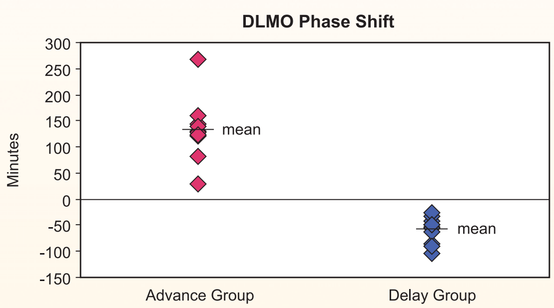
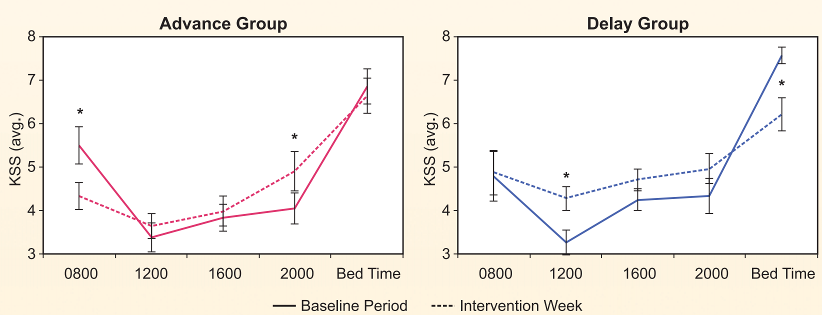
Light, not the Alarm Clock, Controls the Times We Sleep

Many believe that clock time controls when we go to sleep and when we wake up. Theory predicts, however, that light on the retina controls the timing of our biological clock which, in turn, determines when we fall asleep at night and awake in the morning. To test this idea, all subjects in the field study had to set their alarm clocks 90 minutes earlier in the morning than they normally would. Half of them received a light schedule that theory predicted would support early waking (bright morning light and dim evening light) while half of them received a light schedule that theory predicted would counteract early waking (dim morning light and bright evening light).



Salivary dim light melatonin onset (DLMO) phase shifts following advance and delay light schedules. The mean ± standard error of the mean (SEM) phase shift for the advance group was 132 ± 55 minutes and the mean ± SEM phase shift for the delay group was 59 ± 7.5 minutes.



Karolinska Sleepiness Scale (KSS) scores by time of day for the advance and delay groups. Asterisks identify significant differences between the baseline and the intervention periods for each group. Higher KSS scores indicate more sleepiness.

Methods

Twenty-one adults participated in the 12-day study. Following a 5-day baseline period, all participants were given individualized, fixed, 90-minute advanced sleep schedules for one week. For that week, participants were divided into two groups:

- ***Advance group*** had a light schedule designed to advance their circadian phase. This group received two morning hours of short-wavelength (blue) light ($\lambda_{max} \approx 476$ nm) exposure and three evening hours of light restriction during which they wore orange goggles to block out all light below 525 nm.
- ***Delay group*** had a light schedule designed to delay their circadian phase. This group received blue light for three hours in the evening and light restriction for two hours in the morning.

Results

Even though all participants had 90-minute advanced sleep schedules, circadian phase (DLMO) advanced 132 ± 55 minutes for the advance group and delayed 59 ± 24 minutes for the delay group. Partipants in the advance group felt less sleepy (KSS) in the morning and more sleepy at night than those in the delay group following their respective light schedules.

Conclusion

Controlling the light schedule shifts circadian phase in the expected direction irrespective of the alarm clock.

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