

THE "MIRROR-NEURON SYSTEM" AND CORTICAL ADAPTATION IN MS: A 3 TESLA fMRI STUDY

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Introduction

The mirror neuron system (MNS) is an observation-execution matching system activated, in humans, during action observation, motor learning and imitation of action (1). In this study, we used functional magnetic resonance imaging (fMRI) to investigate the adaptive properties of the MNS, if present, in limiting the consequences of central nervous system (CNS) damage.

Methods

Using a 3 Tesla scanner, we acquired fMRI in 16 right-handed patients with relapsing-remitting MS (F=13, mean age=35 years, mean disease duration=9 years, median EDSS score=1.5) and 14 controls. Two motor tasks were studied. The first consisted of repetitive flexion-extension of the last four fingers of the right hand (simple task, ST) alternated to epochs of rest, while the second (MNS task), consisted of observation of a movie showing the hand of another subject while performing the same task alternated to epochs of rest. fMRI analysis was performed using SPM2 software.

Results

During the ST, compared to controls, MS patients had more significant activations of the contralateral primary sensorimotor cortex and supplementary motor area. During the MNS task, both groups showed the activation of several visual areas, the intraparietal sulcus (IPS), and the inferior frontal gyrus (IFG), bilaterally. The IFG and the visual areas were significantly more active in patients than controls. The between-group interaction analysis between ST and MNS task showed that in MS patients, the IPS was more active also during the ST.

Conclusions

Functional cortical changes can be detected in MS patients not only when investigating the performance of active tasks (ST), but also during passive ones (MNS), thus indicating the presence of cortical reorganization. This is the first study demonstrating that activation of the MNS can have an adaptive role in limiting the clinical manifestation of widespread CNS damage. The potentialities of this system in facilitating clinical recovery in patients with MS and other neurological conditions deserve further investigations.

References

1. Iacoboni M, Curr. Opin. Neurobiol. 15, 632 (2005).