Transcutaneous supraorbital nerve stimulation enhances somatosensory thalamic activity in migraine between attacks: a central mechanism of clinical efficacy?

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BACKGROUND

- In a recent randomized double-blind sham-controlled study the Cefaly®, a novel transcutaneous supraorbital electrostimulation device, has been successfully used as a prophylactic treatment for episodic migraine (Schoenen et al., 2013).
- The possible mechanisms of action through which the device is able to induce clinical improvement in migraine are not known.
- In the present study, we investigated whether Cefaly® may act centrally at the thalamocortical/cortical level.

DESIGN & METHODS

- To explore the central mechanisms of action of Cefaly®, we have recorded the somatosensory evoked potentials (SSEPs) before, and twice (intersession interval of 5 minutes) after one session of supraorbital stimulation lasting 20min in 10 migraine without aura patients between attacks.
- We measured the N20-P25 amplitudes on the low-frequency-SSEP, and, after applying a band-pass filter (450-750 Hz), maximal peak-to-peak amplitudes of the *pre-synaptic*, reflecting thalamocortical activity, and *post-synaptic*, reflecting primary cortical activation, high-frequency oscillations (HFOs) (Coppola et al., 2005).

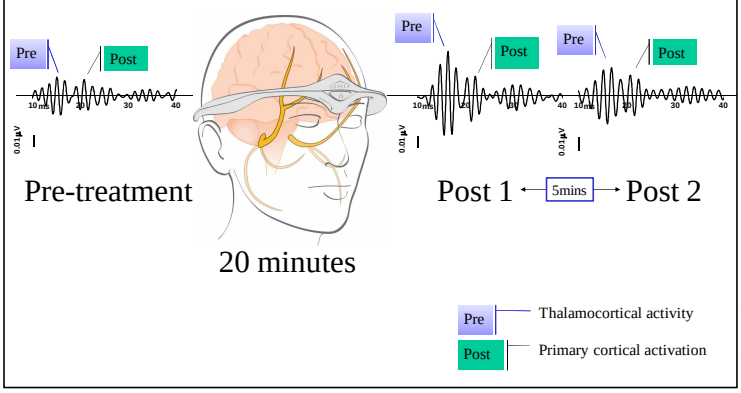
RESULTS

- Pre-synaptic HFO amplitudes, reflecting somatosensory thalamocortical activity, significantly increased immediately after the end of the supraorbital stimulation with Cefaly® (from 0.035 μV to 0.058 μV, $p<0.01$), but recovered to the pre-stimulation values as early as 5 minutes later. Both the low-frequency N20-P25 SSEP component and post-synaptic HFOs were unaffected by Cefaly ®.

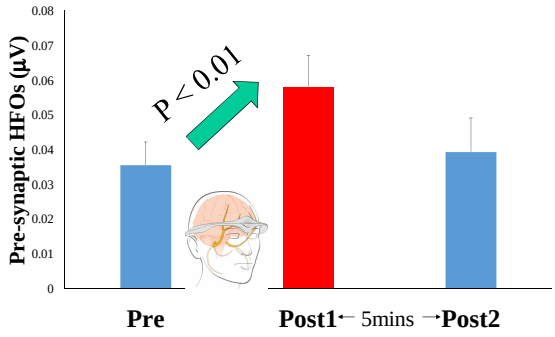
DISCUSSION

- Present data might support the hypothesis that Cefaly® acts centrally through increased thalamocortical activity induced by the neurostimulation.
- It is of obvious interest to verify whether these device-induced changes might persist at long-term after 3-month daily preventive stimulation, and if they follow clinical improvement.

Procedure

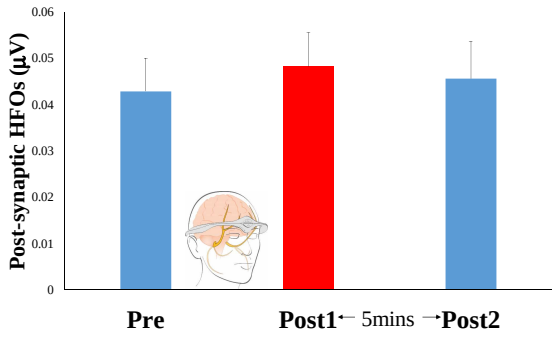


Pre-synaptic HFOs



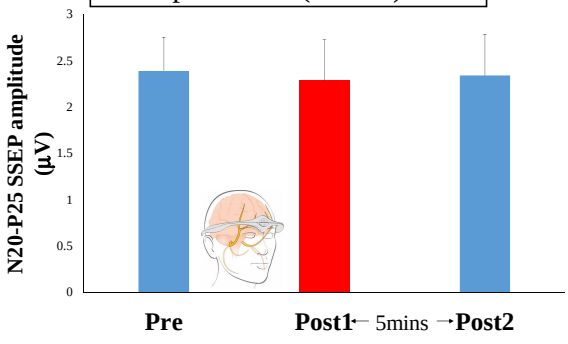
Pre-synaptic HFO amplitudes, reflecting somatosensory *thalamocortical activity*, significantly increased after the supraorbital stimulation with Cefaly®.

Post-synaptic HFOs



Post-synaptic HFOs, reflecting *primary cortical activation*, were unaffected by 20 min supraorbital stimulation with Cefaly®.

Somatosensory evoked potentials (SSEPs)



Low-frequency N20-P25 SSEP amplitude were unaffected by 20 min supraorbital stimulation with Cefaly®.

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