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Effect of the Light/Dark Regimen on Sleep Spindle Distribution in a Simulated Eastward Flight

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Effect of the light/dark regimen on sleep spindle distribution in a simulated eastward flight

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Introduction: Simulated jetlag protocols in healthy individuals have indicated that changes in the sleep-wake schedule have various effects on EEG sleep recordings (1). Recent evidence indicates that spindle frequency activity (SFA) displays a circadian pattern (2). Different schedules of light administration have been shown to have varying effects on the adjustment of the circadian pacemaker (3). The temporal distribution of SFA should thus be sensitive to the circadian phase at which sleep is scheduled. The study aims to test the effect of a 5-hour phase advance on sleep EEG in young healthy individuals and assess the effect of different schedules of light administration. **Methods:** Seventeen healthy drug-free participants (age = 25.20 ± 3.29, 13 males) maintained a regular sleep schedule for 3 weeks prior to admission into a time-free environment. After 3 baseline days, they underwent a 35-hour constant routine to unmask the expression of their endogenous circadian pacemaker. They then lived for one week on a schedule that was advanced by 5 hours relative to baseline. They were assigned to two groups of light exposure using a daily 6-hour light stimulus of 380-lux. Circadian phase was reassessed by a final 45-hour constant routine. In the **late light** group (n=7), phototherapy was planned prior to bedtime to impair circadian adaptation. In the **early light** group (n=10), phototherapy was started at the original wake time and advanced by one hour daily (**early light** group; n=10). This was designed to improve circadian adaptation to the new schedule. Sleep of the last baseline day and of the last shifted day was analyzed. Spectral analysis of frequency ranges were performed using low (12.25–13.00 Hz) sigma activity. **Results:** A phase advance of +5.32 + 0.76 hours and +1.38 + 2.64 hours was observed in the early light and late light groups, respectively. This shift was significantly different between both groups (Two-factor ANOVA: $F_{1,26} = 26.49$, $p < 0.0001$). A circadian misalignment thus persisted in the late light group in that subjects were going to bed at a circadian phase that was about 3.5-hours earlier than on their original schedule. In this group only, the peak of low SFA occurred significantly later compared to baseline conditions (p=0.033). **Conclusions:** The present study indicates that a 5-hour advance in the sleep-wake schedule has significant effects on low SFA. As in previous reports, the low range sigma activity was the most sensitive to circadian phase (2). Moreover, different schedules of light administration had significant effects in modulating the ability of the circadian pacemaker to adjust to an abrupt change in schedule.

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