The Dark (and Light) Side of the Blue

The Harm and Benefits of Blue Light

(Optical Seminars Course # HS-13)

by

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Course Objectives

Upon completion of this course, participants should be able to:

1. **Understand the nature of blue light** within the visible light spectrum, including its sources, wavelength ranges, and role in human vision and physiology.
2. **Identify the proven benefits of blue light**, including its effects on alertness, mood, cognitive function, and regulation of the circadian sleep-wake cycle.
3. **Differentiate between evidence-based concerns and common misconceptions** regarding blue light exposure, including current positions of the American Optometric Association and the American Academy of Ophthalmology.
4. **Recognize the primary causes and symptoms of digital eye strain**, and explain how blue light, viewing habits, ergonomics, and blink rate each contribute to patient discomfort.
5. **Evaluate and appropriately recommend blue-light-filtering lenses and coatings**, based on patient needs, lifestyle, visual tasks, and realistic expectations regarding comfort, glare reduction, and sleep hygiene.
6. **Achieve a minimum score of 70% on the Final Assessment.**

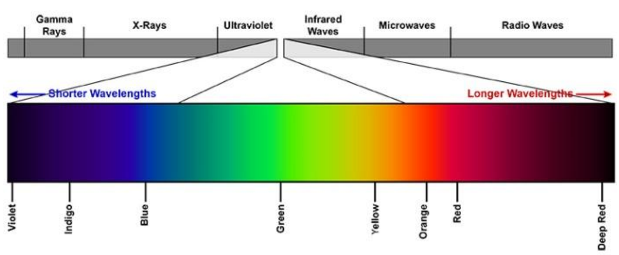
Course Outline:

I Introduction

Though it has little practical application, one of the first things an aspiring optician learns is the acronym ROYGBIV to remember the different hues that make up a rainbow. The letters stand for red, orange, yellow, green, blue, indigo, and violet. While a rainbow is made up of an infinite and continuous spectrum of colors, humans perceive them in that familiar order. What this module is concerned with is the “B” in the acronym: blue; or more specifically, blue light.

Human beings perceive blue when viewing light with a wavelength between approximately 450 and 495 nanometers (nm). A nanometer is one-billionth of a meter. As the frequency of blue increases (and wavelength shortens), light appears more violet. As the frequency decreases (and wavelength lengthens), it appears more green. “Pure” blue appears near the midpoint, around 470 nm.

The visible light spectrum occupies only a small portion of the entire electromagnetic spectrum, extending from roughly 380 nm (violet/blue) to 700 nm (red). Within that visible spectrum, blue light is commonly defined as light ranging from 380–500 nm and is often further subdivided into blue-violet light (approximately 380–450 nm) and blue-turquoise light (approximately 450–500 nm). Taken together, this means that nearly one-third of all visible light is classified as high-energy visible (HEV) or blue light.



In painting, blue is one of the three primary colors, along with red and yellow. These colors can be mixed to create countless hues—blue with yellow makes green; blue with red makes purple. Blue is also a primary color in the RGB model used to create every color on televisions, computers, and digital displays. Because of the Rayleigh scattering effect, the sky and oceans appear blue to the human eye.

The color blue has been used in art and architecture for thousands of years to create specific moods and emotional responses. By the late eighteenth and nineteenth centuries, it became the dominant color for military and police uniforms. Because it is often associated with peace and harmony, blue appears prominently in the flags of both the United Nations and the European Union. By the end of the twentieth century, dark blue replaced black and charcoal gray as the most popular color for men's business suits. Surveys consistently show that blue is associated with intelligence, stability, and trust, and it remains the most popular color among both men and women in the United States and Europe.

When I began my optical career in the 1980s, blue was rarely discussed outside of the occasional fashion tint or an unusual frame color. Fast-forward several decades, and it is nearly impossible to open an optical journal, attend a trade show, or scroll through an industry website without encountering articles, advertisements, and product claims centered on the "dangers" of blue light and the lenses designed to protect us from it.

But is blue light truly dangerous? Does it cause permanent damage to the human eye? Does it contribute to diseases like macular degeneration? And if filtering blue light is advisable, what is the most responsible and evidence-based way to do so?

Before answering those questions and more, it is critical to acknowledge a foundational truth: blue light is not inherently bad. In fact, without blue light, normal human physiology would be profoundly disrupted. As we will see, blue light plays an essential role in mood, alertness, cognitive function, and regulation of the sleep-wake cycle.

II Benefits of Blue Light

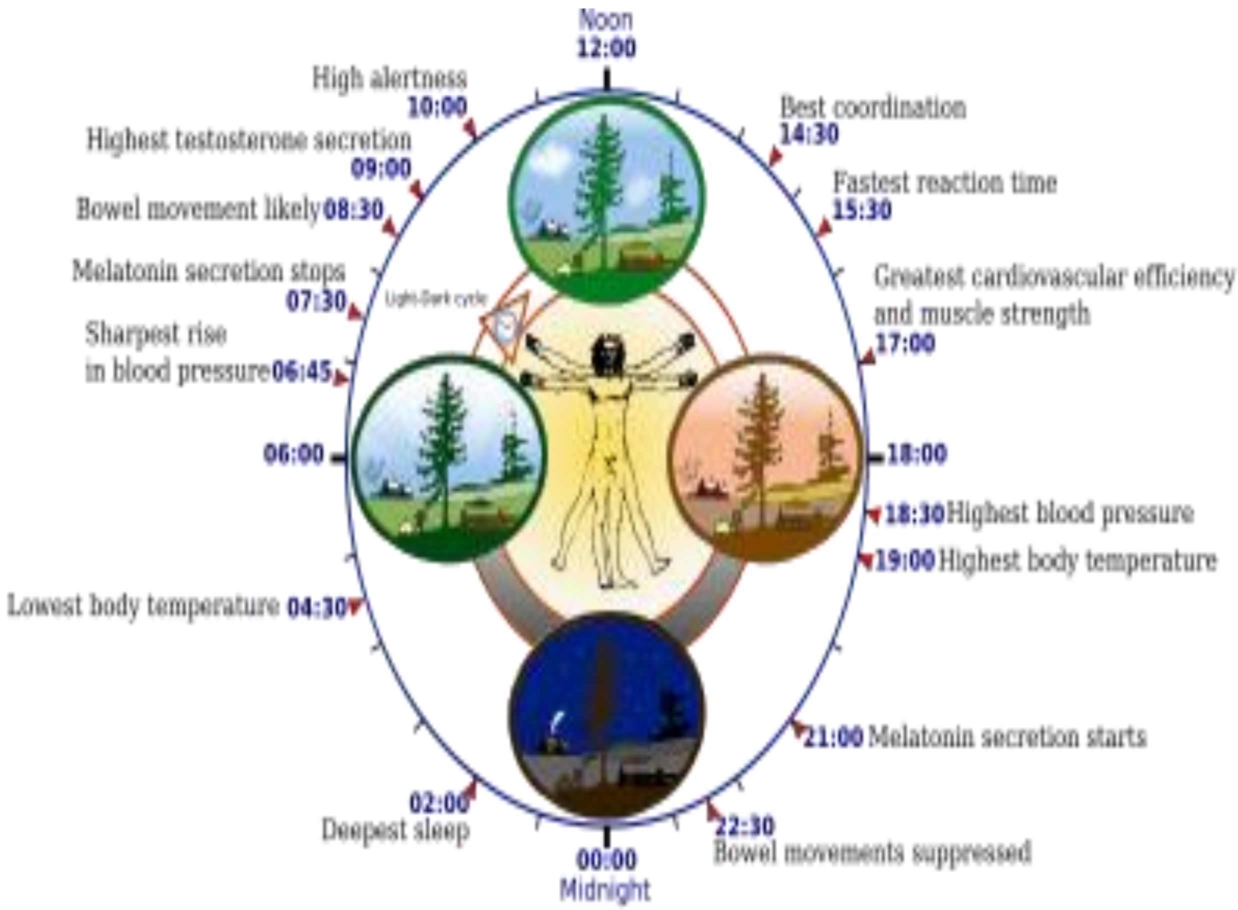
Blue light is everywhere. Sunlight is by far the strongest and most significant source, and spending time outdoors during daylight hours remains our primary exposure. Artificial sources include fluorescent lighting, LED lighting, and virtually all modern digital displays, including televisions, computers, tablets, and smartphones.

Despite popular marketing narratives, it would be neither possible nor desirable to eliminate blue light exposure entirely. Some exposure to blue light is essential to good health. Research has shown that blue light helps boost alertness, improve reaction time, enhance cognitive performance, and elevate mood. For this reason, blue-enriched light is used therapeutically.

Blue-light therapy has long been used in the treatment of Seasonal Affective Disorder (SAD), a form of depression related to reduced sunlight exposure during fall and winter months. The bright white light used in therapy contains significant blue-light energy and has been shown to reduce fatigue and improve mood. Blue light is also used medically to treat neonatal jaundice, helping to reduce elevated bilirubin levels in newborns.

Additionally, blue light plays a critical role in regulating the body's circadian rhythm, the roughly 24-hour biological cycle that governs sleep, wakefulness, hormone production, body temperature, and metabolic activity. Exposure to blue light during daylight hours helps signal alertness and suppress melatonin production, reinforcing a healthy sleep-wake pattern.

Clearly, blue light is not the villain it is sometimes portrayed to be. The question is not whether blue light is good or bad, but when, how much, and under what circumstances exposure occurs.



Note that our best coordination occurs around 2:30 pm, and our fastest reaction time comes an hour later, at 3:30 pm. By 6:30 pm our blood pressure is usually at its highest, and a half-hour later our body experiences its highest temperature. At 9:00 pm melatonin secretion begins, at 10:30 pm bowel movements begin to be supressed, and at 2:00 am our body experiences its deepest sleep. Our lowest body temperature occurs at 4:30 am, and around 7:30 am melatonin secretion ends. By 10:00 am we are experiencing our highest state of alertness, and on, and on…. Two things of interest to keep in mind, especially when we begin to explore the potential dangers of blue light: 1) While circadian rhythms are built-in and self-sustained, they are adjusted and affected by local environments and/or external cues, and 2) Melatonin is a hormone produced by the human pineal gland (a small gland in the brain) and it is the hormone that helps control the natural sleep and wake cycle.

So with all of these (and more) benefits of blue light, I guess we should expose ourselves to as much blue light as possible, right? The answer to that question is no, and if you listen to some opticians speaking to their patients, the dangers are right up there with the Bubonic Plague.

III Three Potential Concerns Related to Blue Light

The word potential is intentional and important. While blue light has been the subject of intense scrutiny, major professional organizations caution against overstating claims of permanent ocular damage. Current concerns related to blue light generally fall into three categories:

- Visual Strain and Fatigue
- Retinal Health and Age-Related Eye Disease
- Sleep Disruption and Systemic Effects

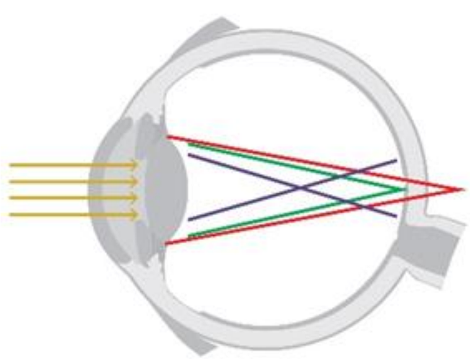
a. Visual Strain and Fatigue (Digital Eye Strain)

Most opticians are well acquainted with Computer Vision Syndrome (CVS), now more commonly referred to as Digital Eye Strain (DES). Symptoms include dry or irritated eyes, blurred vision, headaches, neck and shoulder pain, and general visual fatigue.

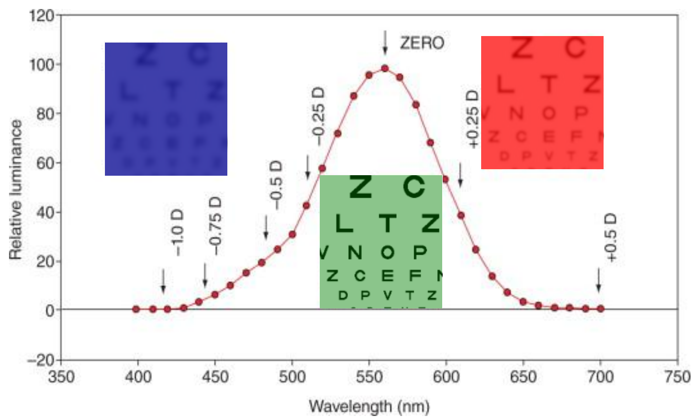
Blue light contributes to visual discomfort primarily for optical and perceptual reasons, not because it causes tissue damage. Blue wavelengths focus slightly in front of the retina and are processed less efficiently due to the relative scarcity of blue-sensitive cones, particularly in the fovea. This can increase glare, reduce contrast, and contribute to fatigue—especially during prolonged near-vision tasks.

Importantly, both the American Optometric Association (AOA) and the American Academy of Ophthalmology (AAO) emphasize that DES is driven primarily by how digital devices are used, including reduced blink rate, prolonged near focus, poor ergonomics, and inadequate breaks—not by blue light itself.

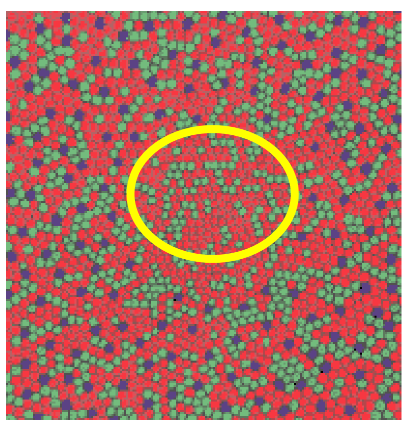
Now that I have that out of my system…one lesser-known fact about the symptoms of Computer Vision Syndrome (such as headache, back aches, neck strain, fatigue, etc.) is that they may be being caused by the one-two punch effect of blue light. Punch number one is that blue light is retinally out of focus. Punch number two is that blue light is not well processed by the eye. (See diagram below, left.)



First, consider that blue light is retinally out of focus. When white light enters the eye, green wavelength light comes into focus directly on the macula. Red light is slightly defocused hyeropically (less than +.50D) behind the retina, which has only a minor effect on vision. However, blue light is defocused myopically in front of the retina, up to -1.00D, which can have a significant effect on vision. This also contributes to what is normally referred to as chromatic aberration. If you think about that in terms of refraction, when a red-green balance test is performed, it should be about equal or a little into the green. So, in looking at an eye chart with red, green, or blue filters over them, the green-filtered chart will be clear, the red-filtered chart will be slightly out of focus, and the blue-filtered chart will be significantly out of focus. (See diagram below.)



`Second, consider that blue light is not easily or efficiently processed by the eye. There are 6-7 million color-sensitive cones concentrated in the macula, and most of those are tightly packed in the fovea. What is depicted in the photo below is a frontal color map view of the macula and fovea. The fovea is depicted in the center ring, and as you know, the fovea is responsible for our most intense, acute, and sharpest vision. When it comes to the cones, 65% are red, 33% are green, and only 2% are blue! Notice too, that there are no blue photoreceptors in the fovea. Therefore, due to this difficult-to-process, out-of-focus blue light, patients experience symptoms associated with glare and fatigue – something that is coming to be known as DES, or Digital Eye Strain.



b. Retinal Health and Age-Related Eye Disease

Laboratory studies have demonstrated that extremely high-intensity blue light can damage retinal cells in animal test subjects (usually mice, rats, or rabbits). However, both the AOA and AAO state clearly that there is no credible clinical evidence that blue light from digital devices causes permanent retinal damage or age-related macular degeneration (ARMD) in humans.

The American Academy of Ophthalmology has repeatedly stated that: "There is no scientific evidence that blue light from digital devices damages the eyes." (www.aao.org)

Similarly, the American Optometric Association acknowledges that while blue light can contribute to visual discomfort and circadian disruption, current evidence does not support claims that it causes structural eye disease. (www.aoa.org).

Sunlight remains the dominant source of high-energy light exposure, and cumulative lifetime exposure to ultraviolet (UV) radiation—not visible blue light—is the primary environmental risk factor for many ocular pathologies. This reinforces the importance of UV protection, particularly outdoors. That said, age-related changes such as reduced macular pigment and crystalline lens yellowing may influence how light is transmitted and perceived, which explains why some patients report greater sensitivity to glare and contrast issues as they age.

Although technically abour our pay grade, most ECPs (eye-care professionals) should be intimately familiar with ARMD, its causes, preventative measures, and common treatments. What may be less known is the role that HEV blue light can play.

Let's consider some misconceptions about light – more specifically UV (ultraviolet) and blue light. UV light is divided into three segments: A, B, and C. UVC (below 286 nm) is effectively filtered by the earth's atmosphere. UVB (286-320 nm) is what causes sunburn and snow blindness, but in terms of retinal damage is inconsequential since it is absorbed by the cornea. UVA (320-400 nm) is what is of most concern in that it is the radiation that is transmitted to the crystalline lens. According to information published by the American Macular Degeneration Foundation in January 2017, "Researchers have identified melanin as the substance in the skin, hair, and eyes that absorbs harmful UV and blue light. It is the body's natural sunscreen protection. By age 65, about half of the protection is gone, increasing susceptibility to eye disease such as macular degeneration." This is why it is critical for opticians to offer UV protection (especially as a patient ages) to help avoid things like a pinguecula, pterygium, cataracts, and ARMD. Consider also that in a 2016 Schepens Eye Institute report that "the blue rays on the spectrum seem to accelerate ARMD more than other rays of the spectrum." Take a few seconds to reread that last citation. The Institute recommends that eyeglasses protect against both UV and blue light. The 2017 article referenced above concludes that, "Recent studies suggest that the blue end of the light spectrum may also contribute to retinal damage and possibly lead to ARMD. The retina can be harmed by HEV [high-energy visible] radiation of blue/violet light that penetrates the macular pigment found in the eye." Where is this blue light present?

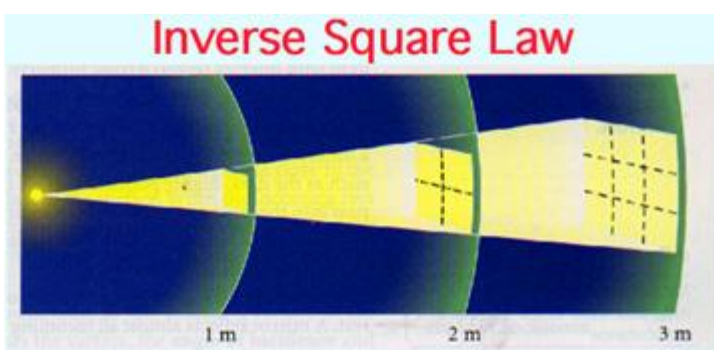
By leaps and bounds, the sun is still the strongest source of blue light. Early man had firelight, but that has a relatively low blue light emission. Eventually humans learned to put firelight in a jar, and we had lamp light. General Electric introduced Thomas Edison's incandescent light bulb to market in 1879. First introduced in 1939, flourescent bulbs were mostly used for commercial and manufacturing lighting, so most humans had little night-time exposure to it. In terms of humans' exposure to blue light things remained fairly constant until about 10 years ago. In 2007, the first iPhone was introduced. Three years later, in 2010, the first iPad became available. In 2014, a report by Cisco reported that smart phones and tablets actually outnumbered people on earth! Digital screens are a significant source of blue light. According to information published by Blue Light

Exposed in 2016, “Most of us spend the majority of our waking hours staring at a digital screen. Studies suggest thatin 2025, more than 60% of people spend more than six hours a day in front of a digital device.” Remember, that sources of blue light include the sun; digital screens that are found on TVs, computers, laptops, smart phones, and tablets; other electronic devices; fluorescent and LED lighting.

With all of this information becoming available to opticians, most have come to embrace the importance of offering some sort of blue-light protection to their patients. (Some of the actual products that can do just that will be presented later in this module.) But there is one demographic that we need to begin thinking about when it comes to UV and blue light protection. That demographic is chidren; and not just children who require visual correction -all children. The causes of ARMD are cumulative, so that protection against the harmful effects of blue light needs to begin at an early age. After all, many of the physiological structures that naturally protect us against light’s harmful effects are not fully formed until later in life. Additionally, when you consider their uses for gaming, social media, virtual reality, and school work, children are being exposed to massive amounts of blue light from these hand-held devices. This becomes even more problematic when you consider Harmon Distance, and The Inverse Square Law.

Our Harmon Distance is defined by visual and ergonomic researchers as the optimal distance for reading and other close-vision tasks. This is also sometimes referred to as the Elbow Distance, because for most people their Harmon Distance is equal to the distance from their elbows to their knuckles. (For an adult, the average Harmon Distance is about 16 inches; for children it can be 8 inches or less.)

The Inverse Square Law states that the intensity of a light source is equal to 1/distance squared that the light source is held. So that means the closer the light source is to our eyes, the more intense (and therefore more damaging) it becomes. (See diagram below.) Now let’s combine this information with the Harmon Distance. For an average adult the Harmon Distance is probably @ 16 inches; a young child on the other hand will have a much shorter Harmon Distance – perhaps 8 inches. Plugging those numbers into the Inverse Square Law you discover that for an adult 1/16” squared = 3.9 lx (light intensity), but for a child it would be 1/8” squared = 15.6 lx (light intensity). That’s four times the exposure!



The inverse square law applies to rays emitted from a point source. The same amount of light is spread out over a larger area and is therefore diluted.

c. Sleep Disruption and Systemic Effects

Just like the ear has two functions (hearing and balance), so does the eye (sight and sleep cycle). While most ECPs know that it is the rods and cones that enable sight, some are unaware that we have a second set of photosensitive cells called intrinsically photosensitive retinal ganglion cells which contain the photopigment called melanopsin. Melanopsin cells are particularly sensitive to the absorption of short-wavelength, blue visible light and communicate information directly to the area of the brain called the Suprachiasmatic Nucleus (SCN), also known as the central body clock in humans. It is exposure to blue light (or lack thereof) that regulates and resets our body's circadian rhythm. Remember, that melatonin is the hormone that helps us go to sleep. When our body is exposed to blue light (whether naturally from the sun, or unnaturally from hand-held devices) a signal is sent to the SCN that supresses secretion of melatonin, which in turn, stimulates wakefulness. Therefore, over exposure to blue light during the hours before we go to bed will make it much more difficult to go to sleep.

According to the National Sleep Foundation, sleep disorders have been linked to obesity, diabetes, heart disease, depression, stroke, and cancer. Additionally, sometimes when kids are tired they actually become hyperactive, which can sometimes lead to the misdiagnosis of ADHD (Attention Deficit Hyperactivity Disorder). In fact, according to WHO (the World Health Organization), night shift work is a known and probable carcinogen.

IV Products to Filter Optical Blue Light

Given what we now understand, the optician's role is not to promote fear, but to match products to patient needs. Blue-light-filtering lenses should be positioned as tools to improve comfort, glare control, contrast, and sleep hygiene, not as medical devices preventing retinal disease.Given all of the information we have learned to this point, one thing is clear: Doing nothing is the wrong thing to do in our role as an optician in Florida. After all, we are only licensed to protect the safety, health, and welfare of our fellow citizens. If we provide a pair of glasses that filters 100% of blue light (and the patient uses *only* that pair), problems especially related to the sleep cycle may occur. On the other hand, if we provide eyeglasses that do not address selective filtering of blue light, most of today's patients (who spend significant time exposed to blue-light emiting devices) will potentially suffer both short-term and long-term problems.

What follows is a list of 14 optical lenses and/or coatings that will address exposure to blue light. The products listed here represent only some of what is available today (December 2025), along with this author's opinion. By the time this module is published some of these products will have been discontinued and others will have found their way to the matketplace. My advice is this: Take in the information, do your own research, consult with your practice manager and prescribing doctors, find out what is available from your lab, and make your own decisions as to how you and your practice can best address this growing concern.

- **BluTech Lenses (VSP)**

Originally developed by VSP, BluTech is a lens material, not a coating. BluTech lenses block virtually all ultraviolet radiation and a very high percentage of high-energy visible (HEV) blue light. Because they significantly reduce blue light transmission and exhibit a noticeable amber appearance, they are generally not recommended as all-day, primary eyewear for most patients. However, BluTech lenses remain an excellent choice for second-pair, task-specific eyewear, such as computer glasses, gaming glasses, or glasses worn during late afternoon and evening device use. They are also a practical option for emmetropes seeking non-prescription blue-light-filtering eyewear. (www.blutechlenses.com)

- **VSP TechShield Blue (VSP)**

TechShield Blue is a near-clear anti-reflective coating offered by VSP. Rather than blocking all blue light, it is designed to selectively filter a portion of short-wavelength blue-violet light commonly associated with digital eye strain while maintaining good cosmetic appearance. The coating primarily reflects blue-violet wavelengths in the 400–455 nm range and reduces reflections from digital screens. As with most blue-light AR coatings, its primary benefits are visual comfort and glare reduction, not disease prevention. (www.techshieldar.com)

- **Coppertone® Polarized Lenses (Vision-Ease)**

Coppertone polarized lenses, manufactured by Vision-Ease, are available in classic sunglass colors including gray, brown, and green. Their primary purpose is sun glare reduction and UV protection, and like most polarized sunglass lenses, they inherently reduce some transmission of blue light—particularly outdoors. Claims of "two times more blue-light protection" should be understood in a relative, product-to-product marketing context, not as a medical benefit. These lenses are best positioned as sunwear solutions, not digital-device protection. (www.visionease.com)

- **Crizal® Prevencia (Essilor)**

Crizal Prevencia was one of the first widely marketed anti-reflective coatings designed specifically to selectively reflect blue-violet light while remaining mostly clear. It exhibits a characteristic purple-blue residual reflection, which should always be explained to patients prior to dispensing. Earlier Essilor marketing referenced laboratory findings related to retinal cell exposure; however, current professional consensus emphasizes that Prevencia's primary benefits are reduced glare and improved visual comfort, not prevention of retinal disease. Prevencia remains available but is now positioned within Essilor's broader Eye Protect System rather than as a standalone "protective" solution. (www.crizalusa.com)

- **DuraVision® BlueProtect (ZEISS)**

DuraVision BlueProtect is a blue-reflective anti-reflective coating from ZEISS designed to reduce reflections from digital devices by selectively reflecting short-wavelength blue-violet light. It produces a visible blue residual reflection and is best suited for patients who prioritize screen glare reduction and contrast enhancement. ZEISS has since expanded its approach to blue light management with newer in-material solutions (see ZEISS BlueGuard below). (https://www.zeiss.com/vision-care/us/eye-care-professionals/lenses/coatings-technologies/blue-light-coating.html)

- **BlueGuard Lenses (Zeiss)**

ZEISS BlueGuard represents a newer in-material blue-light filtering technology, reducing blue-violet light without reflective coatings. It provides a more cosmetic, durable solution and reflects the industry trend away from heavy blue reflections. (https://www.zeiss.com/vision-care/en/need-new-lenses/blueguard.html)

- **Hi-Vision® LongLife BlueControl (HOYA)**

Hi-Vision LongLife BlueControl is an anti-reflective coating from HOYA that selectively reflects a small percentage (approximately 10%) of blue-violet light while preserving lens clarity and durability. Its primary advantages include excellent scratch resistance, easy cleaning, and reduced surface reflections, with blue-light filtering presented as a secondary comfort feature rather than a medical necessity. (www.hoyavision.com) Note: HOYA now offers blue-light management integrated into select lens materials and designs, reducing reliance on reflective coatings.

- **SeeCoat Blue (Nikon)**

SeeCoat Blue is Nikon's blue-reflective anti-reflective coating designed for digital device users. It selectively reflects blue-violet wavelengths while maintaining high visible light transmission. Like similar coatings, its benefits are primarily related to glare reduction and subjective comfort during prolonged screen use. Availability may vary by lab and region.Availability may vary by lab and region. (www.nikonlenswear.com)

- **iBlu Coat™ (PGO Global)**

iBlu Coat is a blue-light-filtering anti-reflective coating developed by PGO Global. It is designed to reduce reflections from both the front and back surfaces of the lens and selectively filter blue-violet wavelengths. It is marketed toward professionals, students, gamers, and children. As with comparable coatings, its benefits are best described as comfort-oriented rather than protective against ocular disease. (PGO Global)

- **Retinal Bliss™ DES Coating (Quantum Optical)**

Retinal Bliss DES was an early blue-light-related AR product introduced by Quantum Optical. While it represented an innovative concept at the time, this product is now largely discontinued or no longer widely available and should be considered of historical interest rather than a current recommendation. It is included here primarily as an example of early industry response to digital eye strain concerns, and to allow ECPs to answer questions posed by clients.

- **Essilor Eye Protect System (Digital Protection Lenses)**

Introduced in 2016, Essilor's Eye Protect System incorporates in-material blue-violet filtering into many Varilux®, Eyezen®, Stellest® and Transitions® lenses using Smart Blue Filter™ technology. Unlike coatings that reflect blue light, this system selectively filters short-wavelength blue-violet light within the lens material itself while allowing beneficial blue-turquoise light to pass. This approach improves cosmetics and durability and reflects the industry's move away from strongly reflective coatings.

- **Shamir Glacier Blue-Shield UV / Shamir Blue Zero / Shamir Blue Sun**

Shamir Glacier Blue-Shield UV is a near-clear anti-reflective coating that selectively reflects a modest portion of blue-violet light (approximately 10% at 450 nm) while providing full UV protection and excellent cosmetic performance. Shamir has since expanded its blue-light strategy with Blue Zero™ (clear indoor lenses that selectively absorb blue-violet light) and Blue Sun™ (sun lenses combining blue-light management and outdoor protection). These products reflect a modern emphasis on selective filtering rather than wholesale blocking. (www.shamir.com)

- **Kodak Total Blue™ Lenses**

Kodak Total Blue lenses selectively filter blue-violet light while remaining clear and cosmetically neutral, aimed at improving comfort and contrast without exaggerated claims. (https://www.kodaklens.us/products/kodak-total-blue-lenses/)

- **Transitions® Lenses (Signature GEN 8 / XTRActive / GEN S)**

Transitions photochromic lenses provide variable blue-light filtering depending on lighting conditions. Indoors, Transitions Signature lenses block approximately 20–36% of blue-violet light, while outdoors they can block over 85%, along with 100% UV protection. These lenses are best positioned as all-purpose, lifestyle lenses that address both indoor screen use and outdoor sunlight exposure. (https://www.transitions.com/en-us/)

V Fact or Fiction?

Not just in the optical field, but when it comes to everything under the sun, it seems for every fact there is an "alternate fact." The best anyone can do is do as much of their own research, and while always keeping the patient's best interest at heart, make their own decision. And so it is with blue light. There is a faction in the optical community that believes that all the attention that has been given to blue-light protection (while not necessarily a hoax) has been blown out of proportion. With that in mind, here are some citations that fall on this side of the spectrum.

In the fall of 2020, staff writer Laura Newpoff conducted an interview that appeared in the Ohio State newsletter. She spoke with Phillip Yuhas, an assistant professor at the College of Optometry, and asked him, “whether they should buy ‘blue-blocking’glasses to protect their eyes from the light they see while staring at computers or smart phones all day.” Here is an excerpt from the rest of her article:

> “His answer, after years of interest in the topic, is no.
>
> Blue light has gotten a bad rap because it has a short wavelength, which translates to high energy. With so many people spending so much time with their faces fewer than 2 feet from computer or phone screens, companies have marketed blue-blocking lenses under the claim they can protect the delicate tissue that covers the back of the eye.
>
> The truth is, while laboratory studies have shown that prolonged exposure to blue light damages retinal cells in mice, studies on people have not yielded similar results. The difference? Humans have natural protective features that act as blue blockers.
>
> The marketing around the issue intrigued Yuhas as he completed his degrees at Ohio State and determined blue light isn’t a patient’s biggest concern.
>
> ‘The effect this has on your eyes typically comes from staring at the computer screen for long periods,’ Yuhas explains. ‘The blink rate drops while you’re on the computer and your tears evaporate, causing the surface of the eye to become inflamed.’
>
> He recommends taking 20-second breaks every 20 minutes to look at something about 20 feet in the distance, using lubricating eye drops and setting devices aside before bed to prevent sleep loss.
>
> ‘Read your favorite paperback instead,’ he says.
>
> Some other opinions:

¨ Blue light from computer screens will not cause eye disease. (*) So far, the evidence shows no meaningful link between blue light and damage to the human retinas or developing ARMD (age-related macular degeneration).” (***)

¨ Sleep can be improved without the use of special glasses. Simply decrease evening screen time and set devices to night mode.” (*)

¨ Avoid using screens one to two hours before going to sleep.” (***)

¨ DES (Digital Eye Strain) is not caused by blue light. The symptoms of DES (tired, burning, or itchy eyes; blurred or double vision; headache; sore shoulders, neck or back; increased sensitivity to light; difficulty concentrating; feeling you cannot keep your eyes open) are ALL linked to *how* we use our digital devices, not the blue light coming from them." (*)

¨ While using digital devices will not damage your eyes permanently, staring at them for a long time can cause discomfort. People experience eye strain in many ways, but common symptoms include dry eyes, blurry vision, tearing or watery eyes, and headache. The reason we get DES is that we blink less when we stare at our devices. Normally, humans blink about 15 times per minute, but this blink rate can be cut nearly in half when staring at screens or doing other near-vision tasks, like reading. To reduce eye strain:

- Take frequent breaks by using the 20-20-20 Rule. Every 20 minutes look away from the screen and look at an object 20 feet away for at least 20 seconds. (*)
- If you wear contact lenses, give your eyes a break and wear eyeglasses while working on the computer. (**)
- Reduce screen glare by using a matte filter screen. (**)
- Adjust room lighting and increase the screen contrast. (**)
- Use artificial tears to lubricate your eye when they feel dry.
- Keep your distance. Sit about 25 inches from your screen and adjust it so that you are looking slightly downward. (*)

Screen Time and Kids:

- **Attention-Related Disorders.** A study in Canada showed that children who spend more than two hours using devices were eight times more likely to develop ADHD (Attention Deficit Hyperactivity Disorder) than those with less screen time.
- **Obesity.** Too much screen time means less time spent on healthier, outdoor activities. This can lead to the risk of childhood obesity.
- **Myopia.** The number of people with myopia in the United States and Asia has risen sharply since the 1970s. Research suggests a link to kids spending more time on their screens and being indoors. The study provided evidence that more time spent on outdoor play in early childhood can slow the progression of myopia.
- **Guidelines.** While the AAO (American Academy of Ophthalmology) has no time guidelines for children, the American Academy of Pediatrics recommends:
    - No screen time for kids until they are two years old (except for video chatting).
    - No more than one hour of screen time for kids age two through five. (*)

(*) Daniel Porter: Reviewed by Ninel Z. Gregori. MD (Americana Academy of Ophthalmology – 10/10/2020)

(**) Celia Vimont; reviewed by Rahul Khurana, MD (American Academy of Ophthalmology – 4/27/2017)

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VI Key Take-Aways

- Keep an open mind.
- Remember blue light is both good and bad.
- Some blue light is essential to good health.
- Overexposure to optical blue light can cause many short-term and long-term problems including strain, ARMD, and sleep disruption.
- There are many products available to protect patients from the harmful effects of blue light.
- In an era of aggressive marketing, both the AOA and AAO urge eye-care professionals to distinguish between evidence-based guidance and overstated claims
- Since it is our duty to protect the health, safety, and welfare of our patients, it is important to understand and communicate the benefits and potential danger of blue light to them.

VII Bonus!

I know you thought you were near the end, and normally, I'd be saying here…good luck on the final assessment. Before I do say that, I want to share a BONUS with you…actually two BONUSES. Assuming that most of you want to begin to more actively promote blue-light protection, I want to give you two sets of questions that should help you be more effective doing just that.

Set # 1 is a set of questions you should be asking your patients to increase sales of blue-light protection:

1. How many hours a day do you spend on digital devices?
2. How 'bout your kids?
3. How often do your eyes feel tired, do they burn, get blurry?
4. How worse have headaches gotten?
5. Insomnia?
6. Tired in general?

I hope you noticed that most, if not all, of those questions are open-ended (questions that cannot be answered "yes" or "no.") They all require conversation to answer them.

Set # 2 is a set of questions you darn well better be ready to answer, when asked by patients:

1. Should I be worried about blue light?
2. Where does blue light come from?
3. Where do I mostly get exposed to it?
4. What kind of glasses should I get for it?
5. Do you wear glasses with blue-light protection?
6. What do ophthalmologists and optometrists say about it?

Hopefully, participating in this module will help you answer these questions more confidently and effectively.

So now I'll say it: Thank you for taking this course: The Dark (and Light) Side of the Blue - The Harm and Benefits of Blue Light. I'm sure you're going to do great with the Final Assessment. Good luck!

VIII 20-Question Final Assessment

1. Because it is sometimes associated with peace and harmony, the color blue was incorporated into the flags of:

a. The United States and Vatican City

b. The United Nations and the European Union

c. Russia and Hungary

d. Iraq and Iran

2. Indoors, Transitions Signature lenses block approximately what percentage of blue-violet light?

a. Between 5% and 15%

b. Between 20% and 36%

c. Between 40% and 56%

d. Between 60% and 80%

3. The average Harmon Distance for a child is approximately:

a. 2 inches

b. 4 inches

c. 8 inches

d. 12 inches

4. Human beings perceive blue light when viewing wavelengths between approximately:

a. 250–295 nm

b. 350–395 nm

c. 450–495 nm

d. 550–595 nm

5. BluTech lenses are best described as:

a. A lens material that significantly reduces blue-light transmission

b. A near-clear AR coating

c. A photochromic treatment

d. A polarized sunglass coating

6. Suppression of melatonin caused by evening blue-light exposure may result in:

a. Retinal cell damage

b. Difficulty falling asleep

c. Permanent vision loss

d. Improved night vision

7. Blue light is more difficult for the eye to process because:

a. It focuses slightly in front of the retina

b. There are relatively few blue-sensitive cones

c. The fovea contains little to no blue-cone concentration

d. All of the above

8. According to the American Academy of Ophthalmology, blue light from digital devices:

a. Has been proven to cause macular degeneration

b. Causes permanent retinal damage

c. Has not been shown to cause physical eye damage

d. Requires mandatory protective eyewear

9. Which of the following is NOT a recognized benefit of blue light?

a. Regulation of circadian rhythm

b. Support of alertness and mood

c. Improved visual acuity

d. Therapeutic use in certain medical treatments

10. Another term commonly used to describe the sleep/wake cycle is:

a. SAD

b. DES

c. HEV

d. Circadian rhythm

11. The visible light spectrum generally ranges from:

a. 100–300 nm

b. 380–700 nm

c. 700–1,000 nm

d. 1,000–3,000 nm

12. Hi-Vision LongLife BlueControl is produced by which manufacturer?

a. Hoya

b. Transitions

c. Essilor

d. VSP

13. TechShield Blue is manufactured by:

a. Essilor

b. Zeiss

c. VSP

d. Nikon

14. According to the National Sleep Foundation, sleep disorders have been linked to all of the following EXCEPT:

a. Obesity

b. Diabetes

c. Macular degeneration

d. Depression

15. Studies suggest approximately what percentage of people spend six or more hours per day using digital devices?

a. 45%

b. 65%

c. 75%

d. 90%

16. Approximately what portion of visible light is classified as high-energy visible (HEV) blue light?

a. One-third

b. One-quarter

c. One-half

d. Two-thirds

17. According to the Inverse Square Law, which Harmon Distance would result in the greatest light intensity at the eye?

a. 10 inches

b. 12 inches

c. 14 inches

d. 16 inches

18. As we age, the eye's natural protection against ultraviolet and blue-violet light:

a. Increases significantly

b. Remains unchanged

c. Gradually decreases

d. Becomes unnecessary

19. Approximately what percentage of cone photoreceptors in the human eye are red-sensitive cones?

a. 65%

b. 33%

c. 10%

d. 2%

20. Coppertone polarized lenses are primarily intended for:

a. Digital device protection

b. Indoor computer use

c. Sun glare reduction and UV protection

d. Night driving enhancement