Effects of low-frequency repetitive transcranial magnetic stimulation over the premotor cortex in Focal Hand Dystonia: an rTMS and EMG study.

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Introduction

Focal hand dystonia (FHD) is a task-specific form of focal dystonia (Sheehy and Marsden, 1982), resulting from abnormal neuroplasticity, associated with deficient cortical inhibition. A series of studies suggest that inhibitory low-frequency repetitive Transcranial Magnetic Stimulation (rTMS) over contralateral premotor cortex (PMC) might ameliorate FHD (Kimberley et al., 2013). To our knowledge, no studies have used multi-channel electromyography (EMG) to investigate the effects of rTMS on FHD, although a previous study (Sivadasan et al., 2013) recommended multi-channel surface EMG to assess FHD. The aim of present study was to explore behavioral and muscle activity outcomes, following a single session (acute effects) and multiple sessions (cumulative effects) of rTMS in a patient with FHD.

Material and methods

The patient's behavior was assessed on handwriting tasks (signature and words copy).

Surface EMG signals were recorded during tasks execution from eight upper limb muscles: first dorsal interosseous (FDI), extensor carpi ulnaris (EUC), extensor carpi radialis (ERC), flexor carpi radialis (FC), biceps brachii (BB), triceps brachii (TB), medial deltoid (AD), upper trapezius (UT). The EMG signals were amplified (EMG-USB, OT Bioelettronica, Torino, Italy), sampled at 2048 Hz, bandpass filtered (20–450 Hz), and converted to digital data by a 12-bit A/D converter.
RTMS was performed using a 70 mm figure-of-eight coil and the MagStim Super Rapid stimulator (Magstim Company Ltd., Whitland, UK).

In **Experiment 1** (acute effects) evaluations were performed before and after one session of 1Hz rTMS (900 stimuli, 90% of resting Motor Threshold) applied over left PMC and before and after sham stimulation.

In **Experiment 2** (cumulative effects), the evaluations were performed before and after six sessions of 1 Hz rTMS over left PMC, administered every other day, for two weeks. A follow-up (FU) evaluation was performed two weeks after the last stimulation.

Discussion and Conclusion

These results suggest that rTMS might represent a useful tool for the treatment of FHD symptoms, since it improved the patient's performance and decreased excessive muscle activity during handwriting.
They also show that a single session of rTMS ameliorated the patient's performance, but multiple sessions were necessary to reduce muscles activity, likely reflecting neuroplastic changes.

Future double-blind placebo-controlled studies on large groups of patients are needed to further explore the effects of rTMS treatment on FHD symptoms and muscle activity, and provide new insights into optimal therapeutic protocols for patients with FHD.

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Results

In **Experiment 1:** active, but not sham, rTMS improved considerably the patient's performance, reducing the tasks execution time by 80% in signature (rTMS: pre=25 seconds, post=5s; Sham pre=24s, post=21s) and by 37% in words coping (rTMS: pre=19s, post=12s; Sham: pre=24s, post=21s). However, the EMG amplitude did not change.

In **Experiment 2:** the patient showed a moderate improvement of performance along with a decrease of 20% in the EMG amplitude. Indeed, the patient showed a moderate improvement of performance reducing the tasks execution time by 33% in signature (pre=18s, post=12s, FU=15s) and by 23% in words coping (pre=22s, post=17s, FU=14s).

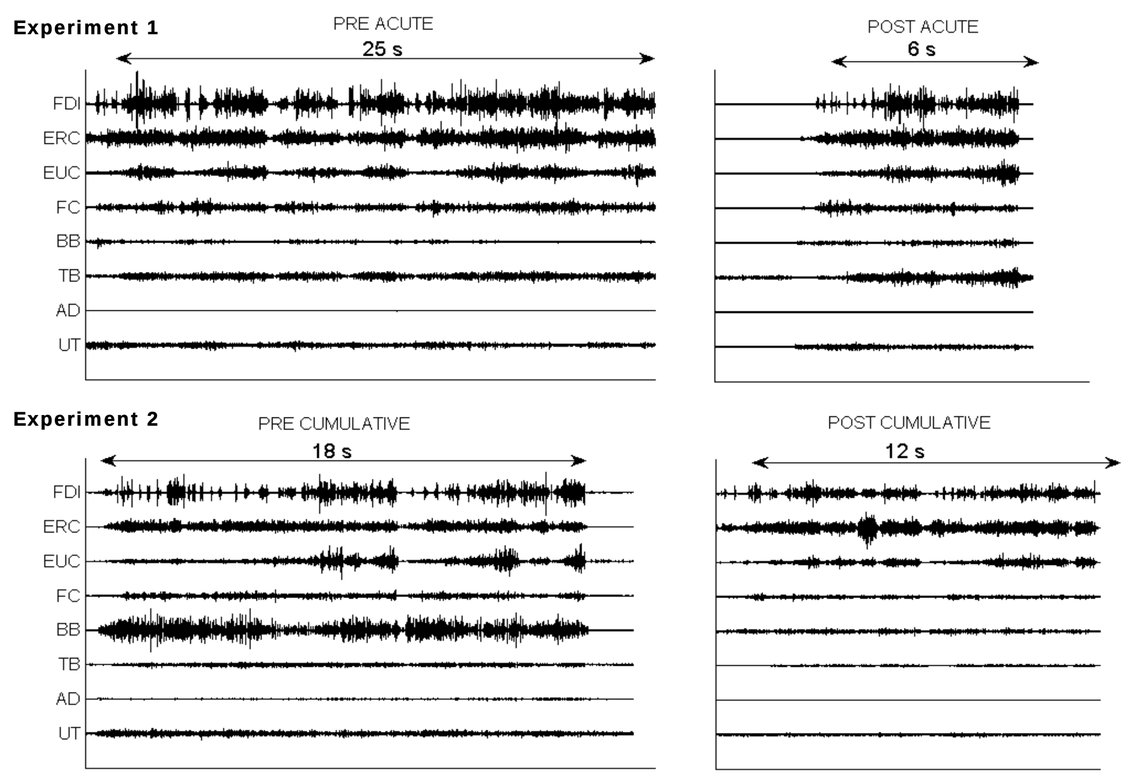

Figure 1. The figure shows the raw EMG signals in the experiment 1 (upper line) and experiment 2 (bottom line).

References

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