"Investigating the Reliability of a Double-Coil TMS Method to Assess Corticospinal Excitability Bilaterally"

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Introduction

During the last two decades, studies have used Transcranial Magnetic Stimulation (TMS) to monitor corticospinal excitability (CSE) changes in various conditions. Traditionally, single-coil TMS is applied over one primary motor cortex (M1), eliciting motor-evoked potentials (MEPs) in the contralateral hand or limb muscle. However, in many studies, such as those focusing on CSE changes during action preparation, it would be useful to obtain MEPs in both hands at once.

The present results suggest that double-coil TMS is a reliable method to assess CSE bilaterally both at rest and during motor preparation.

Methods

Experiment 1

32 subjects were tested (16 women; 22.3 ± 1.9 years old).

TMS was delivered through a single-coil or two double-coil TMS small figure-of-eight coils (inner diameter = 35 mm), eliciting MEPs in the first dorsal interosseous (FDI) muscle.

MEPs were obtained at 5 different intensities of stimulation in separate blocks (TMSINTENSITY = 100%, 115%, 130%, 145% or 160% of the resting motor threshold (rMT)).

In half of the trials, single-coil TMS was used, eliciting MEPs in a single hand (MEPsingle); pulses were delivered through the coil positioned on the left or right M1, eliciting right or left hand MEPsingle in a balanced proportion.

In the other half, MEPs were elicited in both hands at once using a double-coil TMS method (MEPdouble) where the two M1 were stimulated with a 1 ms inter-pulse interval. MEPdouble could either result from a first (MEPdouble-1) or second (MEPdouble-2) pulse.

MEPs were obtained at 5 different intensities of stimulation in separate blocks (TMSINTENSITY = 100%, 115%, 130%, 145% or 160% of the resting motor threshold (rMT)).

24 MEPs were obtained for each TMS condition.

Results

In Experiment 1, increasing TMSINTENSITY by 15% always resulted in larger MEP amplitudes at rest.

In Experiment 2, MEP amplitudes were reduced at TMSdelay when compared to TMSbaseline, regardless of whether they were elicited in a hand that was selected or non-selected for the forthcoming response.

In both experiments, MEPs obtained using double-coil TMS were comparable to those elicited using the standard single-coil technique.

Conclusion

The present results suggest that double-coil TMS is a reliable method to assess CSE bilaterally both at rest and during motor preparation.

Such a technique will allow researchers to acquire twice the amount of data in a single trial and to observe state-related CSE changes for two hands or limb muscles at the same time.