Contact Lens Update
CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Being "SunSmart": Finding the right life-light balance

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David McCanna, PhD is a Research Associate and Adjunct Professor of Immunology at the University of Waterloo.

One of the major functions of a contact lens care solution is to disinfect contact lenses to make them safe to wear. Ultraviolet (UV) radiation and its effect on the eye has been the subject of many recent review articles, including a special issue of Eye and Contact Lens, in July 2011, which included 13 articles written by internationally renowned experts.[1] Since that time, additional articles have been written on the harmful and beneficial effects of UV light.[2-4] Communicating to the public about the beneficial and harmful effects of UV light is essential for people to find the right exposure levels for good health and prevention of UV associated ocular disease.

Factors influencing exposure to UV radiation: A review

Solar UV radiation is divided into categories based on wavelength: UVC (100-280 nm), UVB (280 -315 nm), and UVA (315- 400 nm). UVC radiation is almost completely absorbed by the ozone layer, but UVB and UVA are capable of penetrating the ozone layer to reach the terrestrial surface. Phototoxicity increases as wavelength decreases, so UVB radiation poses a greater potential hazard than UVA because it contains more energy.[5]

In 1974, scientists discovered that chlorofluorocarbons (CFC) were depleting the ozone layer. Emissions from refrigerants and other uses of these chemicals were causing reductions in ozone, resulting in an "ozone hole" in Antarctica and additional depletion of ozone in the atmosphere over all of the other continents on earth. As a result of this discovery, 191 countries signed a treaty (Montreal Protocol on Substances that Deplete the Ozone Layer) that limited production and consumption of CFC. While the ozone layer is starting to recover, projections are that a complete recovery will not occur until 2100.[6] Levels of ozone in regions of the world other than the Arctic and Antarctica have not seen a decrease in ozone since the late 1990s.[7]

Other factors that can influence UV exposure are cloud cover, sunlight angle and elevation. These factors are included in calculating "UV index," which estimates risk of detrimental biological effects from UV exposure. The UV index can be as high as 22 in the tropical oceans,[8] and in other regions governments post monthly average UV indexes to help people choose appropriate sun protection behaviours.In the United States, the UV index can be as low as 0 in the northern regions in January and as high as 12 in the southwest in July.[9] Australia issues SunSmart alerts when the UV index is forecast to reach 3, which is a level that can damage the skin and lead to skin cancer.[10]

The benefits of UV light

A person is considered to be deficient in vitamin D when the levels of 25-hydroxyl-vitamin D , an intermediate metabolite in the production of active vitamin D, in the serum (blood plasma without clotting factors) is lower than 30 ng/ml.[11] Although vitamin D can be obtained through vitamin supplementation, most people in the world derive their vitamin D from sun exposure.[12] Vitamin D is essential for maintaining bone health, and a deficiency can cause a softening of the bones, leading to injury and various complications. In addition, vitamin D may protect against the development of cancer, autoimmunity, rheumatoid arthritis, hypertension, multiple sclerosis, type I and II diabetes and infectious disease.[11, 12]

Low vitamin D levels may increase the chance of developing age-related macular degeneration (AMD), so that a minimum exposure to UV light may be necessary for the endogenous production of vitamin D for disease prevention.[13] A recent epidemiological study evaluated lifetime exposure to ambient ultraviolet radiation and the risk of developing cataract and AMD.[14] The risk for developing early AMD increased in people exposed to high UV, and also people exposed to low UV, where there was less risk in the individuals who received medium light exposure. It is possible that the individuals who received the low dose of UV had low vitamin D levels, which could explain the risk of developing AMD in the low light exposure group.

The risks of overexposure to UV radiation

Acute effects of very high dose UV light can cause photokeratitis and photoconjunctivitis, chemosis, endothelial damage and cataracts.[15] Chronic effects of UV light exposure include pterygium and cortical cataract. Basal stem cells at the junction of the cornea and the sclera can be exposed to UV light, potentially causing mutations and the generation of free radicals.[6] This can lead to pterygium, which is a benign growth of the conjunctiva that typically grows from the nasal side of the sclera. A significant number of epidemiology studies have shown increased incidence of cataract in areas with higher solar radiation.[4] The association of UV light exposure and the development of AMD is less certain. There are epidemiological studies that show increased incidence of AMD in population groups that have greater exposure to UV radiation and other studies that show no association of high light exposure and the development of AMD. [12, 16]

Developing a universal standard for protecting eyes from UV exposure

Currently, the UV index can be used as a rough guide for knowing when the skin and eyes need protection. For example, if the UV index is between 0 and 2 the US Environmental Protection Agency recommends that sunglasses should be worn. Wearing UV blocking contact lenses may help; Class I lenses that block 90% of UVA and 99% of UVB are recommended for high exposure environments such as mountains or beaches, and Class II lenses that block 50% of UVA and 95% of UVB are recommended for general purposes.[17, 18]

Krutmann et al. have called for UV protection guidance that is specific for eye protection. They propose that an "Eye-Sun Protection Factor (E-SPF®)" be developed to describe the intrinsic UV protection properties of lenses and lens coating materials based on their capacity to absorb or reflect UV radiation.[2] These coatings will then need to be tested at different levels of UV light to determine their effectiveness under different UV light conditions. Finding the right balance of UV exposure for obtaining the benefits and reducing the risk will ultimately be achieved when the UV index values can be paired up with eye-sun protection values to better inform the public of the appropriate eye protection for daily UV light conditions.

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