High Energy Visible Light & Potential Ocular Damage

Date posted: June 11, 2014 | Author: Lindsay Snyder | No Comments »

High Energy Visible Light (HEVL) and Potential Ocular Damage

By: Paul M. Karpecki, OD, FAAO
Director of Education – PECAA

When I first looked at this information, I worried it was potentially sensationalism because the thought is alarming. New mandates are requiring that LED lights eventually replace our traditional incandescent bulbs. Some LED's – especially the ultra blue light versions appear to have a dominant wavelength in the blue light spectrum around 400 nm. This truly could contribute to serious issues with our ocular health in the future– especially conditions like age related macular degeneration (AMD), which have been shown to result in damage from the HEVL spectrum of light.

We've known that ultraviolet (uv) light can have adverse effects on the eye ranging from photokeratitis and ptergyium to cataracts. Likewise studies have shown uv damage to the retina with extensive uv exposure. So it's not entirely surprising that some damaging rays might extend into the violet and blue light spectrums.

Studies have shown that the deeper blue light frequencies (similar to what we are exposed to with LED cool blue or even tablets and smartphones) are 50-80 times more efficient in causing photoreceptor death than green light. In this same study the researchers showed that the oxidative damage to the retinal pigment epithelium (RPE) layer –especially those containing lipofuscin is enhanced with response to blue light and results in AMD in patients. Other research showed similar risks of AMD with exposure to the 400+nm wavelength or the blue/violet visible light frequencies.

At the same time, there are risks to being overly cautious and using lenses to block all levels of blue light from our vision.

It is true that blocking some of the higher frequency wavelengths do help with increased contrast or the ability to discern subtle difference such as when driving at night for example. However I don't believe we should overdo it. Studies show that blocking blue light and too much of this color wavelength results in difficulty in discerning colors – especially in low illumination such as dusk for example. It is not unfathomable that a person in a full blue-blocking lens could indeed have difficulty seeing streetlights. But there are other reasons to be cautious.

Research has shown a correlation to blocking the wavelength of 460nm (which happens to be the peak of the older blue blocking technology) and its effect on our sleep patterns, known as our circadian rhythm. The 460nm rhodopsin-based, visual pigments in some retinal ganglion cells may be responsible for light-induced melatonin suppression and, perhaps maintenance of the circadian rhythm. Another study came to similar conclusions when looking at the sensitivity or scotopic

or dimmer light vision as well as melanopsin photoreception and melatonin suppression with blue blocking technology and found all three were indeed affected.

So balance may well be the key. Some HEVL blocking-may indeed help contrast sensitivity of vision and potentially decrease the risks of photoreceptor damage but blocking too much of the blue light visual spectrum can potentially affect color perception and our own natural sleep cycles. Sometimes less is indeed more!

So how to we best block these wavelengths?

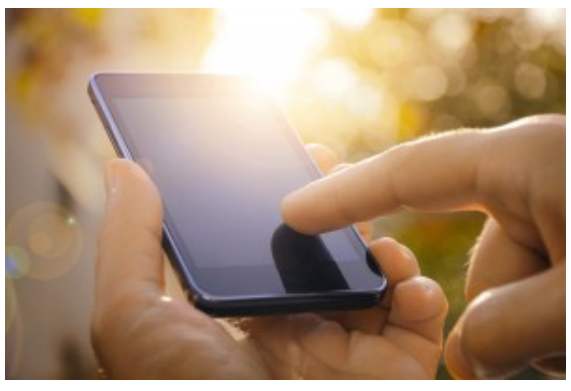
Contact lenses have long been able to block uv light but as of yet there is no filtering tint to block the HEVL and perhaps enhance contract vision in doing so. Perhaps this is an invention in progress or at least should be, as the typical patient starting contact lens wear is at an age of high risk for cumulative light radiation to the macula. Remember that as we age our crystalline lens starts to naturally filter out higher energy wavelengths- but this is not present at an early age. So that leaves spectacles or glasses as our main option.

There are a number of blue and HEVL blocking lenses available. Blue blockers have lost favor because of their effects on color vision perception -especially in dim light. By blocking too much blue light we might also affect our sleep cycles. So the main areas of HEVL blocking (high frequency blue and violet) are what we'll review.

Two inventions currently available that address this are BluTech Lenses and Crizal Prevencia Anti-Reflective Coating. Crizal Prevencia deflects harmful blue light and By blocking both the outside of the spectacle lens and even the inside where light can bounce into the eye may help in reducing the amount of HEVL reaching the eye. BluTech is an actual lens with a key ingredient Ocular Lens Pigment impregnated into the lens itself – this ocular lens pigment within the lens structure absorbs the most dangerous HEVL. Crizal Prevencia reflects the HEVL so it appears as having a slight violet hue in certain light circumstances. BluTech absorbs the HEVL so it has a slight champagne straw color in certain light circumstances. The absorption approach appears to work very well.

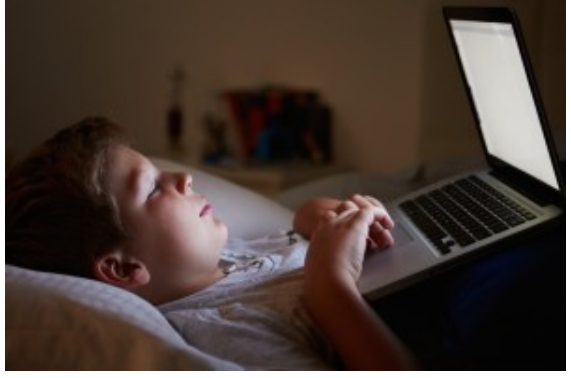
Should everyone be fit with HEVL blocking lenses?

Actually no, for example a person with a cataract already has a built in blue light filter. As the lens turns yellow or their Ocular Lens Pigment builds up which is consistent with the most common type of cataract, the nuclear sclerotic cataract, it absorbs more of the HEVL frequencies. However once the cataract lens is removed, the patient should then consider this option.



Computer & Handheld Device Users:

One key subset of patients for this technology are individuals who spend a great deal of time on the computer, tablets or smart phones. These blue light emitting technologies can, likely over decades, lead to potential retinal damage given that the Paris study showed a 25 x great potential of retinal receptor damage over time. In my clinical experience, these patients will find a great benefit via the increased contrast to letters on the screen and how much better their eyes feel after wearing them in front of a computer for a day. The potential retinal benefits are long-term.



Children:

Another group is children but for a reason that may surprise you: sleep disorders! Children who spend a great deal of time on computers, tablets or playing video games etc. will often have sleep issues. From an evolutionary standpoint, we would not be exposed to the HEVL frequencies into the late afternoon and evening. Children who spend time on these devices may find that the blue light absorption may affect their circadian rhythms. After wearing these glasses during the day, many will have normal sleep cycles soon afterwards. Another reason however is that the younger patient lacks ocular lens pigment in the crystalline lens to absorb these rays and is most at danger for damage occurring early in life but manifesting later.

High-Risk AMD Patients:

The final group is the one you'd expect – patients with a higher risk of age related macular degeneration (AMD). This would include those with a family history of AMD, patients with drusen in the macula, patients who genetically test at higher risk levels and patients who are already diagnosed with AMD.

HEVL blocking lenses such as BluTech and Provencia are fascinating technologies, that have benefits ranging from patients reporting sleep improvement to higher contrast of letters, but the theories of retinal damage may be the main reason for their consideration.

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