Polarization

A Look at All the Choices Available to Patients and Eye-Care Professionals

(Optical Seminars Course # HS-07)

by

Anthony Record, LDO
Optical Seminars, Inc.
PO Box 5445
Spring Hill, FL 34611-5445
homestudy@opticalseminars.com

I Introduction:

This is a one-hour, home study course for Licensed Dispensing Opticians in Florida. We will cover the effects of ultraviolet radiation, and polarized lenses' role in protecting patients; explanations of how polarization works; availability of polarized ophthalmic lenses; different colors and their uses; the benefits of polarized sunglasses; indications and contraindications; creative ways to promote patient awareness; the role of polarized lenses in making us better opticians; and several Internet sites to continue your "Polarization Education."

II Course Objectives:

Upon completion of this course, a participating optician should be able to:

- Have a general, working knowledge of the historical roots of polarization and trace its developments to key moments in its growth in the ophthalmic industry.
- Discuss the "Fathers of Polarization" and their contribution to its development.
- Know exactly how polarization "works."
- More effectively explain the harmful effects of ultraviolet radiation to patients and customers.
- More effectively explain polarized lenses almost universal benefits to their clientele.
- Explain to patients which ophthalmic lenses are available in polarized form.
- Identify specific colors of polarized lenses and how each one is used in various outdoor activities.
- List standard indications and contraindications of polarized lenses.

- Practice new and effective ways of promoting polarized lenses in your practice.
- Use polarized lenses to become better, more effective opticians in general.
- Reference and access outside resources (including websites) for further study.
- Receive a minimum score of 75% upon completion of the 20-question assessment that appears at the end of this module.

III Course Material

Introduction

Ophthalmic polarized lenses are one of the most beneficial ocular aids optical patients can avail themselves of, and yet their utilization is embarrassingly low. In the United States, it is estimated that fewer than twenty percent of all people who wear prescription eyeglasses own a pair of prescription sunglasses. That is less than one in five! Less than half of that twenty percent use polarized lenses. Even more alarming, in a survey conducted a few In 2010, the Poynter institute discovered some alarming statistics:

- Only 33% of people said eye protection (UV filtering) was a crucial factor in choosing sunglasses.
- Just over 73% said they would wear sunglasses with UV protection.
- Only 38% of prescription eyeglass wearers have a separate pair of prescription sunglasses.
- 42% of respondents never wear sunglasses in the winter months.

In fact, going back a bit further, a survey conducted by VICA (Vision Council of America) in the 1990s, just over one-third (34%) of people responding to questions regarding eyeglasses and sunglasses claimed that they "were not aware" they could purchase sunglasses with their prescription ground into the lenses. If you do not think that is true, just think about the last time you saw someone walking through a mall or a flea market wearing a cheap pair of plano sunglasses over top of their prescription eyeglasses. Knowing that sunglasses are readily available in prescription form is one of those things that as an ECP (eye care professional) we take for granted. Clearly (at least with one in three of our patients), that is a mistake.

As of January 2022, the statistics are no more encouraging. The most recent statistics I could find (from 2018) from MES (Medical Eye Services) Vision Administrators states that of the more than 240 million Americans who need some type of vision correction, "3% wear prescription sunglasses *only*," and of those who wear prescription eyeglasses, "20% use eyeglasses and prescription sunglasses." It is my hope that the information and suggestions contained in this module will go a long way in drastically increasing the use of sunglasses in general and polarized lenses in particular, thereby seeing that more patients receive much-needed comfort and protection from the sun's harmful radiation and glare.

The History of Polarization

As I prepare for continuing education lectures for opticians and ophthalmic technicians, I am usually surprised by my research when it comes to the early origins of the ophthalmic products we discuss. For example, Henry Gowland and Owen Aves received patents for their invisible, progressively designed bifocals in the early 1900s. In 1893, a British scientist by the name of Dennis Taylor patented a way of artificially aging ophthalmic lenses to reduce reflections (the genesis of AR?) when viewing objects through them. Likewise, the same holds true for polarization – only its beginning goes even further back in time.

Icelandic sagas claim that the Vikings sailed from the coasts of Norway to Iceland and Greenland, and most likely beyond, to Newfoundland and other coastal areas of North America. This incredible feat happened as early as the 8th Century and well into the 1100s. Captains' logbooks that have survived make note of what we might loosely translate as the "annoying sea glare" they had to deal with on their arduous journeys. There is a description of crude experiments conducted with various rocks and crystals, to see which of them might help reduce or eliminate the glare. Quartz and calcite were used, as well as tourmaline and crystal cordierite, which can still be found as violet-blue pebbles off the coast of Norway. It has some dichroic (a substance that displays two distinct colors when viewed along different axes) properties and has a slight polarizing effect. It also has birefringent (the ability to split a light wave into two, unequally transmitted waves) properties. It is also thought that these rocks and minerals were used as navigational tools, since the magnetic needle compass had not yet made its ways from China to Europe.

Fathers of Polarization

Some five hundred years later at the University of Copenhagen, a Danish mathematician by the name of Rasmus Bartholinus (1625-1698) conducted some experiments and authored a 60-page report about his experiments with polarization and light.

Although he did not get it quite right, Sir Isaac Newton (1643-1727) also toyed with the idea of polarizing light in *Optics*, first published in 1704. A hundred years would go by before any other major treatises would appear on the subject. In 1801, Thomas Young (1773-1829) conducted what came to be known as his "double-slit interference" experiments. These studies seemed to prove that light behaved like "waves" by showing that light + light can equal darkness – a theory that is referred to today as destructive interference.

Surely, children would rather thank him for his invention of the kaleidoscope, but opticians remember him for his "angle." I am talking about Sir David Brewster (1781-1868), a minister in the Church of Scotland turned physicist and oculist who concluded that when light moves between two media with different indices of refraction, light which is polarized with respect to the interface will not be reflected at one incident angle (Brewster's Angle). Fast forward to the United States of America in the 1920s and 1930s.

Edwin Herbert Land (1909-1991) was born in Bridgeport, Connecticut and eventually studied chemistry at Harvard University. To a layperson, Land is most remembered as the inventor of instant photography (think Polaroid Corporation and the Land Instant Camera). Optical professionals, however, might rightly refer to Land as the *modern* Father of Polarization. It might make one feel a bit inferior to learn that Land invented his first thin sheet polarizer in 1928, at the ripe-old age of 19! He went on to receive 535 US patents (only Thomas Edison received more) as well as many foreign patents and trademarks.

Young Edwin had a specific idea in his mind as to how his polarizing sheets would make him a rich man; and it had nothing whatsoever to do with eyeglasses. Land was convinced that the automobile industry would embrace his new product with open arms. Such was not the case. Land thought that by polarizing the light emanating from automobile headlights, he would save lives. Nevertheless, his long struggle to convince the automobile executives to incorporate polarized light covers in their automobile designs was, in a word, unsuccessful. The problem created by oncoming headlights was obvious. Land wrote, “The night driver is faced with a constantly varying, but always substantial, hazard. At every meeting he is called upon to compromise between looking through the oncoming lights, watching the road center for possible sideswipe, or concentrating on the right edge to avoid the road shoulder or a pedestrian…the result is fatigue, annoyance, and discomfort.”

The car companies were initially interested and encouraged Land for a couple of decades. Finally, in the mid-1940s he dropped the idea – for two reasons: Wider divided lanes of opposing traffic lessened the inherent dangers of the on-coming lights, and it was cheaper to devise the still-used system of high and low-beam headlights. They were also worried about further government regulations.

By 1934, Land had dubbed his revolutionary polarizing sheet “Polaroid,” and had begun to consider ophthalmic applications for his invention. Three years later, in 1937, Land pitched his idea to executives at American Optical (the largest optical company in the world at the time). His demonstration was simple, yet powerful. Land arranged a meeting at one of Boston’s hotels, where he explained the whole concept of polarization to the AO executives. On a table in the room, he had placed three fishbowls filled with goldfish. At just the right time, Land opened the draperies, allowing bright sunlight to stream through the fishbowls. He then posed a few questions to his prospective investors: “How many fish do you see in that aquarium? What color is the gravel in that one?” Of course, because of the blinding glare they could not discern the correct answers. Land then distributed makeshift polarized sunglasses he had created. Everything was now clear. The glare was gone. The rest, as they say, is history. AO soon began to manufacture plano, polarized sunglasses. Although there were shortcomings in the first polarized sunglasses (delamination, compromised optics in the horizontal plane, et al), and despite their exorbitant selling price of six dollars, they were extremely popular.

Before his death in 1991, Edwin Land had made great strides in the fields of polarized ophthalmic lenses, instant photography, and high-altitude military surveillance. Many of his inventions are still in use today. He was a brilliant, creative inventor. He once said, “My whole life has been spent trying to teach people that intense concentration for hour after hour can bring out in people resources that they didn’t even know they had.” I think optical professionals can take a lesson from that insightful quotation.

How Does Polarization Work?

Light waves composed of electromagnetic energy. The size of the wave is measured by *wavelength*. The wavelengths of the light we can see with our naked eye range from 400-700 nanometers. (A nanometer is one-billionth of a meter.) The amount of energy in a light wave is proportionally related to its wavelength. The shorter the wavelength, the higher the amount of energy. Of visible light, violet has the most energy; red has the least. Just above the visible light spectrum is ultraviolet (UV) light. The sun is the greatest source of UV light. If UV light is not filtered properly, it can damage your skin, cornea, and retina. We will discuss UV, its harmful effects, and how to present this information more effectively to patients in the next section.

The brightness and intensity of light is measured in *lumens*. Artificial indoor lighting (whether incandescent or fluorescent) ranges between 400-600 lumens. If you go outside on a sunny day, you will experience @ 900 lumens in the shade to nearly 6,000 lumens reflected off concrete or asphalt. Every person is different, but most people begin to feel discomfort somewhere between 3,000-4,000 lumens. When brightness reaches the 4,000 lumens level, our eyes have difficulty absorbing and dealing with the light – regardless of whether it from a direct source (like the sun) or a reflected source (like the road). What we will begin to experience are flashes of white, which is called *glare*. Without proper protection (quality sunglasses and/or a wide-brimmed hat), all we can do to deal with this annoying glare is squint. When brightness approaches 10,000 lumens, your eyes will automatically block out the light. Prolonged exposure to light at this level can cause damage and could cause temporary, and in some cases, permanent blindness. That is why viewing a wide snowfield on a bright day without proper eye protection, sometimes results in snow-blindness.

Unless otherwise affected, in a normal situation, light waves vibrate and travel in all directions. When this happens, the light is described as *unpolarized*. When the vibrations of light become suppressed, the light is described as being *partially polarized*. If the vibration is restricted to a single plane, it would be called *plane polarized*. (Remember, as the Vikings discovered, some naturally occurring crystals such as quartz, calcite, and tourmaline can partially polarize light.)

When direct sunlight (unpolarized) is reflected off bright, flat surfaces such as water, concrete, hot asphalt, wet roads, windshields or trunks of cars, it may become partially or completely polarized. Surfaces that produce polarized light best are referred to as *dielectrics*. The light that is reflected from a dielectric is completely polarized at a specific angle (Brewster's angle of incidence). The most effective way to eliminate the glare from horizontal dielectrics is with polarizing filters that are present in polarized sunglasses. By absorbing the reflected light rays produced by the glare, and transmitting useful light from the ambient scene, protection and comfort occurs.

Some people find the principle of polarization best explained using the analogy of a Venetian blind (Figure 1A). For example, think of the polarizing lens filter as a Venetian blind, with the blinds oriented so that the light rays in the vertical meridian (which come from the horizontal dielectric surfaces) are blocked. Sunglass wearers are mostly concerned with these horizontally reflected light rays. That is why the positioning of the polarizing filter within the ophthalmic lens and subsequently the frame, is critical to the efficacy of the finished, polarized sunglass. This is the responsibility of the lab professional, and with intense quality control at most reputable manufacturers, this issue should not be a practical concern for front-line opticians.

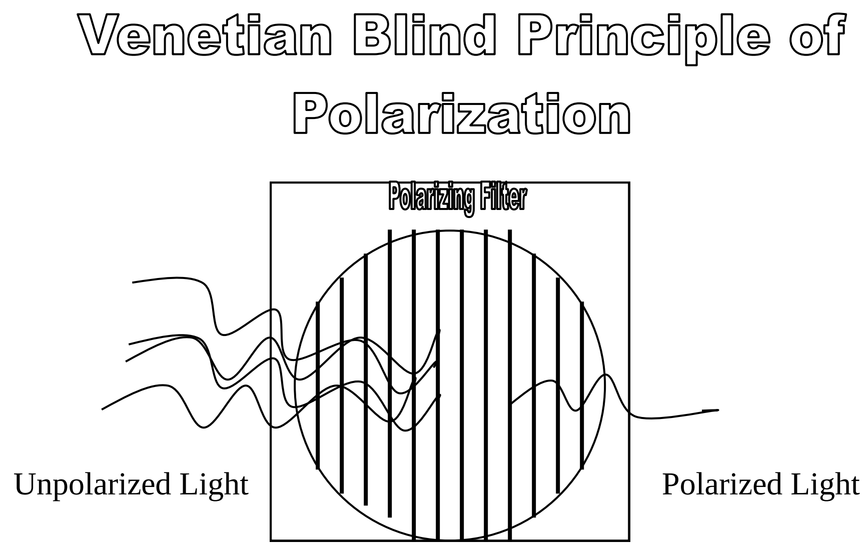


FIGURE 1A

Polarized lenses can do more than eliminate surface glare. Imagine you were standing on the beach, close to the shore, on a calm day. The sun is shining so brightly that all you can see is a bright, glass-like surface on the water, with no detail, no contrast, and little color recognition. As you place your polarized sunglasses onto your face, you now see a completely different scene. You see more detail. The sea now appears richly blue-green. You can see much more contrast. The waves have more texture. You may also be able to see 3-5 feet down into the water. Not only do the polarized sunglasses eliminate glare and protect you from harmful ultraviolet radiation, they also have provided overall better visual quality. Interestingly, the polarizing film itself does not filter much UV. That is why UV inhibitors are added to ophthalmic lenses - so that the finished, polarized sunglass product filters out 100% ultraviolet.

Ultraviolet Radiation and High-Energy Visible Light

The sun is the greatest source of harmful UV radiation in our environment. The sun provides visible light, heat, and ultraviolet radiation. Visible light consists of the colors of the rainbow (think R-O-Y-G-B-I-V – red, orange, yellow, green, blue, indigo, and violet). The UV spectrum is divided into three parts, which have been dubbed UVA, UVB, and UVC. This classification is based on their respective wavelength. They differ also, in how they can adversely affect our skin and eyes. Remember, the shorter the wavelength, the more harmful the UV radiation. However, the shorter the wavelength the more difficult it is for the UV to penetrate the skin and cornea.

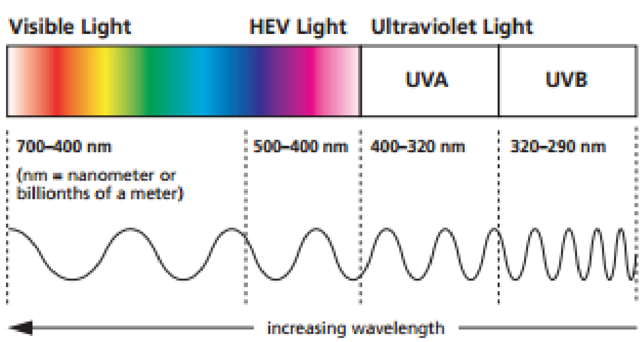
It is important for opticians to realize that the harmful effects of UV exposure are cumulative. That is why we should stress proper sunglasses to children. Their eyes are very susceptible to the sun's UV rays, because they have not fully developed their natural filtering capabilities. We also need to communicate to our patients that even on hazy, overcast days they are in danger from UV. Additionally, lighter-eyed people have less pigmentation and are in greater danger than dark-eyed people are.

UVA Radiation: The relatively long-wavelength (400-320 nm) UVA accounts for nearly 95% of the UV radiation that reaches the Earth's surface. It is absorbed mostly within the cornea. Until recently, it was thought that UVA could not cause any lasting damage. Recent research, however, suggests that UVA in fact, does enhance the damage done by UVB. UVA rays are closer to visible light rays and can easily pass through the cornea and reach the lens. Overexposure to UVA is linked to cataracts and macular degeneration.

UVB Radiation: Medium-wavelength (320-290 nm) UVB rays are the most worrisome. They burn the skin and damage the eyes. These (along with residual effects of UVA) are considered a major cause of cataracts, macular degeneration, eyelid cancer, and other skin cancers. Too much exposure to UVB rays can also cause premature wrinkling and aging of the skin, including around the eye. UVB (at 300nm) is roughly 600 times more biologically effective at damaging ocular tissue than UVA.

UVC Radiation: On the one hand, these short-wavelength (290 -100 nm) rays are technically the strongest. On the other, they are not a practical problem because they are absorbed by the upper atmosphere and do not reach the Earth's surface.

HEV (High-Energy Visible Light): According to the latest research from engineers at Coppertone, "Some of the latest eye research has implicated HEV light – high-energy visible light in the violet/blue spectrum – as a contributor to the development of cataracts, macular degeneration and other serious eye maladies. HEV falls into the near-UV range, from almost 400 to over 500 nm in the visible spectrum. *Blue light,* roughly between 440 and 490 nm within the HEV spectrum, can damage the *retina over time, leading to macular degeneration. The retina is the ocular membrane where images are formed and transmitted to the brain; the macula, the region of sharpest vision located near the center of the retina, is the most likely area to be damaged." The chart below illustrates this phenomenon:



Their researchers continue, "The fairer your skin, the greater your age, and the lighter your eyes, the higher your long-term risk of sun damage to your eyes, especially if your work or recreation involves prolonged sunlight exposure. Light eyes are at increased risk for skin cancer and some eye diseases because they contain less of the protective pigment melanin. According to the National Cancer Institute's SEER database, an estimated 2,390 men and women were diagnosed with, and 240 died from, cancers of the eye and orbit in 2008. With their thin and delicate structures, and greater lifetime exposure to the sun than any other part of the body, the eye and surrounding areas are particularly prone to cancers. The reality is that *all of us* are susceptible to eye and eyelid cancers or other damage from the sun, and we need to find ways to help protect ourselves on a daily basis, because the damage keeps adding up over time."

Polarized Lens Availability; Colors

Polarized lenses are available in a vast array of ophthalmic choices, including:

- Single Vision: glass, CR-39, photochromic CR-39, mid-index, high-index, polycarbonate
- Progressive Lenses (many designs): glass, CR-39, mid-index, high-index, polycarbonate
- FT-28: glass, CR-39, polycarbonate
- FT-35: CR-39, high-index
- 7x28 Trifocals: CR-39, glass, mid-index, high index
- 8x35 Trifocals: CR-39, mid-index, high index

Some opticians are surprised to discover that polarized lenses are available in a rainbow of colors. The following colors are available, and their indications explained:

- **Gray C** reduces the maximum amount of visible light and provides the truest amount of color recognition. Good for bright, sunny days and heavy glare conditions. It is mostly indicated for driving, deep-sea fishing, and general overall use. It is the most popular color for polarized lenses in the United States.
- **Gray A** is a lighter shade of Gray C. It transmits colors evenly and allows for true color recognition. It is good for partly sunny, cloudy days. This lens can be used as a 'base' lens, meaning that it can be tinted to other shades.

- **Brown C** provides maximum contrast, and therefore can improve visual acuity and depth perception. Like Gray C, it is good for bright, sunny days and varying conditions. Reduces blue light and is good for driving, golfing, and fishing in shallow water.

- **Brown A** is a lighter shade of the Brown C. It improves contrast and depth perception. It is also good or partly sunny, cloudy days. This lens can also be used as a 'base' lens.
- **Yellow** provides the maximum amount of light transmission of any color of polarized lenses. It increases contrast and filters out some blue light. It is used in low light conditions such as overcast or cloudy days. It is popular among shooters, hunters, and people who drive at night.
- **Melanin** blocks high amounts of blue light but maintains true color perception. Melanin provides high contrast for better visual acuity and is good for bright, sunny days. It is great for golf, driving and fishing. People who suffer from macular degeneration report good results with melanin colored lenses.
- **Orange** increases contrast and effectively blocks blue light. It is best in overcast and partly cloudy conditions. This color is often used by clay target shooters, hunters, bikers, and skiers.

- **Red** is one of the most vibrant polarized colors that are available. It effectively increases contrast and is advised for fishing in early morning or late evening hours. Sometimes it is used for hunting and skiing.
- **Violet** increases contrast and softens certain backgrounds. It is sometimes used by shooters in bright conditions. It is sometimes used by skiers, snowboarders, and golfers.
- **Blue** is used in partly cloudy to sunny conditions. It is good for tennis, golf, snowmobiling, and shooting at green targets. Blue lenses let in the maximum amount of blue light.
- **Green** has slightly better contrast than gray colors but is not considered a high-contrast lens. Green provides good color balance and is a good choice for varying light conditions. It is sometimes used for tennis, driving, and golf. Some people prefer green as an all-purpose color.

Although most opticians would prefer their patients to have a second, separate pair of prescription sunglasses (preferably polarized), only 10-15% of prescription eyeglass wearers own prescription sunglasses. Therefore the next best thing might be Transitions®. According to their own promotional materials, "Combining the benefits of light-intelligent lenses and variable polarization, Transitions® Vantage® lenses are ideal for those looking for crisper, sharper vision outdoors. Transitions Vantage lenses offer the best of both worlds - light intelligent lenses with the added benefit of our Trans-Polarizing™ process. This means that as Transitions Vantage lenses polarize and get darker, vision becomes crisper, sharper, and more vivid, while glare is reduced even in the brightest sunlight." Transitions lenses effectively filter UV rays, and help with the reduction of blue light. (Issued surrounding the filtering of blue light is addressed in other modules.)

Due to the ever-changing availability of all ophthalmic lenses, it is best to check with your lab to obtain a list of currently available lenses.

Indications and Contraindications

It is not an overstatement to say that, in terms of *indications* for polarized lenses, we could say, "everything." Men or women, young or old…everyone would benefit from owning and using a quality pair of polarized sunglasses…unless they wouldn't - in other words, unless there is a SPECIFIC *contraindication* (a reason not to use them). Here is a list of possible contraindications:

1. Pilots
2. Snow Skiers
3. Water Skiers
4. Avid hikers/naturists
5. People who use certain LCD equipment
6. People who will be annoyed by the effects of cross-hatching

Pilots and other people who must read certain equipment with LCDs (lighted crystal displays) should at least be wary when it comes to polarized lenses. Some of the output on older LCDs becomes partially or totally obscured by polarized lenses. However, do not simply dismiss out-of-hand polarized lenses for pilots. Some pilots prefer several pairs of eyeglasses in the cockpit to utilize during changing weather and environment. Pilots are generally more sophisticated and understand the way polarization works. And it would also serve an optician well to remember that the busiest pilot still drives a car more than he or she flies a plane!

Snow skiers sometimes prefer polarized lenses, but some do not; ironically, for the same reason: because they *do* block glare so effectively. Why some skiers would like them is obvious, why they may not like them is not quite so obvious, but it is because with the surface glare gone, it makes it much more difficult to "read" the terrain. The moguls (dips, crevices, etc.) become almost invisible, creating difficult and sometimes dangerous conditions. The same concern exists for serious water sports enthusiasts who need to discern the "terrain" of the ocean surface.

Avid hikers and naturists are sometimes annoyed by polarization because it eliminates the spectacular views created by nature when there is an image of a mountain, tree, or sunset that is reflected in a body of water. Polarized lenses would compromise that image. Photochromic lenses, such as Transitions, might be a better choice for someone hiking in variable lighting condition.

Additionally, ECPs should educate new wearers about cross-hatching. Cross-hatching is a noticeable visual phenomenon associated with polarized lenses. It does not interfere with vision through the lens; rather, it is a unique property of polarized lenses. Cross hatching is seen in the side (and sometimes rear) windows of automobiles as a crosshatch pattern in the glass. These windows are tempered for safety reasons, which induces stress in the glass that shows up as a strange pattern when viewed through a polarized lens. (Cross-hatching is not seen in windshields, as they are laminated.) This same principle of revealing stress with polarized lenses has been used in optical labs for years for revealing stress in mounted glass lenses. The AO Polariscope Instrument relies on two polarized lenses to reveal unwanted stress in rimless mountings or frames. The instrument is also used to verify that glass lenses have been heat-treated for impact resistance.

Promoting Polarized Lenses in Your Practice

Major lens manufacturers (e.g. NuPolar, KBCo., Essilor, etc.) of polarized ophthalmic lenses offer effective display units to demonstrate the efficacy of polarized lenses to your patients. One of the most dramatic units displays a vibrant color photograph of an autumn scene filled with leaves that are changing color. A bright fluorescent light shines on a pane of glass above the photograph, causing it to be obscured by the person viewing it. A lorgnette of polarized lenses placed in front of the patient's eyes dramatically revealing the scene. If performed correctly, the patient is highly motivated to purchase polarized sunglasses – and that is what it is all about.

Think about a few things: First, why do states require licensing and continuing education of its opticians? The legislative findings of the State of Florida say it all: "We find that the practice of opticianry by unskilled or unprofessional people pose a threat to the general safety, health, and welfare of our citizens." Second, in a recent poll (2014) of nearly 800 opticians, over 95% said they believed that protection against harmful UV rays and glare were important considerations for their patients. Just over 85% said they believe polarized sunglasses were the optimum choice. However, fewer than 19% said that when working on the front lines they presented sunglasses as an option to their patients during every encounter. What a startling disconnect!

By not presenting polarized sunglasses as an option to our patients, we are depriving them of the vital protection they need. This is unconscionable. I believe that this disconnect (85 %

believe…only 19% present…) also creates a major source of stress and job dissatisfaction for an Eye Care Professional – deep down we know that by not educating our patients on sunglasses in general, and polarized sunglasses in particular, we are doing a huge disservice to our clientele.

One easy yet effective method of increasing patient education and exposure to lenses is to use every opportunity that presents itself. For example, how many times a day are we asked to perform a minor adjustment, replace a screw, or restring a rimless lens? Dozens! Usually as we hand the repaired/adjusted glasses back to the patient, they will ask, "how much do I owe you?" The standard response from an optician is something like, "No-charge…glad to help…come back and see us when you need a new pair…" Instead of that response, when asked, "What do I owe you," how about replying, "Two minutes of your time!" That's when I explain that I simply wish to show them the cool new sunglasses that virtually eliminate all surface glare. Then I lead them to the display unit and watch as they are amazed. (I have done this type of thing thousands of times, and NOT ONCE has a person refused to watch the demo. They feel like they do owe me something for my time and expertise, so they cooperate.) This M.O. (method of operation) has led to hundreds of impulse buys, providing a mutual benefit – they receive quality, protective eyewear; I increase profit, job satisfaction, and reduce stress. That sounds like a win-win proposition for everyone involved.

Here is yet another idea: Years ago I attended a continuing education seminar conducted by industry veteran, the late Bob Bieber. Bob claimed that if an optician would simply ask every patient one question every time he initially wrote up a sale, and then repeated the same exact question upon delivery of the glasses, that sunglass sales would increase by 38%! The magical question is: "When will you be updating your sunglasses into your current prescription?" There is a lot going on in that question. First, it presumes two things: 1) They have a pair of prescription sunglasses already, and 2) It is just a matter of *when*, not *if*, they will be doing an update. Second, it provides an opportunity for the optician to be APPALLED if the answer is in any way negative. Try it. You will be amazed by your success.

Although I mentioned it in passing earlier, there is one patient demographic that most opticians overlook and simply do not even think about promoting sunglasses when helping them. I'm talking about children. Remembering that the harmful effects of UV are cumulative, and realizing that children are generally in the sun more than most adults, they are ideal candidates for polarized sunglasses. However, be aware that many school districts do not allow sunglasses in their schools. If this is the case where you live, consider offering Transitions (which *are* usually allowed) as a viable alternative.

As of 2018, a growing concern is over exposure to high-energy visible blue light. While much attention is on the potentially harmful blue light emitted by hand-held devices, the greatest source of blue light is the sun. In fact, if you are serious about protecting your patients from the harm of blue light, remember that their exposure to blue light from the sun is likely 100 times greater than their exposure from all their electronic devices combined! Be sure to consult the scientific specifications of the sunglass lenses you prefer, but remember a few things: First, while blue light *may* be harmful to retinal cells, the body needs it for other functions (for example, sleep regulation). Second, all things being equal, a brown sunglass tint will block more blue light than any other color. Finally, although a second pair of sunglasses is the goal, remember that Transitions lenses also block some blue light. According to information found on the Transitions website in November 2021, the recently released Transitions VIII lenses block @ 20% of blue light indoors, and 85% outdoors. Likewise, the Transitions XTRActive lenses block 34% of blue light indoors and 88% outdoors.

Here is one last idea for effective polarized marketing: Do a little, old-fashioned lifestyle dispensing. Ask a patient about his/her hobbies: “What do you like to do for fun?” Fashion your response based on theirs. For example, if he says, “I like to fish as much as I can,” drag them over to the polarized display saying, “Great! Let me show you these new fishing lenses we have.” If she says, “I play tennis three times a week,” drag them over to the polarized display saying, “Great! Let me show you these new tennis lenses we have.” If he says, “I’m on the senior YMCA softball team,” drag them over to the polarized display saying, “Great! Let me show you these new softball lenses…” You get the picture.

Good luck. Have some fun - and enjoy your success!

Outside Resources for Further Study

- *www.polarization.com*
- *www.physicsclassroom.com/class/light/lesson-1/polarization*
- *www.allaboutvision.com/sunglasses*
- *Fundamentals of Physics* by David Halliday, et al (Wiley, 2013)
- *Light: The Visual Spectrum and Beyond* by Megan Watzke and Kimberly Arcand (Black Dog and Leventhal Publishing, 2015)

IV Final Assessment

1. Having first developed the idea of polarized lenses, who is known as the modern father of polarization?
    a. Joseph Polar
    b. Edwin Polaroid
    c. Edwin Land
    d. Bausch & Lomb

2. Polarized sunglasses were first manufactured by:
    a. Bausch and Lomb
    b. American Optical
    c. Essilor of America
    d. Serengeti

3. It might be said that the initial success of polarized lenses owes it all to:
    a. A goldfish
    b. A Guinea pig
    c. A hamster
    d. A puppy

4. One of the earliest and greatest problems with polarized lenses were:
    a. Significantly superior optics
    b. Marketing budgets
    c. Delamination
    d. Low cost involved in production

5. Delamination is no longer an issue today because:
    a. Manufacturers offer a money back guarantee
    b. The incidence of delamination is less than 5%
    c. Polarization is ground into the lens
    d. Lenses are molded around the polarization film

6. Some of the latest research suggests that in addition to UV exposure, this may also contribute to cataracts, macular degeneration and other ocular maladies:
    a. High-Energy Visible (HEV) light
    b. Poor nutrition
    c. Uncorrected presbyopia
    d. Using crown glass lenses

7. The greatest source of HEV blue light is:
    a. Sun
    b. Computers
    c. Television
    d. iPads and iPhones

8. Most polarized lenses are made with what shade?
    a. Gray A
    b. Gray C
    c. Brown A
    d. Brown C

9. A and C designates what characteristic of polarized lenses?
    a. Color
    b. Darkness of color
    c. Thickness
    d. Weight

10. Polarized lenses are available in all segment styles except:
    a. Progressive
    b. FT-35
    c. 8x35 trifocals
    d. Executive

11. Polarized lenses are available in:
    a. Glass, polycarbonate, CR-39, and high-index
    b. Transitions Gray and Brown
    c. Transitions Green
    d. Trivex and Tribrid

12. The most effective color in blocking blue light is:
    a. Red
    b. Orange
    c. Blue
    d. Violet

13. A highly effective night driving lens would include:
    a. Green, polarized lenses
    b. Gray A, polarized lenses with a progressive bifocal
    c. Pink, polarized lenses
    d. Yellow, polarized lenses with a backside AR coating

14. The phenomenon of seeing car windows with slight aberrations or distortions through polarized lenses is known as:
    a. Cross viewing
    b. Cross hatching
    c. Hatchinization
    d. Cross breeding

15. LCD displays that are obscured or distorted by polarization can easily be viewed if:
    a. The glasses are completely rotated 180 degrees
    b. The wearer tilts his 90 degrees opposite the display
    c. The wearer slightly tilts his head 10-15 degrees
    d. The wearer tilts her head @ 45 degrees.

16. A substance that displays two different colors when viewed along different axes is said to be:
    a. Diatonic
    b. Dichroic
    c. Bilateral
    d. Bipolar

17. The wavelengths of light we can see with our naked eye range between:
    a. 400-700 nanometers
    b. 600-900 nanometers
    c. 800-1,100 nanometers
    d. Under 400 nanometers

18. We begin to feel discomfort as brightness approaches:
    a. 1,000 lumens
    b. 3,000 lumens
    c. 5,000 lumens
    d. 10,000 lumens

19. According to the latest statistics cited in this module, about what percent of people who wear prescription sunglasses also own/wear prescription sunglasses?
    a. 10 %
    b. 20 %
    c. 30 %
    d. 40 5

20. If light rays are otherwise unaffected, they travel in all directions. This light is said to be:
    a. Plane polarized
    b. Fully polarized
    c. Unpolarized
    d. Polarized