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STATEMENT ON

Ocular Ultraviolet Radiation Hazards In Sunlight

A Cooperative Initiative of:
The National Society to Prevent Blindness
The American Optometric Association
The American Academy of Ophthalmology

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 99% of UV radiation is absorbed by the anterior structures of the eye, although some of it does reach the light-sensitive retina. The UV radiation present in sunlight is not useful for vision. 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 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 can cause sunburn and predispose to skin cancer, and the UV-A (315 to 400 nanometers) radiation that causes tanning but is also thought to 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; therefore it can cause damage to these tissues but will not normally damage the retina. However, the retina can be damaged if exposed to UV-B. UV-A radiation has lower energy, but penetrates much deeper into the eye and 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 DISEASES

Ultraviolet radiation can play a contributory 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, which occurs over a period of many years. Laboratory studies have implicated UV radiation as a causal factor for cataract. Furthermore, epidemiological studies have shown that certain types of cataract are associated with a history of higher exposure to UV and especially UV-B radiation.

Age-related macular degeneration is the major cause of reduced vision in the United States for people over age 55. 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 aging 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 skin cancer, which includes ;the eyelids and facial skin.

Photokeratitis is essentially a reversible sunburn of the cornea resulting from excessive UV-B exposure. It occurs when someone spends long 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 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 in developed and developing nations alike 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 off surfaces such as snow, water and white sand, the risk is particularly high on the beach, while boating or at the ski slopes. The risk is greatest during the mid-day hours, from 10 AM to 3 PM and during summer months. Ultraviolet radiation levels increase nearer the equator, so residents in the southern US 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 a 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 resilient to normal exposure levels.

ARE CHILDREN AT RISK?

Children are not immune to the risk of ocular damage from UV radiation. They typically spend more time outdoors in the sunlight than adults. 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 wearing a brimmed hat or cap and sunglasses. Sunglasses for children should have lenses made of plastic rather than glass for added impact protection.

HOW CAN THE EYES BE PROTECTED FROM US RADIATION?

Ultraviolet radiation reaches the eye not only from the sky above but also by reflection from the ground, especially water, snow, sand and other bright 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 roughly 50% of the UV radiation and reduces UV radiation that may enter above or around glasses. Ultraviolet absorbing eyewear provides the greatest measure of UV protection, particularly if it has a wraparound design to limit the entry of peripheral rays.

Ideally, all types of eyewear, including prescription spectacles, contact lenses and intraocular lens implants should absorb the entire UV spectrum (UV-B and UV-A). 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 is not related to price. Polarization or photosensitive darkening are additional sunglass features that are useful for certain visual situations, but do not, by themselves, provide UV protection.

For outdoor use in the bright sun, sunglasses that absorb 99-100% of the full UV spectrum to 400 nm are recommended. Additional protection for the retina can be provided by lenses that reduce the transmission of violet/blue light. Such lenses should not be so colored as to affect recognition of traffic signals. The visible spectrum should be reduced to a comfortable level to eliminate glare and squinting. Individuals who also wear clear prescription eye wear outdoors should consider using lenses which absorb 99-100% of the UV radiation to 380-400 nm.

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 at least 99-100% of both UV-B and UV-A. Consumers are advised to be wary of claims that sunglasses “block harmful UV” without saying how much.

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