Oscillating central motor networks in pathological tremors and voluntary movements. What makes the difference?


Source

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Abstract

Parkinsonian tremor (PD), essential tremor (ET) and voluntarily mimicked tremor represent fundamentally different motor phenomena; yet, magnetoencephalographic and imaging data suggest their origin in the same motor centers of the brain. Using EEG-EMG coherence and coherent source analysis we found a different pattern of corticomuscular delays, time courses and central representations for the basic and double tremor frequencies typical for PD suggesting a wider range defective oscillatory activity. For the basic tremor frequency similar central representations in primary sensorimotor, prefrontal/premotor and diencephalic (e.g. thalamic) areas were reproduced for all three tremors. But renormalized partial directed coherence of the spatially filtered (source) signals revealed a mainly unidirectional flow of information from the diencephalon to cortex in voluntary tremor, e.g. a thalamocortical relay, as opposed to a bidirectional subcortico-cortical flow in PD and ET promoting uncontrollable, e.g. thalamocortical, loop oscillations. Our results help to understand why pathological tremors although originating from the physiological motor network are not under voluntary control and they may contribute to the solution of the puzzle why high frequency thalamic stimulation has a selective effect on pathological tremor leaving voluntary movement performance almost unaltered.

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