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OCULAR ULTRAVIOLET RADIATION HAZARDS IN SUNLIGHT POLICY STATEMENT

Introduction

Ultraviolet (UV) radiation comprises invisible high energy rays from the sun that lie just beyond the violet/blue end of the visible spectrum. More than 97% of UV radiation is absorbed by the anterior structures of the eye, although some of it does reach the light-sensitive retina.

There are good scientific reasons to be concerned that UV absorption by the eye may contribute to age-related changes in the eye and a number of serious eye diseases. Protection can be achieved by simple, safe and inexpensive methods such as wearing a wide brimmed hat and using eyewear that absorbs UV radiation.

What part of the UV radiation is harmful to the eye?

Ultraviolet radiation in sunlight is commonly divided into two components: UV-B represents the short wavelength radiation (280 to 315 nanometers) that causes sunburn and predisposes to skin cancer, and the UV-A (315 to 380 nanometers) radiation that causes tanning and may contribute to aging of the skin and skin cancer.

Clinical experience and evidence from accidents and experimental studies show that UV-B is more damaging, presumably because it has higher energy. Most of the UV-B is absorbed by the cornea and lens of the eye and can cause damage to these tissues. The retina may also be damaged if exposed to UV-B. UV-A radiation has lower energy, but may also cause injury. Sunlight contains much more UV-A than UV-B. Neither UV-B nor UV-A has been shown to be beneficial to the eye, and neither contributes to vision. Optimal sun protection should screen out both forms of UV radiation.

Sunlight-related eye disease

Ultraviolet radiation can play a role in the development of various ocular disorders including age-related cataract, pterygium, cancer of the skin around the eye, photokeratitis and corneal degenerative changes, and may contribute to age-related macular degeneration.

Cataract is a major cause of visual impairment and blindness worldwide. Cataracts are a cloudiness of the lens inside the eye that develops over a period of many years. Laboratory studies have implicated UV radiation as a cause of cataract. Furthermore,

epidemiological studies have shown that certain types of cataract are associated with a history of higher ocular exposure to UV and especially UV-B radiation.

Age-related macular degeneration (AMD) is a major cause of vision loss in the U. S. for people age 55 and older. Exposure to UV and intense violet/blue visible radiation is damaging to retinal tissue in laboratory experiments; thus scientists have speculated that chronic UV or intense violet/blue light exposure may contribute to degenerative processes in the retina.

Pterygium is a growth of tissue on the white of the eye that may extend onto the clear cornea where it can block vision. It is seen most commonly in people who work outdoors in the sun and wind, and its prevalence is related to the amount of UV exposure. It can be removed surgically, but often recurs, and can cause cosmetic concerns and visual loss if untreated.

Excessive UV exposure is well known to predispose to cancer of the skin, including the eyelids and facial skin.

Photokeratitis is essentially reversible sunburn of the cornea resulting from excessive UV-B exposure. It occurs when someone spends hours on the beach or snow without eye protection. It can be extremely painful for 1-2 days and can result in temporary loss of vision. There is some indication that long-term exposure to UV-B can result in corneal and conjunctival degenerative changes.

Who is at risk?

Everyone is at risk. No one is immune to sunlight-related eye disorders. Every person in every ethnic group is susceptible to ocular damage from UV radiation that can lead to impaired vision.

What factors increase the risk?

Any factor that increases sunlight exposure of the eyes will increase the risk for ocular damage from UV radiation. Individuals whose work or recreation involves lengthy exposure to sunlight are at greatest risk. Since UV radiation is reflected from surfaces such as snow, white sand and water, the risk is particularly high on ski slopes, on the beach or while boating. The risk is greatest during mid-day hours, from 10 a.m. to 3 p.m., and during summer months. Ultraviolet radiation levels increase nearer the equator, so residents in the southern U.S. are at greater risk. UV levels are also greater at high altitudes.

Since the human lens absorbs UV radiation, individuals who have had cataract surgery are at increased risk of retinal injury from sunlight unless an UV-absorbing intraocular lens was inserted at the time of surgery. Individuals with retinal dystrophies or other chronic retinal diseases may be at greater risk since their retinas may be less resistant to normal exposure levels.

Are children at risk?

Children are not immune to the risk of ocular damage from UV radiation. More UV is transmitted to the retina of the child than to the retina of the adult. Children also typically spend more time outdoors in the sunlight than adults do. Solar radiation damage to the eye may be cumulative and may increase the risk of developing an ocular disorder later in life. It is prudent to protect the eyes of children against UV radiation by having them wear a wide-brimmed hat or cap and sunglasses. Sunglasses for children, as with all glasses, should have lenses made of polycarbonate because of their superior impact resistance.

How can the eyes be protected from UV radiation?

Ultraviolet radiation reaches the eye not only from the sky above, but also from the ground, especially snow, sand, water and other highly reflective surfaces. Protection from sunlight can be obtained by using both a brimmed hat or cap and UV-absorbing eyewear. A wide-brimmed hat or cap will block up to 50% of the UV radiation and reduces the amount that may enter above or around glasses. Ultraviolet absorbing eyewear provides the greatest degree of UV protection, particularly if it has a wraparound design to limit the entry of peripheral rays of sunlight.

Ideally, all types of eyewear, including prescription spectacles, contact lenses, sunglasses and intraocular lens implants should absorb at least the full UV spectrum (UV-A and UV-B). UV absorption can be incorporated into nearly all optical materials currently in use, is inexpensive and does not interfere with vision. The degree of UV protection offered by eyewear is not necessarily related to price.

For outdoor use in the bright sun, sunglasses that absorb 99-100% of the full UV spectrum from 280nm to 380nm are recommended. Lenses that also reduce much of the transmittance up to 400nm may provide additional protection for the retina. Such lenses should not be so strongly colored as to affect recognition of traffic signals. Sunglasses should be dark enough to reduce glare and squinting to a comfortable level. Polarization, anti-reflective coatings and photosensitive darkening are additional features that are useful for certain visual situations, but do not, by themselves, provide UV protection.

There is presently no uniform labeling of sunglasses that provides adequate information to the consumer. Labels should be examined carefully to insure that the lenses purchased absorb 99-100% of both UV-A and UV-B. Consumers are advised to be wary of claims that sunglasses “block harmful UV” without providing the degree of protection in percent of UV-A and UV-B.

Prevent Blindness America Scientific Advisory Committee Task Force on Ultraviolet Radiation

This statement was prepared by members of Prevent Blindness America’s Ultraviolet Radiation Task Force. Prevent Blindness America gratefully acknowledges their contribution. The members of the task force are:

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Approval

This policy statement was approved by the Prevent Blindness America board of directors on November 8, 2003 and supercedes all previous policies on ultraviolet radiation. The American Academy of Ophthalmology and the American Optometric Association approved this statement.

Founded in 1908, Prevent Blindness America is the nation's leading volunteer eye health and safety organization dedicated to fighting blindness and saving sight. Focused on promoting a continuum of vision care, Prevent Blindness America touches the lives of millions of people each year through public and professional education, advocacy, certified vision screening training, community and patient service programs and research. These services are made possible through the generous support of the American public. Together with a network of affiliates, divisions and chapters, it's committed to eliminating preventable blindness in America. For more information, or to make a contribution to the sight-saving fund, call 1-800-331-2020 or visit us on the web at www.preventblindness.org.

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