Exploring the effect of TMS over primary motor cortex during Eye-Hand coordination

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The ability to track a moving target with the eye is substantially improved when the target is self-moved as compared to when it is moved by an external agent. To account for this result, previous literature has proposed that the oculomotor system has access to an estimate of the current hand position by means of a forward model that receives the arm efferent copy. However, direct neurophysiological evidence for this scheme is still lacking. The goal of the current study was to investigate the effect of TMS over the hand area of the primary motor cortex (M1) during a eye-hand coordination task. Subjects were asked to track with their eyes a visual target whose motion was driven by their grip force. When TMS was applied over M1 hand area, involuntary grip force pulse led to transient target jumps. We reasoned that if the output of M1 is used by the oculomotor system to keep track of the target, TMS on top of disturbing grip force, should also disrupt eye tracking performance. For comparison purposes, eye tracking was also monitored when these (perturbed) target trajectories were played back, as well as when TMS was applied while tracking an externally-moved target. Our preliminary data (4 subjects) suggest that eye tracking performance is poorly influenced by TMS over M1. First, we found no obvious effect of TMS on eye motion when tracking an externally-moved target. Second, during the self-moving task eye tracking performance within 200ms following TMS was similar to what was observed when playing back the same target trajectories. Overall the results of this TMS study suggests that the output of M1 has a limited contribution into Eye-Hand coordination.

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