Effectiveness of Sunglasses

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WHO UV Index Workshop

3rd World Conference of UV & Skin Cancer Melbourne December 2015

Effectiveness of Sunglasses

Topics Covered:
1. Protection against solar UVR
2. Australian/NZ Sunglass Standard
3. Compliance with the Standard
4. Other Sunglass Standards
5. UV effects on the eyes

UVR, SUNGLASSES AND THE EYE

RULE NUMBER 1

No one’s eyes should be worse off when they are wearing sunglasses compared to when they are not wearing sunglasses!

Protection Against Solar UVR

There exist two effectiveness functions that are important in protection against solar UVR

1. CIE Erythemal Effectiveness
2. ICNIRP Effectiveness > a combination of skin and eye effects vs wavelength > is used in occupational assessments
The 3rd International Conference on UV & Skin Cancer Prevention, Melbourne 7-11 December 2015
Global UV Index Pre-conference Workshop_Day 1

### CIE and ICNIRP Comparison

<table>
<thead>
<tr>
<th>UV Index</th>
<th>Tmax</th>
<th>Terythema</th>
<th>UVReff</th>
<th>SEDs/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>39.5</td>
<td>66.6</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19.8</td>
<td>33.3</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>13.2</td>
<td>22.2</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9.9</td>
<td>16.7</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7.9</td>
<td>13.3</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>6.6</td>
<td>11.1</td>
<td>10.8</td>
<td></td>
</tr>
</tbody>
</table>

### AUSTRALIA/NZ Sunglass Standards

- Australia had the first Sunglass Standard in 1971
- The Sunglass Standard was revised in 1983 and was again revised in 1990
- The latest and current Standard was issued in 2003
- The 2003 Standard is currently being revised
AS/NZS 1067 Sunglasses and Fashion Spectacles

- Is a mandatory standard in Australia
- The standard became mandatory on 1 July 1985
- The standard was last amended on 25 Aug 2005
- The standard is monitored by the Australian Competition and Consumer Commission (ACCC)

Other Sunglass Standards

- ANSI Z80.3 (Sept 2015) Ophthalmics – Non Prescription Sunglass and fashion Eyewear Requirements
- French and German Sunglass Standards superseded by European Sunglass Standard (EN 1836-1997)
UVR, SUNGLASSES AND THE EYE

RULE NUMBER 1

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AUSTRALIAN Sunglass Standard

• The ACCC regularly tests sunglasses to check compliance with the Standard and orders recalls of any non-compliant sunglass styles
• Between August and November 2013, 15,000 product lines were tested across Australia

ACCC Website

• Nearly one in seven of the products surveyed failed to comply with product safety laws
• Over 2,400 sunglasses from across the retail market were removed from sale for having no mandatory lens category labelling and for failing lens performance requirements

ARPANSA ACCC Testing Results

• One third of the failures were due to incorrect Category eg claims were for Category 2 when it was measured as Category 3 and vice versa
• Another batch of sunglasses many of which passed the transmittance requirements of the Standard all failed because none had a label that was compliant with the required descriptions of Table 4 of the Standard
Some 2013-14 Sunglasses - FAIL

Some 2013-14 Sunglasses - PASS

UV EFFECTS ON THE EYE

- PTERYGIUM
- PHOTOKERATOCONJUNCTIVITIS
- CATARACT
- PINGUECULA
- LABRADOR KERATOPATHY
- ENDOTHELIAL POLYMEGATHISM
- EYELID DAMAGE
CATARACT

Because of the near universal exposure to UV-B in the environment, ocular protection has one of the highest modifiable attributable risks for cortical cataract and would therefore be an ideal target for public health intervention.


“UVB is important because of the attributable risk and the fact that this exposure, unlike many of the other potential risk factors, is modifiable.”


Risk Factors for Cataracts

“In addition to UVB, potential risk factors include:
Age, female gender, family history of cataract, smoking, alcohol intake, blood pressure, diabetes, medications and low anti-oxidant intake.”

UV EFFECTS ON THE EYE

CATARACT

- Sunlight exposure presents an attributable population risk of 10% for cortical cataracts (Robman & Taylor 2005; Eye V19:1074-1082).
- Many possible associations including: age, female gender, diabetes, smoking, steroids and sunlight have been shown to be definite risk factors.

UV EFFECTS ON THE EYE

- Numerous studies have looked at the incidence of cataracts
- They have made assumptions about what level of UV exposure subjects have had
Assumptions re UV Exposures of the Eye
1. Place of residence defines a person’s UV exposure
2. UVR dose to the eye is proportional to number of hours spent outside
3. No of sunny days in a subject’s environment will predict relative life-time UVR exposure to the lens
4. Cloud cover/overcast will decrease the eye’s exposure
5. At high altitude the ocular exposure will be higher than at sea level
6. Wearing sunglasses & a hat will reduce ocular exposure
7. UVR exposure of the lens is directly correlated with skin exposure (determined by UV dosimetry or skin ageing)
8. UVR exposures of the eyes are directly proportional to measures of global UVR
9. UVR exposure conditions vary in the same way as visible light with season and time of day

UV EFFECTS ON THE EYE

PTERYGIUM
- prevalence is ~ 10% in men and 4% in women
- Is related less to direct exposure & more to reflected UV from the environment
- Shows the need for sunglasses to have large eye coverage and side shields ***

PHOTOKERATOCONJUNCTIVITIS
- Often known as “snow-blindness”
- The link to UV was shown to have a broad spectrum and peak at 270nm > not present in sunlight

EYELID DAMAGE
- Is simply sunburn of a very susceptible and thinner skin area
UV EFFECTS ON THE EYE

PTERYGIUM

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- Is related less to direct exposure & more to reflected UV from the environment
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Some Astronomy

- Vernal Equinox: 20/21 March
- Summer Solstice: 21/22 June
- Winter Solstice: 21/22 December
- Perihelion: ~ 1.017 AU
- Aphelion: ~ 1.017 AU

Measured Solar UV Levels

- Map of Australia showing UV index maximum for various cities.
- UV Index Maximum:
  - Darwin: 17.7
  - Alice Springs: 15.6
  - Brisbane: 16.6
  - Sydney: 13.9
  - Adelaide: 13.8
  - Perth: 14.0

- ARPANS Measurement Sites:
  - www.arpansa.gov.au/uvindex

- Graph showing yearly total (SED) vs. latitude for different countries:
  - Aust
  - NZ
  - UK
  - USA
  - Japan
  - Germany
  - Swe
  - AAD
  - Spain
  - Arctic
3 : UVR Protection - ICONS

Hats
Clothing
Shade
Sunglasses
Sunscreens

Other Protection Methods

- Hats > are now covered in the Sun Protective Clothing Standard
- There is now a revised Shade Cloth Standard which will be covered in the UV and Skin Cancer Conference
- Sunscreen standard is ongoing
- Sun Protective Clothing is also being revised

AS/NZS 4399

Types

<table>
<thead>
<tr>
<th>UPF Rating</th>
<th>UVR Protection</th>
<th>Effective UVR Penetration, less than or equal to (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Minimum</td>
<td>6.7</td>
</tr>
<tr>
<td>30</td>
<td>Good</td>
<td>3.3</td>
</tr>
<tr>
<td>50, 50+</td>
<td>Excellent</td>
<td>2.0</td>
</tr>
</tbody>
</table>

NOTE: Effective UVR is the sunburn-weighted effectiveness of sunlight on human skin.
SHADE CLOTH

• A new Standard after may years
• Main use was horticulture
• Now shade for people is a major priority
• Have a new protection rating scale
• Uses erythemally weighted UVR to calculate PF

CONCLUSIONS

• Australia has a mandatory Sunglass Standard
• It also has correct UV limits ie 400nm
• What’s on sale here is checked regularly by the ACCC
• Compared to anywhere else, the safety of sunglasses on sale in Australia is first rate and I urge you all to buy some while you are here

ACKNOWLEDGEMENTS

Thanks to the staff of the ARPANSA UVR Group for their help with the data. Thanks also to the Cancer Council Victoria, the Australian Antarctic Division and the Bureau of Meteorology who all contributed to this work.

THANK YOU

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TABLE 4
LENS CATEGORIES AND DESCRIPTIONS

<table>
<thead>
<tr>
<th>Lens category</th>
<th>Description</th>
<th>Additional required information</th>
<th>Required symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Fashion spectacles—not sunglasses</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Very low sunglare reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some UV protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fashion spectacles—not sunglasses</td>
<td>NOT SUITABLE FOR驅動 AT NIGHT</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Limited sunglare reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some UV protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sunglasses</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Medium sunglare reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good UV protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Sunglasses</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>High sunglare reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good UV protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sunglasses——special purpose</td>
<td>MUST NOT BE USED WHEN DRIVING</td>
<td>Figure 1</td>
</tr>
<tr>
<td></td>
<td>Very high sunglare reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good UV protection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Skin Cancer Deaths - Men spend longer outside

Distribution of UV Exposures for Subject Groups
25th Anniversary - Montreal Protocol

- Limits ozone depleting substances
- Return to normal ozone means lower UV
- As a result has impacted on skin cancer rates worldwide > 2 million skin cancers avoided each year

*Van Dijk et al (2013) “Skin cancer risks avoided by the Montreal Protocol... with a risk model*

ARPANSA Solarium Operators Training Course

- Skin type assessment is important before clients are exposed
- Australasian College of Dermatology has checked this
- Web based training course almost complete ??