

## **Manipulation Of The Sensorimotor Loop With A Novel Quantitative fMRI Approach Reveals Motor Networks In Essential Tremor**

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### **Objective:**

Identifying specifically motor related activation patterns in essential tremor by manipulation of the sensorimotor loop to separate motor activity from sensory feedback during functional magnetic resonance imaging (fMRI) applying a haptic wrist manipulator.

### **Background:**

Essential tremor is a high prevalent movement disorder with yet unclear pathophysiology and overlapping clinical features with other tremor disorders. In essential tremor efferent motor activity and afferent sensory activity are intermingled, thereby hampering identification of truly tremor related brain areas (efferent drive) in neuroimaging studies<sup>1</sup>. With help of novel quantitative fMRI approach we manipulate both motor and sensory input to gain insight in the sensorimotor closed loop.

### **Methods:**

Seven essential tremor patients, diagnosed according to the criteria of the Tremor Investigation Group<sup>2</sup>(four men; mean age 66±16) with bilateral postural arm tremor, were studied off medication. Subjects performed a motor task with the right hand using a haptic manipulator during fMRI. Tasks included an active isometric motor task (exerting a static torque to the handle) and a passive movement task (going along with a continuous (multi)sinusoidal perturbations). Results were derived from a conventional block-design with random effects analysis of the group comparing active motor tasks and passive motor conditions, with the tasks and the movement parameters used as regressors (FWE corrected,  $p < 0.05$ ).

### **Results:**

The active motor task versus the passive movement in essential tremor was associated with activation in bilateral cerebellum, bilateral basal ganglia, thalamus, SMA and motor cortex (fig 1). The reversed contrast did not show any activations in motor networks.

### **Conclusions:**

Our preliminary findings show accurate identification of motor network activity including the cerebellum, thalamus, basal ganglia and motor cortex during isometric contraction versus passive movement. By manipulation of the sensorimotor loop with a wrist manipulator we are able to reveal specific motor network activations. This novel quantitative approach is a promising new technique to study pathophysiological mechanisms in hyperkinetic movement disorders, and potentially lead to new diagnostic approaches.

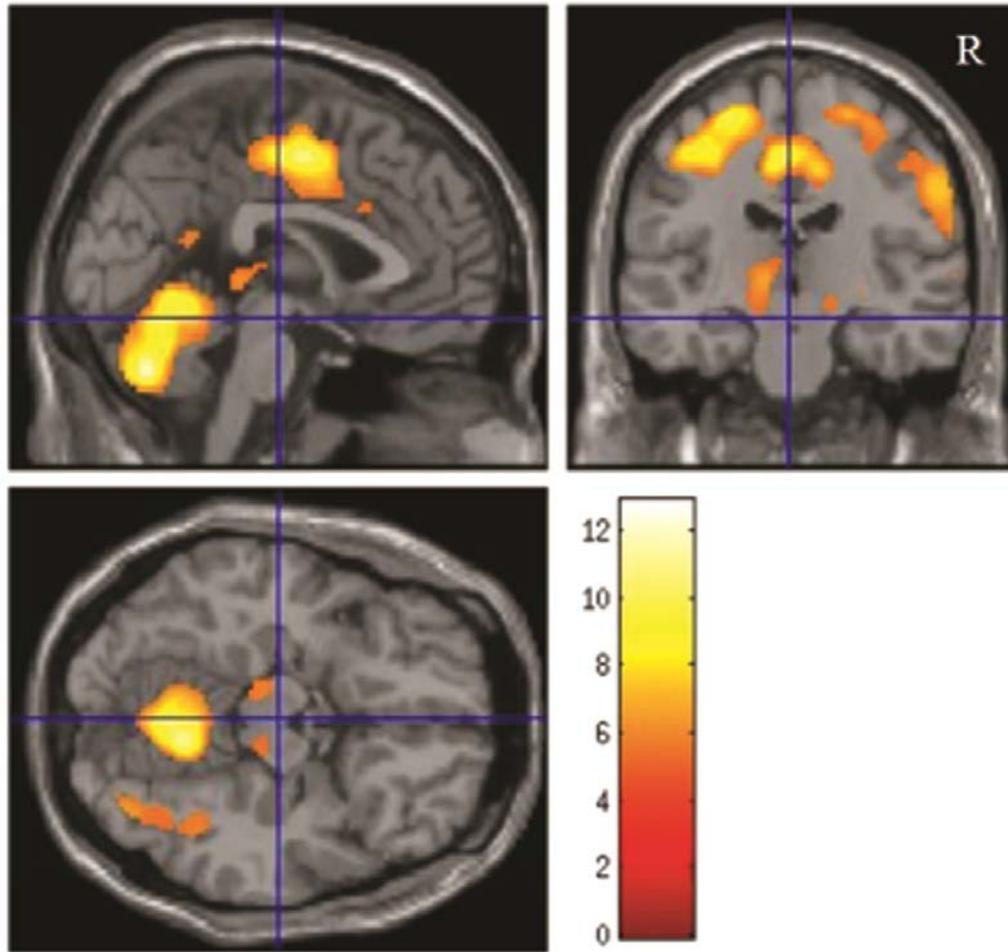


Figure 1 Active motor condition versus passive movement condition that primarily shows accurate motor networks including cerebellum, thalamus, basal ganglia and motor cortex

1. Bucher SF, et al. Ann Neurol. 1997; 41: 32-40. 10.1002.
2. Bain P, et al. Neurology. 2000;54:S7.

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