World Society of Paediatric Ophthalmology & Strabismus Consensus Statement on:

Sunlight Exposure and Childrens' Eyes

Statement: **While there are cultural and ethnic variances across different parts of the globe which must be respected,** shielding children's eyes from excessive ambient UV radiation in direct and reflected sunlight is extremely important - based on cumulative evidence from epidemiologic human studies and experimental animal studies. Significant long-term damage to eye-related tissues (the eyelid skin, conjunctiva, cornea, lens and in young children possibly the retina) can be caused by UV radiation, and thus can be prevented. Children who have undergone cataract surgery and some with other ocular diseases may be at even greater risk of retinal damage; protective UVA/B blocking glasses are especially important for these children. The best prevention continues to be avoidance of significant sun exposure during the highest risk time periods during the day (typically '9 to 5') and during the year (e.g. UV radiation reaches its highest level in the Scandinavian countries in June & July) whenever possible. When outside look for shaded areas and wear brimmed hats. **These recommendations do not mean, and should not be understood as sun or outdoor activity is to be avoided at all times; on the contrary clear evidence exists that sunlight is needed for appropriate Vitamin D metabolism and more recently there is some early evidence that myopia progression may be decreased by time outdoors. The advice of a local Ophthalmologist specializing in child eye health should be sought for specific instructions in your region.**

With this in mind whenever outside appropriate UVA/B blocking protective lenses in well fitted, safe spectacle frames are valuable for all; particularly in the younger child, adolescent and those who are geographically or medically at higher risk. The lenses should block at least 99% of UVA/B light and meet local protection standards. The spectacles should (1) provide safety when impacted, (2) leave little room for light to enter around the temporal edges, and (3) be comfortable to wear for any age. Parents may look for lenses made of polycarbonate, CR39 type material or meeting local safety standards, and labels stating that the glasses meet ANSI (American National Standards Institute) requirements or block UV absorption up to 400 nm (nanometers). Polarized lenses often provide greater comfort from glare, especially for light sensitive children.

These recommendations include both prescription (tinted or not) glasses and nonprescription sunglasses. Poorly made spectacles, improper lens material, non UVA/B block material or unreliable labels from unknown manufacturers all place the child at greater risk and should be avoided.

Evidence and Basis

Visible light is a small part of the electromagnetic radiation spectrum. Electromagnetic radiation, however, also consists of ultraviolet light (or radiation - UVR) and infrared light (or radiation -IR). The sun represents the largest single source of optical electromagnetic radiation (UV, Visible light and IR). Additionally the majority of lifetime sun exposure occurs under the age of 21.

Several factors must be taken into consideration when evaluating the effect of sunlight on the child's eye:

Mechanism of Damage to Tissues by ambient Optical Radiation: photochemical damage may be direct (a photon of light is absorbed by a molecule with important function(s) within the eye causing a change in biological function) or indirect (photon absorption results in a change in structure of e.g. intermolecular bonds. These changes effect the normal tissue metabolism by either (1) Type I Photosensitivity reaction (e.g., lens epithelial damage from UV contributing to cataract formation) or (2) Type II photosensitivity reaction: a photon photosensitizes a molecule(s) and the energy is carried by oxygen to biologically important molecules, causing a change in its biological function (e.g. UV blue light damage to the macula).

Damage is also dependent on penetration of optical EMR into the eye. UVR penetrates and is absorbed by the anterior segment up to and including the lens. Visible light essentially threatens the retina because it is mainly transmitted through and not absorbed by the ocular media, while IR appears to have little effect due to attenuation by water absorption. The retina is largely protected from UVR exposure by the anterior segment except for a small spectral range at around 320 nm. This is however extremely age dependent with transmittance maximum around birth at about 20%, slowly reducing to 2-3 % at 20 years of age. *This suggests that lens filters, especially those blocking UVR, may have a significant effect in children - by protecting the anterior segment, the retina and the eyelids specifically during that time in life when there is maximal EMR exposure and the least natural protection.*

Ambient exposure of UV within sunlight: this is extremely variable but depends on the solar angle (greatest at the earth's equator), atmospheric conditions (greatest in clear blue skies), and the reflectivity of the background surface (ie zero for grass and 90% for freshly fallen snow and water). The eyebrows and the upper eyelid reduce overhead globe exposure, – but are exposed themselves. Avoidance of exposure during the times of greatest risk remains the most powerful prevention, but is not always possible. Thus, peaked/brimmed caps and adequate UVA/B lens filters contribute further to the shielding effect.

Dose of optical radiation to cause damage - The lowest dose required to cause a short delay onset damage is referred to as the threshold dose. The only data available for human ocular tissue threshold dose is for the conjunctiva and the cornea. Data on all other ocular tissues come from animal models. The problem is that the daily ambient exposure dose is below threshold dose however it is the long-term nature of the exposure (potentially daily) that represents the problem. Thus, the only way to assess such damage is through retrospective epidemiological studies, some of which have very convincingly shown a relationship between UVR exposure and subsequent lens opacities.

Clinical expression of optical radiation damage in ocular tissue
Epidemiological data on long term sub threshold optical electromagnetic radiation exposure shows that eyelid skin is at risk for basal cell carcinoma, conjunctiva for pingueculae and pterygia, cornea for climatic droplet keratitis, lens for cortical cataract (with animal model experiments showing that younger individuals at higher risk than older ones). The retina is protected against UV radiation by the anterior segment including the lens, likely not entirely so. While the effect is unproven, there is clearly a theoretical risk of increased Age Related Macular Degeneration with long-term visible light exposure.

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