Effect of Hand and Lip Contraction on Motor-Evoked Potentials of the First Dorsal Interosseous Muscle

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Introduction

Lip and Hand Movement Connection
Previous studies have suggested that evolutionarily, there is a connection between brain regions that control lip and tongue movements and those that manipulate hand movements [1]. In this study, we used transcranial magnetic stimulation (TMS), a form of non-invasive brain stimulation, to examine the relationship between the lip and hand motor regions in the brain.

Active vs. Resting MEPs
Studies have shown that cortical excitability increases during active muscle contraction [2]. This is evident from increases in MEPs during muscle contraction (active MEPs) compared to MEPs of a relaxed muscle (resting MEPs). We hypothesized that the contraction of both the lip and hand muscles will impact the amplitude of the MEPs generated in the hand.

Research Question

Does contraction of the lip muscle influence the peak-to-peak amplitude of motor-evoked potentials (MEPs) generated through external stimulation of the first dorsal interosseous (FDI) muscle?

Methodology

- For this study, we had a total of 4 healthy adults.
- Electrodes placed on the subject’s first dorsal interosseous muscle
- TMS coil placed at C3 electrode and location and intensity were adjusted until the “hot spot” was found
- The following tasks performed in randomized order:

  Tasks
  1. Finger and Lip Relaxation (FRLR)
  2. Finger Relaxation and Lip Contraction (FRLC)
  3. Finger Contraction and Lip Relaxation (FCLR)
  4. Finger and Lip Contraction (FCLC)

  - For each task, pulses were applied in intensities from 50%-90% and then 90%-50%, both in increments of 10% with 5 repetitions at each intensity
  - The MEP peak to peak amplitude was compared between tasks, subjects, and intensity variations

Results

- Finger and Lip Relaxation (FRLR)
- Finger Relaxation and Lip Contraction (FRLC)
- Finger Contraction and Lip Relaxation (FCLR)
- Finger and Lip Contraction (FCLC)

Fig. 1. Cerebral Cortex
Fig. 2. TMS Machine
Fig. 3. EMG electrode placement for FDI muscle
Fig. 4. Electrode cap locations highlighting C3 electrode

Conclusion and Future Work

Currently, this study is ongoing. Our preliminary results indicate that lip contraction may increase resting MEPs of the hand muscle but does not influence the active MEPs of the hand muscle. Future work includes observing the effect of hand muscle activation on lip MEPs and observing the spread of hand and lip activation over the cortex at various intensities.

References: