

Abstract

Sleep is regulated by homeostatic and circadian processes. The circadian process is controlled by the internal biological clock, which is regularly synchronised with the external world by so-called zeitgebers. The most important zeitgeber for humans is light, therefore incorrect timing of light signals can lead to desynchronisation of the clock and sleep disruption; however, this depends on the intensity and spectral characteristics of the light. Dimmed red light is unlikely to significantly interfere with sleep regulation, but white light with a higher intensity could. White light is typically used when people stay awake during the night and experience acute total sleep deprivation. This could potentially interfere with the compensatory mechanisms occurring during subsequent recovery sleep. We therefore decided to test whether and how different lighting conditions during sleep deprivation can affect the structure of recovery sleep. We had 12 healthy uniform volunteers undergo two acute total sleep deprivations; one under normal white light, the other under dim red light. Using polysomnography, we measured the sleep parameters of both recovery sleeps and compared them. It turned out that sleep that occurred after the sleep deprivation in constant dim light conditions was less fragmented, had shorter latency, higher efficiency, and higher representation of REM. We have therefore confirmed that the light present during sleep deprivation affects the structure of subsequent recovery sleep. The results also suggest that the setting of lighting conditions needs to be considered when conducting experiments related to sleep deprivation or recovery sleep and that dim red light has the potential to become a suitable alternative to conventional night-time lighting in both home and work environments.

Key words: sleep deprivation, sleep, light, polysomnography, circadian rhythm