. Falini<sup>2,3</sup>, G. Scotti<sup>2,3</sup>, G. Comi<sup>4</sup>, and M. Filippi<sup>1,2</sup>

<sup>1</sup>Neuroimaging Research Unit, Department of Neurology, Scientific Institute and University Ospedale San Raffaele, Milan, Italy, <sup>2</sup>CERMAC, Scientific Institute and University Ospedale San Raffaele, Milan, Italy, <sup>3</sup>Department of Neuroradiology, Scientific Institute and University Ospedale San Raffaele, Milan, Italy, <sup>4</sup>Department of Neurology, Scientific Institute and University Ospedale San Raffaele, Milan, Italy

## Introduction

Using functional magnetic resonance imaging (fMRI), abnormal patterns of movement-associated cortical activations have been demonstrated in patients with multiple sclerosis (MS) (1). Aim of this study was to determine the functional and structural substrates of motor network dysfunction in patients with relapsing-remitting (RR) MS without overt motor impairment, using analysis of functional connectivity and MR tractography.

## Methods

Using a 3 Tesla scanner, dual-echo (DE), diffusion tensor (DT) MRI and fMRI during the performance of a simple motor task with the dominant hand were acquired from 12 right-handed patients with RRMS and 14 matched controls. Using DT MRI tractography probability maps for the corticospinal tract (CST) and the corpus callosum (CC) were constructed from healthy volunteers data and then applied to patients. The left (L) primary sensorimotor cortex (SMC) was selected as the seed region to compute correlation maps with other brain regions, using statistical parametric mapping (SPM2) and dynamic causal modelling.

## Results

Compared to control, MS patients had significantly higher MD and lower FA values in the CC and CST. Compared to controls, MS patients had increased functional connectivity between: the supplementary motor area (SMA) and the right (R) cerebellum ( $p=0.05$ ); the R primary SMC and the R cerebellum ( $p=0.01$ ), and the L inferior frontal gyrus (IFG) and the L primary SMC ( $p=0.004$ ). They also showed reduced connectivity between: the R cerebellum and the L IFG ( $p=0.009$ ), and the L secondary sensorimotor cortex (SII) and the L IFG ( $p=0.01$ ). Strong correlations were found between coefficients of altered connectivity and DT MRI metrics of CC and CST damage.

**Conclusions** In RRMS patients, altered functional connectivity in the motor network is observed. The correlations between measures of abnormal connectivity and DT MRI metrics of CC and CST damage suggests an adaptive role of changes of functional connectivity in limiting the clinical consequences of structural damage.

## References

1. Filippi M, Rocca MA. Cortical reorganisation in patients with MS. *J Neurol Neurosurg Psychiatry* 2004;75:1087-1079.