Contrasting effects of anodal and cathodal high-definition TDCS on proprioceptive responses in sensorimotor cortex, measured with MEG during voluntary finger movements.

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Protocols for noninvasive brain such changes generalize to other cortical regions beyond motor cortex, and how such protocols might be expected to modulate stimulation (NIBS) are generally categorized as “excitatory” or “inhibitory” based on their ability to produce short-term modulation of motor-evoked potentials (MEPs) in peripheral muscles when applied to motor cortex. It is as yet poorly understood whether neural signals generated during task performance, at rest, or in response to sensory stimulation. To characterize such changes, we measured spontaneous and movement-related neural activity with magnetoencephalography (MEG) before and after high-definition transcranial direct-current stimulation (HD-TDCS) of the left motor cortex (M1), while participants performed simple finger movements with the left and right hands. Anodal HD-TDCS (aTDCS), thought to be excitatory, decreased the movement-related cortical fields (MRCF) localized to left M1 during contralateral right finger movements while cathodal HD-TDCS (cTDCS), thought to be inhibitory, increased them. In contrast, oscillatory signatures of voluntary motor output were not differentially affected by the two stimulation protocols, and tended to decrease in magnitude over the course of the experiment regardless. Spontaneous resting state oscillations were not affected either. Because MRCFs are thought to reflect reafferent proprioceptive input to motor cortex following movements, these results suggest that processing of incoming sensory information may be affected by TDCS in a polarity-dependent manner that is opposite that seen for MEPs – increases in cortical excitability as defined by MEPs may correspond to reduced responses to afferent input, and vice-versa.