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PREFACE

Light: An underestimated environmental factor in sleep medicine

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Sleep researchers and clinicians working in sleep medicine know that the environmental light-dark cycle is crucial for entraining human circadian rhythms to the solar day. Despite this knowledge, the importance of light-dark exposure is still fairly underestimated. In fact, if the sleep-wake cycle of their study participants or patients shows no major deviation from the 24-h day, as indexed by sleep logs or actigraphy, they commonly assume normal circadian entrainment and thus no aberrant light-dark exposure. Only a few sleep clinicians measure the dim light melatonin onset (DLMO), a reliable circadian marker, to actually prove whether their "circadian diagnosis" is correct. In fact, DLMO should become common clinical practice for quantifying circadian phase position in every sleep-disturbed person. Many people working in the sleep field are not aware about light's non-circadian action. Besides photic resetting of the circadian clock, artificial light striking the retina between dusk and dawn directly or indirectly impacts on neurons regulating sleep-wake cycles, by inhibiting sleep-promoting neurons and activating arousal-promoting orexin neurons in the hypothalamus, and by suppressing the release of the soporific hormone melatonin at night. These effects can outlast the duration of light exposure without necessarily affecting circadian phase. There is a clear dose- and wavelength dependency with a strong "blue-shift" most probably also involving the novel photoreceptor pigment melanopsin as a mediator of the direct effects of light in humans.

Blue-enriched light as low as at 40 lux, and light from solid-state light-emitting diodes (LED)-backlit computer screens in the evening is strong enough to elicit significant alerting responses as indexed by subjective and objective correlates of sleepiness. Furthermore, subjective well-being and performance in different cognitive domains are enhanced during a 2-hour evening exposure to the above-mentioned light sources and affects subsequent sleep. Energy efficient LEDs are now widely used in televisions and computer screens, laptops, tablets and hand-held devices, and used very often between dusk and dawn, particularly in the late evening. Checking messages etc. on their hand-held devices before going to sleep has become common practice in teenagers, but also in adults, with the consequence of reducing sleepiness, increasing alertness and interfering with sleep. Thus, "light hygiene" should be become an integral part of sleep hygiene. In fact, "light hygiene" could advise us on how much daily natural light-dark exposure we need, and, equally important, on what we "should" and "should not" do when using artificial light, thus enhancing its pros and minimizing its cons on alertness, performance and sleep.

The discoveries of light's repercussions on the brain's sleep and wake-promoting regions, along with the recent advances in solid-state LED technology, will help to design and implement potentially successful novel light devices and light exposure schedules for at home and in the work place environment to promote beneficial effects of light beyond vision.