AAD Summer Meeting
U013: Photoprotection
July 26, 2019

• Environmental impact, frontal fibrosing alopecia
  – Henry W. Lim, MD. Detroit

• FDA proposed rule
  – Steven Q. Wang, MD. New York
Sunscreen: Environmental Impact, and Frontal Fibrosing Alopecia

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Disclosure

- **Investigator:**
  - Estée Lauder
  - Ferndale
  - Unigen
  - Incyte

- **Consultant:**
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- **Speaker, educational session:**
  - Pierre Fabre
  - Eli Lilly
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
- 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).
Octinoxate

- Octinoxate = ethylhexyl methoxycinnamate
- Photostable UVB filter
- In FDA sunscreen monograph
Oxybenzone and Octinoxate
(Schneider, S, Lim, HW. JAAD 2019 Jan;80(1):266. Detroit)

- **Oxybenzone**, 4-methylbenzylideneacamphor (not FDA approved), octocrylene, and **octinoxate** (ethylhexyl methoxycinnamate) are used in personal care products (cosmetic items, fragrances, flavors) and as photostabilizers plastics.
- Not easily removed by waste water treatment plan.
- Centers for Disease Control has estimated that up to 96.8% of the US population is exposed to oxybenzone.
Oxybenzone

(Schneider, S, Lim, HW. JAAD 2019 Jan;80(1):266. Epub 2018 Nov 14.)

- Endocrinologic effects in rat model
- No known safety issues in humans (has been in use in the US since 1978)
Oxybenzone

(Schneider, S, Lim, HW. JAAD 2019 Jan;80(1):266. Epub 2018 Nov 14)

• Endocrinologic effects in rat model
• No known safety issues in humans (has been in us in the US since 1978)
• Oxybenzone kills adult coral reefs, and deforms DNA in the larval stage (in laboratory settings)
• Detected in fish (low concentration)
UV Filters in Water and Coral in Hawaii


Bleaching of Coral Reefs


- Along the Great Barrier Reef in Australia, bleaching of coral reefs occurred in remote areas with infrequent human contacts.
- Warming of ocean water: major cause.
Central equatorial Pacific: 8 severe (>30% bleaching) and 2 moderate (<30% bleaching) events since 1960, each coinciding with extreme heat associated with El Niño.
Oceans Warming


• Rapid warming of oceans over the past few decades:
  – Destruction of coral reefs
  – Declines in ice sheets

Jan 10, 2019
Safety of Oxybenzone

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

- Photoallergen
- Endocrinologic effects and adverse effects on coral reefs: only in animal model and in laboratory settings, respectively
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
Safety of Oxybenzone
(Schneider, S, Lim, HW. JAAD 2019 Jan;80(1):266. Epub 2018 Nov 14)

• Fish/food chain:
  – *Bioaccumulation*: chemicals reach higher concentrations in organisms vs environment.
  – *Biomagnification*: chemicals become more concentrated one moves higher up the food chain.
  – Oxybenzone, octinoxate: in various species of fish worldwide (low levels)
Regulations: Oxybenzone and Octinoxate

• Jan 2021: Ban in Hawaii and Key West, FL
• Legislation for 2019 to prohibit sale of sunscreens containing oxybenzone and octinoxate: introduced in California and Florida (? withdrawn)
• Palau (Jan 2020), Bonaire, Mexico (nature reserve)
• Being discussed in Brazil
Reef-safe sunscreens: ZnO and TiO$_2$
ZnO and TiO$_2$

*Corinaldesi, C, et al. Sci Total Environ 2018 Oct; 637-638; 1279-1285*

Laboratory settings:

• Uncoated ZnO: rapid bleaching of coral *in sunscreens, ZnO particles are coated*

• TiO$_2$: Did not cause bleaching
Efficacy of Filters
(5% in the Same Vehicle)

Courtesy of La Roche-Posay
TiO$_2$ and ZnO Nanoparticles

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

• No evidence of clinically relevant percutaneous penetration; no side effects in human
• Not sufficient data on inflamed skin where epidermal barrier function has been compromised.
• Environmental adverse effects: very low
Frontal Fibrosing Alopecia
# UV filters and FFA


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<tr>
<th>Studies</th>
<th>Subjects</th>
<th>Results</th>
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**Limitations:**

- Recall bias
- Association ≠ causative
FFA and TiO$_2$

- Titanium species on hair shaft of one pt with FFA
  - Brunel-Possenti, F, et al. JEADV 2019; 32: e442

- 20 pts (16 affected women, 4 unaffected women, 1 unaffected man): titanium species on hair shaft of all but the one unaffected man
What should we advise our patients?
(Schneider, S, Lim, HW. JAAD 2019 Jan;80(1):266. Epub 2018 Nov 14)

• 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
- With practice of rigorous photoprotection:
  vit D 600-800 IU daily
- More studies are needed on the association of FFA and sunscreen use