Paired Pulse TMS and the Likelihood Of Eliciting Motor Evoked Potentials
Ethan Kizziar, Dr. Ian Greenhouse: Action Control Laboratory, University of Oregon

Introduction

Transcranial Magnetic Stimulation (TMS) uses electromagnetic induction to non-invasively stimulate the brain. TMS to primary motor cortex above a threshold intensity can elicit muscle twitches, called motor evoked potentials (MEPs), in targeted muscles.

A conditioning subthreshold TMS pulse delivered 3 ms before a suprathreshold TMS pulse can influence the size of the MEP (Kujirai, 1993). This project used a non-traditional paired-pulse TMS protocol to study the effects of two subthreshold pulses on the size and likelihood of MEPs. Previous studies showed subthreshold paired TMS pulses can influence MEPs (Du, 2014). Here, we examined whether paired subthreshold pulses increase the likelihood of MEPs.

Methods

- 7 healthy subjects (4 male 25.5yrs+/−3.7yr, AMT=41+/−9.62), (3 female 20.3+/−1.2 years, AMT=45+/−5) were tested.

- Surface electromyography (EMG) was recorded from the left first dorsal interosseous (FDI) and C7 on the neck. A ground electrode was also placed on the wrist above the head of the ulna.

- TMS was administered at five different intensities relative to the subject’s active motor threshold (AMT), the threshold needed to elicit MEPs consistently 50% of the time while maintaining a tonic contraction.

- The conditioning pulse was randomly administered at 50%, 65%, 80%, 95%, 110% AMT and separated by 3ms from the test pulse at 115% AMT.

Discussion

Figure 1A shows MEP amplitudes vs. conditioning pulse intensity by subject. Figure 1B is the mean across subjects. A one-way repeated measures ANOVA revealed a significant effect of conditioning pulse intensity on MEP Amplitude, \( F(4, 27) = 4.81, p = .005 \). Post hoc Tukey tests revealed that 110% conditioning pulse (M = 0.37mV, SD = 0.27) had significantly larger MEP amplitudes than the 4 other lower intensities. ** = p < .01

**MEP Likelihood Increases At Higher Conditioning Pulse Intensities**

Figure 2A shows number of accepted MEPs vs. conditioning pulse intensity per subject. Figure 2B is the mean across subjects. A one-way repeated measures ANOVA revealed a significant effect of conditioning pulse intensity on likelihood of MEPs as well, \( F(4, 30) = 6.89, p < .001 \). Post hoc Tukey tests revealed that 110% intensity (M = 17.42, SD = 2.07) had significantly more MEPs than the 4 other levels. *** = p < .001

Example Electromyography Data

**Small MEP at 65% Intensity**

**Large MEP at 110% Intensity**

References
