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FUNCTIONAL BRAIN IMAGING OF SENSORIMOTOR DYSFUNCTION AND RESTORATION

**Investigations of Discomplete Spinal Cord Injury and
Deep Brain Stimulation for Essential Tremor**

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Akademisk avhandling

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Abstract

Sensorimotor dysfunction is the basis of disability in most neurological pathologies. In the current thesis, two conditions with different types and degrees of sensorimotor dysfunction are explored with functional magnetic resonance imaging (fMRI). In part 1, we assess residual sensory connections to the brain in clinically complete spinal cord injury (SCI) with seemingly complete loss of sensorimotor function below the injury level. In part 2, fMRI is combined with deep brain stimulation (DBS) to investigate interventional mechanisms of restoring dysfunctional sensorimotor control in essential tremor (ET).

In part 1 (study I and II), we demonstrate somatosensory cortex activation due to somatosensory (tactile and nociceptive) stimulation on below-level insensate body parts in clinically complete SCI. The results from studies I and II indicate preserved somatosensory conduction across the spinal lesion in some cases of clinically complete SCI, as classified according to international standards. This subgroup is referred to as sensory discomplete SCI, which represents a distinct injury phenotype with an intermediate degree of injury severity between clinically complete and incomplete SCI. In part 2 (study III and IV), DBS was shown to cause modulation in the activity of the sensorimotor cerebello-cerebral regions during motor tasks, but did not modulate the functional connectivity during resting-state.

fMRI is a valuable tool to investigate sensorimotor dysfunction and restoration in SCI and DBS-treated ET. There is evidence for sensory discomplete SCI in about half of the patients with clinically complete SCI. DBS modulates DBS modulation of the activity in the sensorimotor cerebello-cerebral circuit during motor tasks, but not during resting-state, is action-dependent.

Keywords

Sensorimotor control, fMRI, discomplete spinal cord injury, essential tremor, deep brain stimulation, cerebello-thalamo-cerebral circuit

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