Therapeutic Use of High-Frequency Repetitive Transcranial Magnetic Stimulation in Stroke

To the Editor:

We read with great interest the article published by Kim et al on repetitive transcranial magnetic stimulation (rTMS)–induced corticomotor excitability and associated motor skill acquisition in chronic stroke.1 The authors used high-frequency (10 Hz) rTMS over the primary motor cortex contralateral to the paretic hand in patients with chronic subcortical stroke and reported an immediate enhancement of excitability associated with an improvement in motor skill of the paretic hand.

The induced enhancement of corticomotor excitability and the related improvement in performance open new and fascinating possibilities for future rehabilitation strategies. Despite our genuine enthusiasm for this kind of initiative, we feel that the effects of high-frequency rTMS still have to be firmly established and better understood, before it is proposed for widespread clinical use.

First, the effect of rTMS is dependent on the frequency, intensity, intervals and duration of stimulation. At high frequency (>1 Hz), the effects on corticomotor excitability are highly variable across subjects.2 Some healthy subjects even do not show any significant enhancement of corticospinal excitability after 10 Hz stimulation (although admittedly with other parameters of stimulation than those used by Kim et al).3 An even greater variability is to be expected in disease. This implies that in the context of the rehabilitation of stroke patients, the stimulation protocol will probably have to be tailored to each individual case.

Second, high-frequency rTMS may worsen motor skill in healthy volunteers.4 We used in healthy volunteers high-frequency (20 Hz) rTMS with an intensity of 90% of resting motor threshold, during 20 minutes with trains of stimulation of 2 seconds and intertrain intervals of 28 seconds. Immediately after rTMS, subjects had a significantly lower performance on a finger-tapping task than controls (without rTMS).

Third, rTMS effects may be temporary and unrelated to the motor performance eventually achieved in the long term. In our case, the detrimental effect of high-frequency rTMS was transient and the performance was similar 2 days later whether or not subjects had previously received rTMS. In patients, multiple sessions of rTMS5,6 would probably have to be performed to promote cortical plasticity and to induce a long-lasting functional recovery after stroke.

Fourth, there are so far no safety guidelines for the use of rTMS in pathological conditions. For safety and methodological reasons, the authors restricted their study to subcortical stroke patients. Nevertheless, because of a higher motor threshold,1,7 these patients required a higher intensity of stimulation to enhance corticomotor excitability. This increases the risk of seizures and rTMS can become painful.

Finally, low-frequency rTMS, which is typically better tolerated and safer, has also been shown to improve motor performance of the paretic hand when applied on the unaffected hemisphere.6,8,9 The respective risks and benefits of low- and high-frequency rTMS should be further specified.

Disclosures

None.

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