AAD and Photoprotection

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Disclosure

- **Investigator:**
  - Incyte
  - L’Oréal
  - Pfizer
  - PCORI

- **Consultant:**
  - Pierre Fabre
  - ISDIN
  - Ferndale
  - Galderma

- **Speaker, educational session:**
  - Johnson & Johnson
  - Ra Medical SysTeem
Photoprotection

• Environmental impact
• Photoprotection for visible light
• Photoprotection of SOC
• AAD and photoprotection
Photoprotection

- Environmental impact
Oxybenzone

- Oxybenzone (benzophenone 3) is a short UVA and UVB filter
- Is the most common photoallergen among UV filters.
- Benzophenones: 2014 ACDS Allergen of Year
- No known safety issues in humans (has been in use in the US since 1978)
- In Europe, it has been replaced with other UVA filters in many sunscreens.
- It is still commonly used in the US because lack of other UVA filters (2018: in 2/3 of non-mineral sunscreens).
UV Filters in Water and Coral in Hawaii


Range of Mean Surface Seawater Concentrations at 19 sites, Oahu, HI (parts per trillion):
- BP-3 = 0.1 to 136.2 ng L⁻¹
- EHMC (octinoxate) = not detected
- OC = < LOD to 26.9 ng L⁻¹
- OS = 33.1 to 96.0 ng L⁻¹
- HMS = 53.0 to 444.9 ng L⁻¹
Safety of Oxybenzone
(Schneider, S, Lim, HW. JAAD 2019 Jan;80(1):266. Detroit)

- UV filters are detected in water and coral tissues, but at magnitude lower that the lethal concentration for coral (ppt, vs ppb)
- Ocean warming is the major cause of coral reef bleaching
Regulations: Oxybenzone and Octinoxate

- Jan 2021: Ban in Hawaii and Key West, FL
- March 30, 2020: Ban in US Virgin Islands (oxybenzone, octinoxate, octocrylene)
- Palau (Jan 2020), Bonaire, Mexico (nature reserve)
- Being discussed in Brazil
Reef-safe sunscreens: ZnO and TiO$_2$
TiO₂ and ZnO Nanoparticles

(Schneider, S, Lim, HW. Photodermatol Photoimmunol Photomed 2019 Nov;35:442. [Epub: 2018 Nov 18]
Mohammed, YH, et al. JID 2019 (Feb); 139:308. Australia)

- No evidence of clinically relevant percutaneous penetration; no side effects in human
- FDA Proposed Rule (2/26/19): Category I (GRASE)
- Not sufficient data on inflamed skin where epidermal barrier function has been compromised.
- Environmental adverse effects: very low
- Whitish discoloration in SOC individuals unless it is tinted
Photoprotection

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Visible Light in Photodermatology

Kohli, I,…, Lim, HW, Hamzavi, I. Br J Dermatol 2018 May; 178:1173. Detroit)

• Visible light + UVA1 (≤ 2%) induces biologic effects on the skin:
  – Pigmentation in dark-skinned individuals.
  – Immediate erythema in light-skinned individuals.

• This might contribute to conditions that cause pigmentary alteration (melasma, PIH).

• Organic sunscreens do not protect against VL; other means of photoprotection are being studied
Clinical Implications

- Tinted sunscreens could be beneficial on down-regulating the effect of VL.
  - Boukari, F, ... Passeron, J. Am Acad Dermatol. 2015 Jan;72(1):189

- Development of new generation of filters that cover long UVA and VL region
  - Bacqueville, D, et al. ESP-IUPB mtg. 2019
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<tbody>
<tr>
<td>Chemical formula</td>
<td>Fe₂O₃</td>
<td>FeO(OH)•H₂O</td>
<td>FeO•Fe₂O₃</td>
<td>TiO₂</td>
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<tr>
<td>INCI name</td>
<td>Cl 77491*</td>
<td>Cl 77492</td>
<td>Cl 77499</td>
<td>Cl 77891</td>
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*Color index (CI), a universally accepted nomenclature for pigments and dyes.

**Table II. Chemical formulas of pigments used in tinted sunscreens**
Fig 1. Two different shades of tinted sunscreens on various skin types.

Fig 2. Absorbance profile of iron oxides and inorganic (mineral) filters. Reprinted from Sayre et al,12 with permission.
Clinical Implications

• Antioxidants might be beneficial as visible light exposure generates reactive oxygen species (*Polypodium leucotomos*, topical antioxidants)
  - Mohammad, T, ...Lim, HW, Hamzavi, I. *J Drugs Dermatol.* 2019 Dec;18:1198

• Afamelanotide for erythropoietic protoporphyria
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Photoprotection in Skin of Color Individuals

• Keratinocyte carcinomas do occur in SOC individuals
• Melanoma: palms, soles, oral mucosa
• Photoprotection needs to be practiced, but probably at a modified degree compared to fair-skinned individuals
  – AAD Skin Cancer and SOC Work Group
Need for a well-balanced sunscreen to protect human skin from both Ultraviolet A and Ultraviolet B damage, esp those with SOC

D. Moyal. *Indian Journal of Dermatology, Venereology, and Leprology* | 2012 | Vol 78 | Supplement 1, p S24-S30

<table>
<thead>
<tr>
<th>Fitzpatrick Skin Phototypes</th>
<th>Time to achieve 1 MED</th>
<th>UVA dose received during 1 MED time</th>
<th>Equivalent of UVA MPPD during 1 MED time</th>
<th>Ratio MED/MPPD</th>
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<tr>
<td>I/II</td>
<td>15 min</td>
<td>5 J/cm²</td>
<td>1/3 MPPD</td>
<td>3</td>
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<td>III</td>
<td>30 min</td>
<td>10 J/cm²</td>
<td>2/3 MPPD</td>
<td>1.5</td>
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<tr>
<td>IV</td>
<td>45 min</td>
<td>15 J/cm²</td>
<td>1 MPPD</td>
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</table>

MED: Minimal erythemal dose, MPPD: Minimal persistent pigment dose
Impact on New Filters in the US

(Diffey, B. JAMA Dermatol. 2016;152(5):511)

• Comparison of 4 US sunscreens with 4 sunscreens sold in Europe.
• All had SPF 50 or above
• US sunscreens: transmitted 3 times more UVA compared to the European products
FDA Proposed Rule (Feb 26, 2019)

• New broad spectrum test requirement (UVA1/UV ratio ≥ 0.7) will be added.
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AAD/A Sunscreen Position and Advocacy

- Using sunscreen is one part of a comprehensive photoprotection plan.
  - AAD encourages the public to continue to protect themselves from the sun by seeking shade; wearing protective clothing, including a lightweight, long-sleeved shirt, pants, a wide-brimmed hat and sunglasses; and generously applying a broad-spectrum, water-resistant sunscreen with an SPF 30 or higher to exposed skin.

- The AADA advocates for access to safe and effective sunscreen products for the benefit of our patients and the public.
  - No position on safety testing methodology. Instead, we are encouraged to see FDA and industry working together to further access.
  - FDA is not questioning the effectiveness of sunscreen products.
What should we advise our patients?

(Schneider, S, Lim, HW. JAAD 2019 Jan;80(1):266. Detroit)

• The adverse effects of sun exposure is well established.

• Practice of photoprotection is essential:
  – Seek shade
  – Wear photoprotective clothing, wide-brimmed hat, sunglasses
  – Apply SPF>30 broad spectrum sunscreen to otherwise exposed area
What should we advise our patients?

(Schneider, S, Lim, HW. JAAD 2019 Jan;80(1):266. Detroit)

• For those concern about the environmental effect of oxybenzone or octinoxate:
  – US: Use mineral (inorganic) sunscreen. FDA: GRASE
• With practice of rigorous photoprotection: vit D 600-800 IU daily
• Photoprotection for SOC needs to be re-evaluated
  – good broad spectrum sunscreens
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