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Review Article

PATHOGENIC POWER OF BLUE LIGHT WITH REFERENCE TO SLEEP AND CANCER

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Abstract: Natural light is essential for human healthy life, however, over exposure to night artificial light is a cause for many disorders in the human body. Certain wavelengths (long) of the emitted light are not that much pathogenic as (short) wave lengths are. The short wavelength has more penetrating power than that of long wavelength.

The human eye is the only organ in the body that has evolved to allow radiation to penetrate deep within it and is capable of "seeing"- wavelengths of light and turning it into visual images. This penetration in the eye is a paradox as light is an essential component for vision but it may also be a biohazard. Short wave-length blue-violet light is potentially harmful whilst longer wavelength blue-turquoise is essential for healthy living [1]

Kyewords: Cancer, Light effect

INTRODUCTION

Light for vision necessary but biohazard too: The various ocular tissues and fluids, cornea, aqueous, lens and vitreous act as progressive wavelength selective filters such that ultraviolet B (280-315 nm) radiation is absorbed almost exclusively in the cornea whilst ultraviolet A (315-400 nm) may be attenuated by the cornea with almost all of the remaining radiation of this wavelength being absorbed in the lens [2- 4] and only a very small amount passaged to the retina (Fig 1).

However optical radiation between 400 and 1400 nm made up of visible radiation or light (400-800 nm) and infrared A (800-1400 nm) not only passes through the various optical media to fall upon the retina but at the same time undergoes a concentration in irradiance of up to a hundred times between the cornea and the retina as a result of the refractive power of the cornea and to a lesser extent of the lens. It is this refractive property that concentrates the incident energy and converts for example the rays of the summer sun from the pleasantly warming sensation on the skin to a potential hazard to the eye if the sun is viewed directly. This penetration of optical radiation is the first paradox as radiation is a biohazard [5-7] but light is an essential component in the process we know as vision.

Every coin has two faces, so as the light. It's a well-known fact that the light is the fundamental requirement for healthy survival in this world but its pathogenic power cannot be ignored [8].

Nevertheless, natural light is necessary. Light is received by our body by skin and the retina where

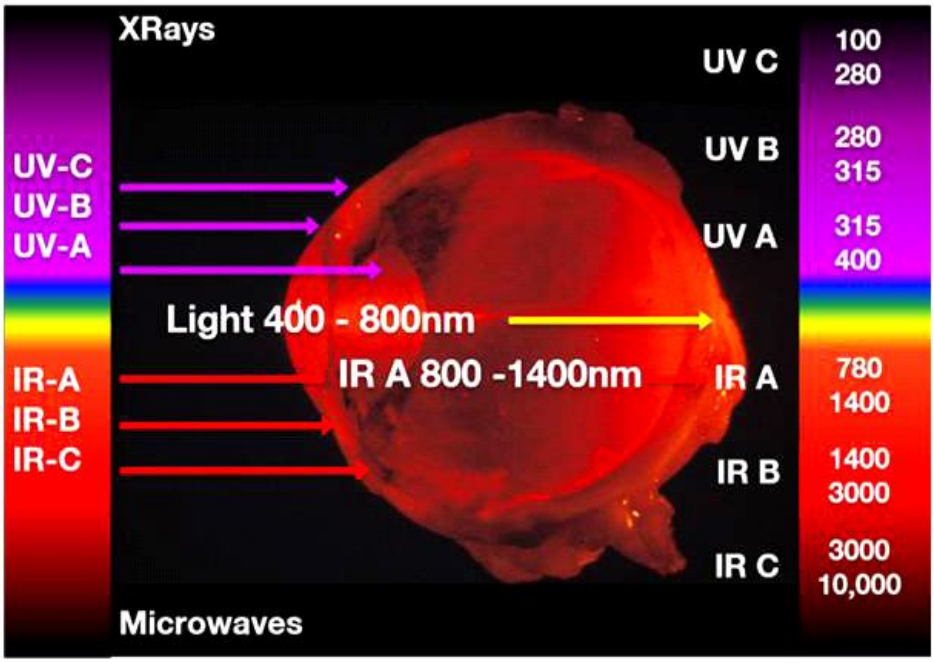

Fig. 1: Penetration of optical radiation within the human eye (Lvanov et al. 2018)

photoreceptors are distributed. Light is an essential component for vision; The human eyes are the only organs in the body capable of "seeing"- wavelengths of light and turning it into visual images. On the other hand, without penetration of optical radiation deep within the eye which is a sort of biohazard, the eye cannot see an object. This is a paradoxical situation. Short wave-length blue-violet light is potentially harmful whilst longer wavelength blue-turquoise is essential for healthy living. In the human eye evolutionary development both mechanisms have been integrated to facilitate separation of health and hazard [9].

Since people who are lacking natural light don't sleep as well, it can leave a person feeling fatigued and exhausted. It is also essential for the immune system. Both vitamin D and nitric oxide are needed by the body to help to regulate the metabolism. Nitric oxide is also important to help to discourage overeating, which also helps to prevent obesity. More so our biological clock works only if light-dark cycles exist.

Blue light glasses: Exposure to blue light during the day is important to suppress melatonin secretion, the hormone that is produced by the pineal gland and plays a crucial role in circadian rhythm entrainment. While exposure to blue is important for keeping an organism's wellbeing, alertness, and cognitive performance during the day, do blue light glasses really work? The short answer: No according to an American Academy of Ophthalmology report, "it's not necessary to spend money on special [eyewear] for computer use." "There's really no evidence that [blue light glasses] help".

With all of that said, blue light glasses are fine to wear even when you're not exposed to digital screens (which is rare these days). As stated before, a blue light coating can only help you — wearing blue light glasses all the time will not hurt your eyes. Blue light blocking lenses should be worn anytime you are using a screen or device that emits blue light. Keep your eyes healthy and reduce digital eye strain with a great pair of blue light blocking lenses. Chronic exposure to low intensity blue light directly before bedtime, may have serious implications on sleep quality, circadian phase and cycle durations [10].

For that matter not only the blue light but light as a whole is a paradoxical energy if not for others but for the human body.

Bad side of nighttime light: Plethora of literature is available to shed light on the possible connection to various metabolic diseases and sleep disorders which in turn manifest in neurological disorders [11]. Blue light can damage the retina and cause vision problems, such as age-related macular degeneration (AMD) and cataracts. Children are more at risk than adults because their eyes absorb more blue light. Blue light can also contribute to dry eye and eye strain [12]. Exposure to light suppresses the secretion of melatonin, a hormone that influences circadian rhythms. Even dim light can interfere with a person's circadian rhythm and melatonin secretion. A mere eight lux—a level of brightness exceeded by most table lamps and about twice that of a night light has an effect. Light at night is part of the reason so many people don't get enough sleep, and researchers have linked short sleep to increased risk for depression, as well as diabetes, cancer and cardiovascular problems [13].

While light of any kind can suppress the secretion of melatonin, blue light at night does so more powerfully. In an experiment comparing the effects of 6.5 hours of exposure to blue light to exposure to green light of comparable brightness. The blue light suppresses melatonin for about twice as long as the green light and shifted circadian rhythms by twice as much (3 hours vs. 1.5 hours).

In another study of blue light, researchers at the University of Toronto compared the melatonin levels of people exposed to bright indoor light who were wearing blue-light–blocking goggles to people exposed to regular dim light without wearing goggles. The fact that the levels of the hormone were about the same in the two groups strengthens the hypothesis that blue light is a potent suppressor of melatonin. It also suggests that shift workers and night owls could perhaps protect themselves if they wore eyewear that blocks blue light. Inexpensive sunglasses with orange-tinted lenses block blue light, but they also block other colours, so they're not suitable for use indoors at night.

The researchers put 10 people on a schedule that gradually shifted the timing of their circadian rhythms. Their blood sugar levels increased, throwing them into a prediabetic state, and levels of leptin, a hormone that leaves people feeling full after a meal, went down.

Effects of blue light and sleep: If blue light does have adverse health effects, then environmental concerns, and the quest for energy-efficient lighting, could be at odds with personal health. Those curlicue compact fluorescent light bulbs and LED lights are much more energy-efficient than the old-fashioned incandescent light bulbs we grew up with. But they also tend to produce more blue light.

The physics of fluorescent lights can't be changed, but coatings inside the bulbs can be so they produce a warmer, less blue light. LED lights are more efficient than fluorescent lights, but they also produce a fair amount of light in the blue spectrum. Richard Hansler, a light researcher at John Carroll University in Cleveland, notes that ordinary incandescent lights also produce some blue light, although less than most fluorescent light bulbs.

Protect yourself from blue light at night: Use dim red lights for night lights. Red light is less likely to shift circadian rhythm and suppress melatonin. Avoid looking at bright screens beginning two to three hours before bed.

If you work a night shift or use a lot of electronic devices at night, consider wearing blue-blocking glasses or installing an app that filters the blue/green wavelength at night.

Expose yourself to lots of bright light during the day, which will boost your ability to sleep at night, as well as your mood and alertness during daylight.

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