Ultraviolet (UV) Radiation and the Eye: Complete Protection Requires Blocking Both Transmission and Backside Reflection

Research shows that effective protection from the serious hazards of ultraviolet (UV) radiation requires that all lenses (clear, photochromic, and tinted/polarized) protect wearers from both transmitted and reflected UV.

Chronic exposure to the ultraviolet (UV) radiation has been implicated in a number of serious ocular diseases, including pterygium, cataract, and climatic droplet keratopathy; and research has uncovered unexpected risks to the eyes. Unfortunately, the public remains dangerously under-informed about the nature and degree of this risk as well as the circumstances in which eye protection is most necessary.

Unexpected Risks

Research has shown that the time of maximum risk for UV damage to the eyes is very different from the time of maximum risk to the skin. Risk to the skin is greatest when the sun is highest in the sky—ie, at solar noon and on the summer solstice (June 21st).

But because the eyes are deep set in the orbit, they are partially protected when the sun is high in the sky; so direct ocular UV exposure is greatest when the sun is somewhat lower in the sky. For spring, summer, and fall, maximum ocular UV exposure occurs between 8:00AM and 10:00AM, and between 2:00PM and 4:00PM.[1] The danger is, these are not the times that people are most likely to wear sunglasses.[1]

Side and Back Exposure

Even when the sun is high in the sky, the eye is exposed to a significant amount of UV that is scattered by clouds or reflected by surrounding surfaces (Figure 1). This indirect radiation is responsible for nearly half of the UV we receive.[2]

Most higher-quality sun, photochromic, and clear spectacle lenses effectively block the transmission of UV, so UV coming from in front is not usually an issue for people wearing glasses. But eyes still need to be protected from the significant amount of UV that is reflected off the backside of all lenses (Figure 1).

Measuring Protection

ANSI standards for UV blocking are designed for sunglasses and are based solely on how much perpendicularly incident UV passes through the lens; they do not take into account the substantial amount of UV that comes from the side or is reflected off the backside of the lens. Nor are they applied to everyday use lenses, where UV protection is equally, if not more, important.

Research by Karl Citek, OD, PhD, has found that while lenses treated to be No-Glare (or antireflective) transmit almost all of the visible light spectrum, they actually reflect up to 50% of the incident UV.[3] So even lenses that block its transmission can reflect UV into the eyes when the source is not directly in front of the wearer.[3,4]

With this important information in mind, a global index, the Eye-Sun Protection Factor (E-SPF®), was created. Like the index used in the skin care industry, it measures the degree of eye protection provided by a lens. Unlike transmission data alone, however, the E-SPF measures eye protection by integrating reflected UV data with transmission data (see box).

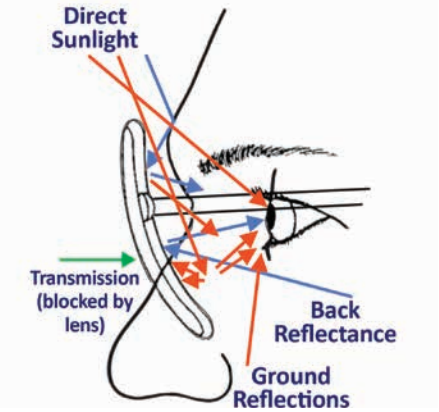

FIGURE 1 Note that UV blocking can effectively eliminate transmission through the lens, but UV can still enter the eye from the side or by reflection from the backside of the lens. (*Image adapted from:* Sliney D, Photoprotection of the eye—UV radiation and sunglasses; 2001.)

What Patients Need

Knowing what we now do about sources of UV exposure, it becomes apparent that for the most complete protection, everyday clear lenses and sun lenses must offer UV protection from both transmission and reflection. To address this need, all Crizal® No-Glare lenses have been engineered to reduce UV reflection from the backside, for a lens that truly maximizes UV protection.

The Eye-Sun Protection Factor (E-SPF®)

The index utilized for skin care and sunscreen products in the skin care industry, tells consumers how well a sunscreen protects skin from UV; but although UV protection is as important for the eyes as it is for the skin, we have no similar system to compare the total UV protection of different lenses. Aiming to develop an index for eyewear similar to the index for sunscreens, Essilor scientists, in conjunction with an independent third party expert, have created the Eye-Sun Protection Factor (E-SPF®).

By incorporating measurement of both UV transmission and backside reflection, the E-SPF provides a simple but effective way to grade the protection offered by a lens. Higher values of E-SPF indicate greater levels of protection against damaging UV.

REFERENCES

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