Effects Of Blue Light on Our Brain and Health

When desktop computers were the only choice for digital applications, few people worried about screen time causing anything more serious than eye strain, but that's changed. Our lives are now filled to overflowing with mobile digital devices like cell phones, tablets, and laptops. They're small, light, and equipped with bright, colorful screens. It's the blue light coming from these brilliant digital device screens that's concerning. Can blue light really affect our health?

First, let's break down what we mean when we discuss "blue light." All light is made up of different colors, which correspond to different wavelengths of light. Ultraviolet light is known for causing sunburn and contributing to some skin cancers, but blue light is nearly as powerful. It sits right next to ultraviolet on the spectrum and has the most energetic wavelength of all colors that we can see.

However, there's a big difference between the blue light coming from sources like an arc-welder and that originating from digital devices. Light waves from sources like arc welders are also full of high-intensity ultraviolet radiation, which can cause damage to the retina. The blue light from cell phones and tablets, although energetic, has no ultraviolet light at all.

That's not to say blue light doesn't affect our brains and health. Read on to find out how.

Blue light's effects on sleep and circadian rhythms

Light from digital screens is produced by red, green, and blue light-emitting diodes (LEDs). However, it's the white LEDs of the backlight in digital devices that radiates the highest levels of blue light into our eyes.

We use our devices at all hours, but it's at night when exposure to blue light is problematic. There's solid evidence that blue light from digital devices is disruptive to the sleep cycle. When we use our devices immediately before we go to sleep, we bathe our eyes in that intense blue light, which can be problematic, because blue light is a key part of our daily sleeping and waking cycles.

Blue light stimulates a special kind of light receptor in the retina called the melanopsin retinal ganglion cells (MRG cells). These cells send signals to the area of the brain that is responsible for our natural cycle of sleep and wakefulness. This tiny area, the suprachiasmatic nucleus (SCN), communicates with the pineal gland deep inside the brain to produce melatonin, a powerful hormone that makes us sleepy and regulates our sleeping and waking schedules.

When plentiful blue light from our digital screens shines in our eyes, the SCN can't readily distinguish it from natural sunlight and thus doesn't signal the pineal gland that it's time to ramp up melatonin production. Without melatonin flowing into our systems, we don't fall asleep promptly.

Disturbing the circadian rhythm does more than upset the brain's delicate balance. It also throws many of the body's biological processes off. All these processes are affected by digital blue light.

- **Hormone production**. Excessive blue light exposure (defined as 4 hours of exposure without at least one 15-minute break) interferes with melatonin production.
- **Metabolism**. Interruptions to the circadian rhythm harm the way our bodies metabolize fats. This means that blue light can negatively affect a person's weight and even contribute to obesity.

To avoid the effects that blue light has on sleep, put aside all digital devices at least an hour before you plan to go to sleep, or turn on your device's blue light protection.

Blue Light and Digital Eye Strain (DES)

Digital eye strain (DES), also called "Computer Vision Syndrome," is caused in part by exposure to blue light. Focusing on a blue light-emitting screen for more than 2 hours without at least a 15-minute break is enough to cause eye strain.

Blue light and vision

There's no final word yet on whether or not exposure to digital blue light can lead to permanent harm to a person's vision or exacerbate disorders like macular degeneration, but research studies are underway. Although high intensity blue light from the sun is known to aggravate disorders of the retina, there's still a lack of consensus about the long-term effects of blue light from cell phones, tablets, and computer screens. However, studies conducted within the last 10 years indicate that exposure to more than 4 hours of digital blue light may aggravate conditions like macular degeneration.

Blue light precautions

If you're concerned about the cumulative effects of blue light on your health and vision, there are several effective precautions you can take.

- Enable "nightlight" protection on your digital device. Cell phones, computers, and tablets all have optional settings that reduce blue light emissions coming from the device's screen.
- Blue-light glasses also reduce the impact of blue light on your eyes. Ultraviolet protection can be found in sunglasses, as well as protective coatings on prescription lenses.

The takeaway

Blue light from digital devices can upset the circadian rhythm and interfere with sleep. There's burgeoning research that shows more than 4 hours of exposure to blue light without a break, over a period of years, may contribute to eye disorders like macular degeneration. Many research studies are underway, investigating the long-term effects of our love affair with our many digital companions on our health.

Works Cited

Armstrong, R. A., & Mousavi, M. (2015). Overview of Risk Factors for Age-Related Macular Degeneration (AMD). Journal of stem cells, 10(3), 171–191.

Blue light has a dark side. Harvard Health. (2020, July 7). https://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side.

Comparetto, R., Farini, A. Mitigating retinal damage and circadian rhythm modification by blue-blocking spectacles lenses: evaluation parameters. Eur. Phys. J. Plus 134, 494 (2019). https://doi.org/10.1140/epjp/i2019-12848-x

Government of Canada. (2018, May 1). Welding - radiation and the effects on eyes and skin : OSH answers. Canadian Centre for Occupational Health and Safety. https://www.ccohs.ca/oshanswers/safety_haz/welding/eyes.html.

Holzman, D. (2010, January 1). What's in a color? The unique human health effects of blue light. National Institute of Environmental Health Sciences. https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.118-a22.

Karolina Janků, Michal Šmotek, Eva Fárková & Jana Kopřivová (2020) Block the light and sleep well: Evening blue light filtration as a part of cognitive behavioral therapy for insomnia, Chronobiology International, 37:2, 248-259, DOI: 10.1080/07420528.2019.1692859

Porter, D. (2020, September 18). Blue light and digital eye strain. American Academy of Ophthalmology. https://www.aao.org/eye-health/tips-prevention/blue-light-digital-eye-strain.

Ratnayake, K., Payton, J., Lakmal, O. H., & Karunarathne, A. (2018, July 5). Blue light excited retinal intercepts cellular signaling. Nature News. https://www.nature.com/articles/s41598-018-28254-8#Abs1.

Roenneberg, T., & Merrow, M. (2002). Light reception: discovering the clock-eye in mammals. Current biology. CB, 12(5), R163–R165. https://doi.org/10.1016/s0960-9822(02)00731-5

Uv radiation. The Skin Cancer Foundation. (2021, August 2). https://www.skincancer.org/risk-factors/uv-radiation