High-definition transcranial direct current stimulation (HD-tDCS) over the primary somatosensory cortex exerts a differential effect on nociceptive and non-nociceptive inputs processing

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Background and aims. The role of the primary somatosensory cortex (S1) in vibrotaction is well established. In contrast, its involvement in nociception remains debated. Here, we test the involvement of S1 in the processing of nociceptive and non-nociceptive somatosensory inputs by comparing, within-subjects, the after-effect of high-definition transcranial direct current stimulation (HD-tDCS) of S1 on the perception and event-related potentials (ERPs) elicited by nociceptive and non-nociceptive stimuli delivered to the ipsilateral and contralateral hand.
Methods. HD-tDCS was delivered using a cathode electrode over C3 or C4, surrounded by four anode electrodes positioned 5 cm from the cathode (20 minutes; 1 mA). Nociceptive (laser heat pulses) and non-nociceptive (short-lasting mechanical vibration and transcutaneous electrical stimulation of the median nerve) were delivered to the ipsilateral and contralateral hand, immediately before and after HD-tDCS.
Results. After applying HD-tDCS, pain perception decreased similarly in both hands. The N240 wave of nociceptive ERPs followed the same symmetric trend. The percept elicited by vibrotactile stimuli remained unchanged. However, as compared to the ipsilateral hand, the N120 of vibrotactile ERPs and the N20 elicited by median nerve stimulation of the contralateral hand were significantly reduced.
Conclusion. HD-tDCS over S1 exerts a differential effect on brain responses elicited by nociceptive and non-nociceptive somatosensory stimuli. The responses to nociceptive stimuli delivered to ipsilateral and contralateral hands decreased symmetrically. In contrast, there was an asymmetric reduction of the responses to non-nociceptive stimulation of the contralateral hand. This demonstrates a differential involvement of S1 in the processing of nociceptive and non-nociceptive inputs.