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0078 Influence of Light on Brain Activity Upon Waking From Slow Wave Sleep

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starting at ZT4. Each mouse was recorded for three days to establish baseline sleep calcium activity with at least two days between sessions. During sleep deprivation sessions, an experimenter sleep deprived each mouse starting at ZT0 for six hours by gently brushing the animal with a small paintbrush to maintain wakefulness and minimize the stress to the animal.

Results: During baseline sleep recordings, GABAergic$^{POA\ ->TMN}$ projection neurons are most active during sleep (NREM and REM) which is maintained until wake onset. As sleep pressure increases, GABAergic$^{POA\ ->TMN}$ projection neurons display gradual increase in neural activity compared to time-matched points during baseline sleep recordings. Once mice were permitted to enter sleep rebound, GABAergic$^{POA\ ->TMN}$ projection neurons gradually displayed decreased activity as sleep pressure eased.

Conclusion: GABAergic$^{POA\ ->TMN}$ projection neurons show a strong increase in activity to drive homeostatic sleep need during periods of increased sleep pressure but subside once this pressure is reduced.

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OBJECTIVE SLEEP AND NEURAL RESPONSE TO THERMAL PAIN TESTING FOLLOWING COGNITIVE BEHAVIORAL TREATMENT IN PATIENTS WITH COMORBID INSOMNIA AND FIBROMYALGIA: A PILOT STUDY

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Introduction: Fibromyalgia (FM) is characterized by high rates of insomnia and abnormal central pain processing/heightened response to stimuli (i.e., central sensitization). This study examines whether cognitive behavioral treatments (CBTs) that target insomnia and pain improve central pain processing [indicated by decreased response to quantitative sensory testing (QST) using thermal stimuli] in patients with fibromyalgia and insomnia.

Methods: Before and after CBT-I, CBT-P or waitlist, adults (N=32, M_{age}=55.9, SD=12.2) with FM and insomnia completed QST during *f*MRI (Phillips Achieva 3T scanner), 14-daily pain ratings [least(0)-most(100) intense pain imaginable] and 1-night in-home polysomnography (AURA/Grass Technologies). Imaging data were processed using Brain Voyager (Brain Innovation/Netherlands). Random effects ANCOVA identified regions with significant group (3-CBT-I, CBT-P, waitlist) by time (baseline, post-treatment) interactions in brain hemodynamic response to QST. Linear regressions (using residualized change scores) were conducted for each significant region to examine how pain and sleep changes (%Stages 1–3 NREM, %REM) were related to brain response changes.

Results: Eleven regions exhibited significant interactions (ps&lt.00; large effects; right hemisphere: inferior frontal, superior temporal, mid-occipital, and cingulate gyri, lentiform nucleus; left hemisphere: angular, superior temporal, mid-frontal, inferior occipital, mid-temporal, and inferior frontal gyri). CBT-I decreased brain response to QST in 8 regions and CBT-P in 3 regions (CBT-I effects&gtCBT-P). Waitlist increased response in 6 regions. Pain ratings, %Stage 2 and %REM sleep were not significant for any region and were dropped from the models. Increased %Stage 1 and/or %Stage 3 predicted decreased brain response to QST in 8 of the 11 regions (ps&lt.01), accounting for 19–45% of the variance.

Conclusion: Compared to CBT-P, CBT-I prompted greater improvement in abnormal pain processing in patients with fibromyalgia and insomnia. Increased NREM sleep may underlie these pain processing improvements following treatment. Future research examining the potential role of NREM sleep in central sensitization and pain processing is warranted.

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INFLUENCE OF LIGHT ON BRAIN ACTIVITY UPON WAKING FROM SLOW WAVE SLEEP

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Introduction: Waking from sleep is associated with reduced alertness due to sleep inertia. Light acutely improves alertness during sleep deprivation. In this study we assessed the influence of light on brain activity and connectivity after waking from slow wave sleep (SWS).

Methods: Twelve participants kept an actigraphy-confirmed stable sleep schedule with 8.5 hours for five nights and five hours for one night prior to an overnight laboratory visit. Participants completed two three-minute Karolinska Drowsiness Tests (KDT) before going to bed at their habitual bedtime. They were monitored continuously using high-density EEG (32-channel; Brain Products GmbH). Participants were woken twice and exposed to red light (0.01 melanopic-lux; control) or blue-enriched light (63.62 melanopic-lux) for one hour, in a randomized order, following at least five minutes of SWS. EEG artifact were removed algorithmically and the spectral composition of each electrode (i.e., fast fourier transform, FFT) and effective connectivity (i.e., partial directed coherence, PDC) between each electrode were estimated. A graphical analysis was conducted to extract features relevant to the facilitation of efficient communication between electrodes. All data were averaged within frequency bins of interest that correspond to delta (1-3Hz), theta (4-7Hz), alpha (8-12Hz), and beta (13-25Hz) bands and expressed relative to the pre-sleep baseline.

Results: Compared to the pre-sleep baseline, participants exposed to blue-enriched light experienced reduced theta and alpha activity; however, these results were not significantly different from the control. In contrast, the communication of frontal electrodes significantly increased across all frequency bands compared to the control, and this effect was most prominent in the alpha ($t(11)=3.80$, $p=.005$) and beta bands ($t(11)=3.92$, $p=.004$).

Conclusion: Exposure to blue-enriched light immediately after waking from SWS may accelerate the process of waking and help to improve alertness by facilitating communication between brain regions. Future analyses will explore the temporal persistence and granularity of the communicative properties associated with this response.

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