“Cyan-gap” Light Sources and Melatonin Suppression

The human circadian system is maximally sensitive to short-wavelength light, which can suppress melatonin and reset the circadian pacemaker. In an effort to avoid problems with sleep and health that are associated with circadian disruption, the lighting industry has begun to develop “cyan-gap” white light sources devoid of energy around 480 nm. This study tested the effectiveness of a newly designed cyan-gap LED luminaire on melatonin suppression.

Methods

Sixteen adult participants (12 female, 4 male; mean ± standard deviation [SD] age = 37.8 ± 13.9 years) completed this nighttime study. The participants experienced a 3000 K intervention, a 3000 K cyan-gap intervention, and a dim light control condition.

The lighting interventions delivered either high or low light levels to the participants’ eyes during each experimental session, followed by a dim light control session. Salivary melatonin samples were collected 3 times per session, and participants’ retinal light exposures were measured at 30-s intervals with a Daysimeter mounted on lensless eyeglasses frames.

The participants were exposed to low and high light levels of the lighting interventions. Participants reported to the LRC laboratory at 23:30 h and remained in dim light prior to the experiencing the 1-h condition. Light levels were maintained at < 5 lux for the dim light period (represented by the hatched pattern) and the control condition.

Results

Repeated measures analysis of variance (ANOVA) revealed significant main effects of light level ($F_{1,12} = 9.1, p < 0.05$) and exposure duration ($F_{1,12} = 47.7, p < 0.05$), with greater melatonin suppression being observed following exposure to higher light levels and longer exposure durations.

Conclusions

- The results are consistent with previous studies showing that higher light levels and longer exposure durations result in greater melatonin suppression.
- Spectrally tuning a white light source to reduce stimulation of the ipRGCs does not necessarily lower the source’s impact on melatonin levels.
- The study results are relevant for lighting designers and specifiers who make lighting recommendations for optimizing non-visual stimuli.

Sponsor

Lumileds, Light and Health Alliance