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PRIMARY eye care

Blue Light - How scared should we be?

The body of research on the visible spectrum and particular wavelengths of light is immense and while some effects of exposure are well established others are still being investigated.

On the one hand, light is essential for various functions. It helps us to see better, it helps us with our visual acuity and contrast acuity, it helps us perceive colours, and it helps with various non-visual functions of the body e.g. maintaining and regulating the sleep/wake cycle. The sleep/wake cycle (or circadian rhythm) in turn affects memory, mood and hormonal balance.

However, some components of natural light can be harmful to the cells of our bodies and these harmful rays tend to be mainly in the part of the spectrum where the light radiates at a high frequency. The amount of damage from this type of light will depend on a combination of intensity of light exposure and accumulated amount of exposure. **Many countries have guidelines for exposure to different wavelengths of light and the biological evidence for blue light hazard is reviewed periodically to set levels below which adverse health effects are unlikely.**

Most people are aware that light in the UV and violet regions are particularly harmful to eyes. However, the Blue-Violet range with frequencies between 400 nm to 470 nm has also been linked to retinal damage and cell decay following direct exposure in laboratory and animal studies. The blue light emitted from illuminated screens such as laptops, tablets, and smartphones peaks around the 460nm point (white led sources peak in the 450-470 range). Of course the luminance of these light sources has to be relatively low for comfortable viewing, but it is clear that people are using these devices for many hours each day.

In 2008 in an effort to establish more specifically the wavelengths which are more effective than others at causing harm to the eyes researchers at the Paris Vision Institute isolated small bands of blue light wavelengths and focussed each band on cells from pig retinas for several hours. They found that the band between 415 nm and 455 nm caused maximum retinal cell death (1).

In a 2016 study which assessed the blue light hazard from a variety of light sources by measuring luminance, researchers from the Centre for Radiation, Chemical, and Environmental Hazards in the UK (2) found that in terms of **blue light hazard the domestic lamps tested (incandescent, LED and CFL) ranged from 10 to 20% of the current exposure limit, assuming long-term viewing.**

Tests were also run for worst-case viewing of white screens across computer monitors, laptop screens, tablet screens and smartphone screens; i.e. brightness set to maximum brightness viewed from 100 mm. **Computer monitors, laptop screens, tablet screens, and smartphone screens all tested below the published exposure limits, even for extended viewing times.**

The authors concluded that the reasonably foreseeable exposure to optical radiation from lamps, computer screens and mobile devices, such as smartphones is lower than for the exposure likely to be received from staring at a blue sky. **Under even extreme long-term viewing conditions none of the devices suggested cause for concern for public health.**

(Note: The research was limited to exposure of human eyes to blue light and effects on circadian rhythm and sleep quality was outside the scope of the study.)

Recently a group of UK and Australian researchers (3) reviewed randomised controlled trials (RCTs) which recruited adults from the general population and investigated the effect of blue blocking spectacle lenses on visual performance, symptoms of eyestrain or eye fatigue, changes to macular integrity and subjective sleep quality. They concluded and the conclusion after review is that there is a lack of high quality evidence to support using blue blocking spectacle lenses for the general population to improve visual performance or sleep quality, alleviate eye fatigue or conserve macular health.

Three studies (with 136 participants) met their inclusion criteria. One study compared the effect of blue blocking lenses with clear lenses on contrast sensitivity and colour vision using a pseudo-RCT crossover design and found no observed difference between lens types. Another study measured critical fusion frequency as a proxy for eye fatigue, on wearers of low and high blue blocking lenses, before and after a two-hour computer task. There was no observed difference between low blue blocking and standard lens groups, but there was a less negative change in critical fusion frequency between the high and low blue blocker groups. Both studies compared eyestrain symptoms with Likert scales but there was no evidence of a difference in the proportion of participants in the various groups showing an improvement in symptoms of eyestrain or eye fatigue. The third study reported a small improvement in sleep quality in people with self-reported insomnia after wearing high compared to low blue blocking lenses using a 10-point Likert scale. A comparison involving normal participants found no observed difference in sleep quality. No studies investigating effects on macular structure or function were found.

Blue light aside, it is generally accepted that people who use computers commonly experience problems with their eyes. The main symptoms are:

- Eyestrain
- Irritation
- Redness
- Tired eyes
- Burning sensation
- Blurred vision

Often latent eye conditions become manifest when people start to use computers especially for long periods without a break. The main issue is that people are not well adapted to staring directly at a close stimulus for long periods and often fail to blink enough while staring at the screen.

If people do experience problems their optometrist can prescribe glasses to make computer use more comfortable and for people with dry eye optometrists can provide a management plan for the condition.

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3. Lawrenson JG, Hull CC & Downie LE. The effect of blue-light blocking spectacle lenses on visual performance, macular health and the sleep-wake cycle: a systematic review of the literature. Ophthalmic Physiol Opt 2017; 37: 644–654. https://doi.org/10.1111/opo.12406