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The Global Voice of Pilots

Medical Briefing Leaflet

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Ocular hazards of UV exposure

The electromagnetic spectrum is very large ranging from gamma rays to AM waves. The visible part of this spectrum however is limited from about 400nanometers (nm) to about 700nm. Sunlight is a major source of UV radiation which can damage the delicate tissues of the eye e.g. cataract (lens) and macular degeneration (retina). The energy field in the electromagnetic spectrum rises from the red, orange, yellow and green through to the high energy found in the blue and violet and is highest of all in the invisible ultraviolet end of the spectrum (VIBGYOR).
Ultraviolet radiation is divided into 2 major component bands - UV-A and UV-B. UV-A is the longer wavelength radiation that is close to blue in the visible spectrum that is usually responsible for skin tanning and browning and is responsible for pre-mature aging of the skin due to prolonged exposure. UV-B is the more active and shorter wavelength radiation that causes blistering sunburn and is associated with skin cancer.
As it turns out, the hazardous component of sunlight is all concentrated in the high energy end of the spectrum – in the blue-violet and ultraviolet end of the scale. The retina of the eye is spared the harmful effects of UV as this end of the EM spectrum is absorbed by the anterior part of the eye and causes other sunlight related diseases. It is the high energy violet and blue part of the sunlight spectrum that prove to contain the radiation that harms the retina.
Excessive exposure to intense sunlight or to any artificial source of light like welding torches and sunning lamps can and will lead to burning of the delicate tissues in the eye. The highest risk of exposure comes from direct exposure to sunlight reflected from snow and when flying above light reflected from cloud surfaces.

Cataract

Pilots have in some occupational hazard studies shown to have a higher incidence of cataract when compared to the average population. Cataract is clouding of the lens in the eye and is a major but common surgical procedure among the elderly. Globally, 20 million people are affected by serious visual impediment due to cataract. Epidemiological studies have shown a close link between sun exposure and cataract.

Macular degeneration – (age related damage in the central vision area)

Both UV and deep blue light have in some occupational hazard studies shown to be damaging to the retina in laboratory studies. Macular disease produces a degeneration of the light sensitive retina in the worst possible location- directly in the centre of the visual field. Wherever the person looks, there is always a blind spot directly in the centre of the visual field. Nothing can be done to restore this vision loss. Protection from UV-A and UV-B may thus be prudent.

Sunglasses

In the past, sunglasses have been popular both for comfort and as a fashion accessory. Ophthalmologists now believe that there is now a more compelling reason to wear sunglasses - to protect the long term health of your eyes. The scientific prescription for protective sunglass lenses begins with 100% UV absorption – all of the UV, both A and up to 400nm of B. UV is useless for vision and harmful to every part of the eye that absorbs it. There is absolutely no justification for exposing delicate eye tissues to UV radiation. The second part of the prescription protects the retina against macular disease: the sunglass lens should absorb almost all of the violet/blue radiation.
Why not all of it? Well as it turns out, absorbing all of the violet/blue light has the unwanted side effect of producing severe colour distortion. Blue and violet appear grey, yellows fade and purple looks red. Many people will not wear sunglasses that distort colour perception. Scientists have found that up to 96% of the violet/blue radiation can be eliminated without affecting colour vision. This is the most favourable result which provides perfectly natural visual function and at the same time protection against all sunlight related diseases.

Sunglasses come in a wide variety of styles and colours the keys in selecting a pair it to choose a style you like that will provide 99-100% UV-A & UV-B protection without distorting the clarity or readability of objects.

Tips for Sunglass Selection

The task of choosing sunglasses is multi-faceted. Sunglasses must be practical enough to protect our eyes, yet stylish enough to make us want to wear them. To aid you in your decision-making process, the American Academy of Ophthalmology offers some handy tips for assuring defence against the summer sun. Look at the Label. Although universal federal regulations for UV light and sunglasses do not currently exist, most sunglasses carry a label stating their protective ability. The American Academy of Ophthalmology recommends glasses that block 99 to 100 percent of UV light (both UV-A and UV-B).

Wrap-Arounds

Especially if you expect to be in the sun a great deal, wrap-around, close-fitting sunglasses will provide the most protection for your eyes by preventing light from shining around the frames and into your eyes. Don't be Deceived by Colour or Cost. People mistakenly confuse the ability of sunglasses to block UV light with the colour and darkness of their lenses. In truth, UV protection comes from a chemical coating applied to the surface of the lens. Another common myth about sunglasses is that they must be expensive to protect the eyes. Many $10 glasses provide equal or greater protection than a $100 pair. Expense may reflect other factors, such as optical quality and durability. More likely, sunglass expense reflects the current trends in fashion.

Conflicting Claims

Manufacturers have developed new sunglasses designed to protect eyes from the sun's harmful effects. They promise protection from ultraviolet light and other kinds of natural radiation. It is more important to protect your eyes from some kinds of light than others.

► *"Blocks 99% of Ultraviolet Rays"*

You should always buy sunglasses with this feature. Long-term exposure to ultraviolet (UV) radiation in sunlight is linked to eye disease. Both plastic and glass lenses absorb some UV light, but UV absorption can be improved by adding chemicals to the lens material during manufacturing or by applying special lens coatings. Shop for sunglasses that block 99 or 100% of all UV light. Some manufacturers' labels say "UV absorption up to 400nm." This is the same thing as 100% UV absorption.

► *"Blocks 90% of Infrared Rays"*

Infrared wavelengths are invisible (they are longer than light rays that you can see) and produce heat. Sunlight has low levels of infrared rays, and the eye tolerates infrared well. Some sunglasses manufacturers make health claims for their products based on infrared protection, but research has not shown a close connection between eye disease and infrared rays.

► *"Blue-blocking"*

Whether blue light is harmful to the eye is still controversial. Lenses that block all blue light are usually amber and make your surroundings look yellow or orange. The tint supposedly makes distant objects appear more distinct, especially in snow or haze. For this reason, amber sunglasses are popular among skiers, hunters, boaters and pilots.

► *"Polarized"*

Polarized lenses cut reflected glare - sunlight that bounces off smooth surfaces like pavement or water. They can be particularly useful for driving and fishing. Polarization has nothing to do with UV light absorption, but many polarized lenses are now combined with a UV-blocking substance. Check the label to make sure the lenses provide maximum UV protection. Polarized lenses should not be used by pilots, since polarization can reduce or eliminate the visibility of instruments that incorporate anti-glare filters, and they may interfere with visibility through an aircraft windscreen by enhancing striations in laminated materials. In addition, polarized lenses can mask the sparkle of light that reflects off shiny surfaces, such as another aircraft's wing or windscreen, which can reduce the time a pilot has to react in a "see-and-avoid" traffic situation.

► *"Mirror-coated"*

Mirror finishes are thin layers of various metallic coatings on an ordinary lens. Although they do reduce the amount of visible light entering your eyes, do not assume they will fully protect you against UV radiation.

► *"Wraparound"*

Wraparound glasses are shaped to keep light from shining around the frames and into your eyes. Studies have shown that enough UV rays enter around ordinary eyeglass frames to reduce the benefits of protective lenses. Large-framed wraparound sunglasses canprotect your eyes from all angles

► *"Gradient"*

Gradient lenses are permanently shaded from top to bottom or from top and bottom toward the middle. Single-gradient lenses (dark on top and lighter on the bottom) can cut glare from the sky but allow you to see clearly below. They are useful for flying because they don't dim your view of the instrument panel. Double-gradient lenses (dark on top and bottom and lighter in the middle) may be better for sports where light reflects up off the water or snow, such as sailing or skiing. Double-gradient lenses are not recommended for flying, because they make the dashboard appear dim.

► *"Photochromic"*

A photochromic glass lens automatically darkens in bright light and becomes lighter in low light. Most of the darkening takes place in about half a minute, while the lightening takes about five minutes. They come in a uniform or gradient tint. Although photochromic lenses may be good UV-absorbent sunglasses (again, the label must say that), it takes time for them to adjust to different light conditions.

► *"Ground and polished"*

Some non-prescription glasses are ground and polished when they are manufactured to improve the quality of the lenses. Non-prescription lenses that are not ground and polished will not hurt your eyes. You do want to make sure that the lenses you buy are made properly. To judge the quality of non-prescription sunglasses, look at something with a rectangular pattern such as floor tile. Hold the glasses at a comfortable distance and cover one eye. Move the glasses slowly from side to side, then up and down. If the lines stay straight, the lenses are fine. If the lines wiggle, especially in the centre of the lens, try another pair.

► *"Impact resistant"*

All sunglasses must meet impact standards set by the Federal Food and Drug Administration. No lens is truly unbreakable, but plastic lenses are less likely than glass lenses to shatter when hit by a ball or stone. Most non-prescription sunglass lenses are plastic. Polycarbonate plastic, used in many sports sunglasses, is especially tough but scratches easily. If you buy polycarbonate lenses, look for ones with scratch-resistant coatings.

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