

Cortical activation during voluntary and non-voluntary associated contractions

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During high effort contractions (maximal voluntary contractions) or during long-lasting contractions at sub-maximal level, muscles other than the target muscles also are activated. Often even muscles at the contralateral side become active. This activity is non-voluntary and most subjects are not aware of activating these muscles. We would like to suggest the term contralateral associated contractions (CAC) for this non-voluntary activation. The origin of the CAC activation is not yet known. From a theoretical point of view CAC activity could originate from: 1) the contralateral motor areas, 2) the ipsilateral motor areas and/or 3) from neuronal circuits at spinal levels. Pilot-experiments performed with transcranial magnetic stimulation suggested that the CAC activity originated in the motor cortex contralateral to the CAC producing muscle.

In the present experiments the origin of the CAC activity will be analysed with the use of fMRI.

Subjects were asked to perform voluntary contractions of the index finger while recording EMG and force of both hands, and simultaneously measuring brain activity in a 3-Tesla MRI machine. The subjects were asked to produce a maximal voluntary contraction. During this contraction the CAC-force and EMG of various lower arm and hand muscles were measured. In the next trial the amount of CAC-force was given as a target level for a voluntary contraction. The amount of brain activity in the contralateral and ipsilateral motor areas are being measured and compared between the CAC-activation and the voluntary submaximal contraction at comparable force levels. At the moment we are collecting the fMRI data. It is our hypothesis that the CAC activity originates in motor areas contralateral to the CAC muscle.

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