

BLUE LIGHT IMPACT IN CHILDREN

Blue light can cause retinal damage

Visible light passes through the media of the eye to the retina where photoreceptors transform it into an electrochemical signal. Humans depend on this process for image-formation and regulation of daily sleep-wake cycles. Commonly encountered light emitted by the sun and personal electronic devices contain significant amounts of high-energy, short-wavelength blue light.¹

Ultraviolet (UV) light contains more energy than blue light, but is absorbed by the cornea and crystalline lens, limiting retinal exposure.

Visible blue light may potentially be harmful to the human retina, as it can be absorbed by the retinal pigment epithelium (RPE) and certain photoreceptors, generating localized oxidative and thermal stress. Laboratory studies on rodent and primate models have demonstrated that extended time periods of direct retinal exposure to bright blue light accelerate rates of RPE and photoreceptor death.^{2, 3}

Is outdoor blue light exposure dangerous for children's eyes?

Researchers have hypothesized that sunlight exposure is a risk factor for the development of age-related macular degeneration (AMD). Large-scale epidemiological studies investigating this association in adult subjects have produced mixed results, with some supporting the hypothesis^{4, 5} and others disagreeing.⁶⁻⁸

Children may be at higher risk for blue light retinal damage than adults. The juvenile lens absorbs less short-wavelength light than the adult lens,⁹ allowing more blue light to reach a child's retina. Although one epidemiological study suggests that life-long sunlight exposure is not a risk factor for the

development of AMD,¹⁰ the long term consequences of blue light exposure in children are not well understood.

The benefits of limiting sunlight exposure with UV-filtering sun spectacles are well established. These devices reduce the eye's UV and visible blue light exposure, slowing the development of cataract, eyelid cancer, pterygium and soft drusen, a risk factor for the development of exudative AMD.^{8, 11}

Thus, clinicians and parents should act with caution when managing children's outdoor sunlight exposure. Specifically, all children should possess ocular sun protection in the form of dark sun spectacles that filter UV light. Any potential safety benefits of blue-blocking antireflective coatings are not well elucidated; therefore, these products are not an adequate replacement for sun spectacles.

Is computer-generated blue light exposure dangerous for children's eyes?

Although the light emitted by personal electronic devices is not bright enough to damage the human retina,¹² it is able to stimulate blue-light-sensitive ganglion cell photoreceptors that regulate circadian rhythms.¹³ As a result, cellular telephone, tablet and personal computer use before bedtime can delay sleep onset, degrade sleep quality and impair alertness the following day.¹⁴ Extended use of these devices has also been shown to cause symptoms of dry eyes, blurred vision and headaches.¹⁵

Limitation of personal electronic device use before bedtime is recommended to be the most effective method for reducing light-induced sleep disruption in children. The use of amber-tinted spectacle lenses during the use of electronic devices immediately before bedtime has shown promise as a strategy to reduce their altering effects,¹⁶ but such filters require more investigation before this practice can be advocated. Any potential benefits to sleep quality of blue-blocking antireflective coatings have not been investigated.

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