

Altered cortical inhibition after sleep restriction in interictal migraine, a blinded longitudinal study of cortical silent period

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Objective

There is a well-known, but unexplained association between sleep and migraine. Changes in sleep affects cortical excitatory/inhibitory balance which is also known to be altered in migraine. To investigate this relationship, we measured Cortical Silent Period (CSP) induced by Transcranial Magnetic Stimulation (TMS) after normal and reduced sleep. CSP is a measure of GABA mediated intracortical inhibition.

Methods

We examined 47 migraine patients with at least one interictal recording and 30 controls. Participants were randomized for order of sleep conditions. Examinations and data analyses were performed by an investigator blinded for diagnosis and sleep.

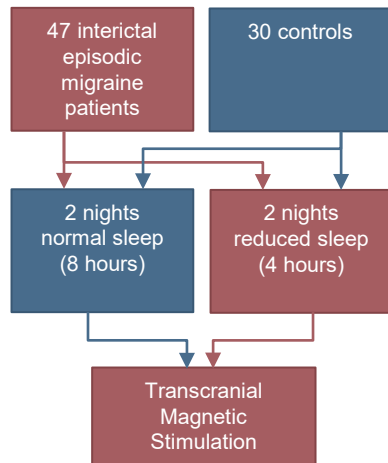


Figure 1: Flow chart of patient examinations. Both groups were randomized for order of sleep conditions before examination with Transcranial Magnetic Stimulation.

CSP was recorded from the Abductor Pollicis Brevis (APB) muscle during approximately 50% of maximum muscle force with TMS intensity of 120% of the resting motor threshold.

Results

The duration of the CSP decreased in migraine patients after sleep restriction compared to controls. This was observed as a statistical trend for the interaction between sleep condition and diagnosis (95% CI -24.0, 0.4; $p = 0.058$), and also as a significant interaction between achieved sleep and diagnosis ($p=0.034$). Interictal migraine patients had an opposite pattern compared to controls.

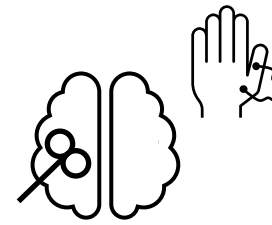


Figure 2: Transcranial Magnetic Stimulation of contralateral motor cortex while recording Electromyography from Abductor Pollicis Brevis.

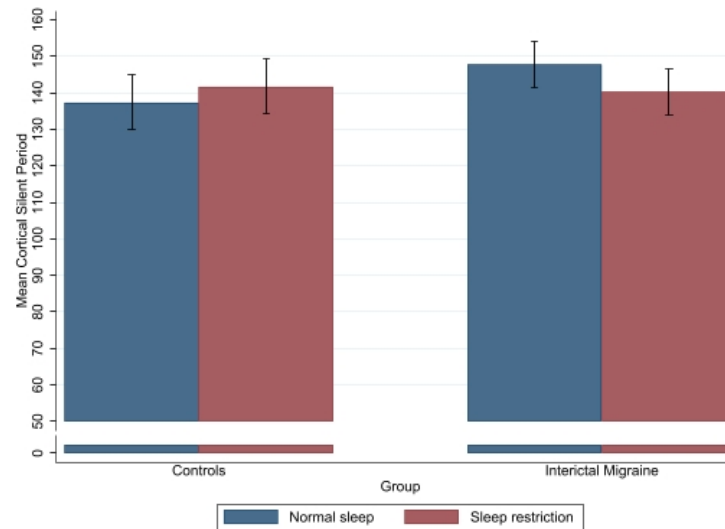


Figure 3: Estimated marginal means of Cortical Silent Period (ms) for controls and interictal migraine patients after two nights of normal sleep (8 hours) and sleep restriction (4 hours). Standard error bars.

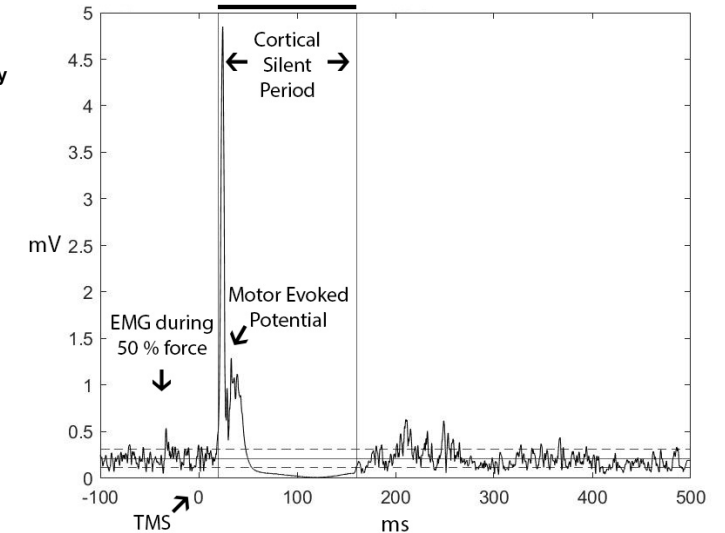


Figure 4: Single patient average rectified Electromyography (EMG) from Abductor Pollicis Brevis followed by the Motor Evoked Potential after Transcranial Magnetic Stimulation (TMS) of contralateral motor cortex (0 ms) and the Cortical Silent Period.

Conclusion

These findings suggest that migraine patients may have a dysregulation of GABA mediated intracortical inhibition after sleep restriction, possibly driven via dopaminergic mechanisms. Although speculative, it has been shown that dopamine can regulate the duration of CSP, and that dopamine metabolism is also altered after sleep deprivation in healthy subjects.