What’s New in Photoprotection and How it Impacts Your Patients

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Disclosures:
J and J – A, H, I
Beiersdorf – C, H

Importance of UV Protection
Protection

What Causes Skin Cancer?

What Causes Melanoma?
The overwhelming majority caused by UV exposure
UV and Melanoma Risk

- Sunlight is the major environmental risk factor for melanoma.
- Examine if S-shaped curves describe the relationship between solar UV doses and MM incidence and the % of MM that can be directly related to UV exposure.
- Analysis indicates that S-shaped associations describe the data well (P < 0.0001).
- Conclusion:
  - Between 89 and 95% of the annual CM cases are caused by solar UV exposure.
  - Avoidance of UV radiation will reduce the incidence of MM.


Are ALL melanomas caused by UV exposure?

No, but the vast majority are!

Who is more likely to get Melanoma?

Why?

Who is more sensitive to UV radiation?

Social media that patients read...

2 things happen during the 3rd week of May

Consumer Reports
EWG
Conflict!!!

Hazard scores given to properties of particular concern for sunscreens including products that contain:

- Oxybenzone
- Vitamin A
- Products listing SPF values exceeding “SPF 50+
- Products in a spray or powder form that may pose a risk when inhaled

Data Source: IRI, current 52 Weeks ending 09/22/2013

Change in “traditional” formulation mix
US Sunscreen Sales Last Year
Spray sales exceed lotions for the first time

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11 Worst Spray Sunscreens

These sunscreens are aerosol sprays with octylmethoxycinnamate and the harmful additives oxybenzone and retinyl palmitate.

Banana Boat Clear UltraMist Ultra Defense MAX Skin Protect Continuous Spray Sunscreen, SPF 110
Coppertone Sport High Performance Aloe/Continuous Spray Sunscreen, SPF 70
Coppertone Sport High Performance Clear Continuous Spray Sunscreen, SPF 100+
CVS Clear Spray Sunscreen, SPF 100
CVS Sheet Mist Spray Sunscreen, SPF 30
CVS Sport Clear Spray Sunscreen, SPF 100+
CVS Wet & Dry Sunscreen Spray, SPF 10
Neutrogena Ultra Sheer Body Mist Sunscreen Spray, SPF 30
Neutrogena Ultra Sheer Body Mist Sunscreen Spray, SPF 100+
Neutrogena Ultra Sheer Body Mist Sunscreen Spray, SPF 70
Neutrogena Wet Skin Sunscreen Spray, SPF 85+
Does sunscreen usage lower skin cancer risk?
Reduced melanoma risk after regular sunscreen use

- 1,621 randomly selected residents of Nambour (Queensland) Australia, age 25 to 75 years, were randomly assigned to daily or discretionary sunscreen application to head and arms
- Treated for 5 years then followed for 10 years

Sunscreen Usage and Melanoma Risk

Invasive MMs

- Only 11 new MMs in daily group vs. 22 (p=0.051)
- 2 Invasive MMs in daily group vs.11

Conclusions:
- Melanoma may be preventable by regular sunscreen use in adults

Skin cancers in Australia prevented by regular sunscreen use

- Estimated the proportion of skin cancers that would have occurred but were likely prevented by regular sunscreen use
- Regular sunscreen use prevented around 14,190 persons from developing SCCs (PF 9.3%) and 1,730 from Melanoma (PF 14%)

Conclusions:
- Prevailing levels of sunscreen use probably reduced skin cancer incidence by 10-15%
- Sunscreen should be a component of a comprehensive sun protection strategy

MM risk using SPF<15 vs SPF >15

Blond/Red Hair Freckling in Sun Changing from SPF<15

Norwegian Women Study N = 143,844

Sunscreen Usage and Melanoma Risk

All Melanomas

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Does SPF>50 provide additional benefit?

In-vivo comparison of SPF 100 vs 50 in Actual Use Conditions

SPF 100 protects better than 50 in Actual Use Conditions

Secondary Endpoint

SPF 100 protects better than 50 in Actual Use Conditions

Bilaterial comparison after 1 day skiing
Are vitamin A analogues in sunscreen risky?

SPF 100 protects better than 50 in Actual Use Conditions

- SPF 100+ Side
- SPF 50+ Side
- No Difference

Wang et al, JAAD, 2010

Are Sunscreens with Retinyl palmitate Safe?

- Retinyl palmitate – cosmetic ingredient and antioxidant
  - 41% of sunscreens
  - photo degraded → induces ROS
  - photocarcinogenic
  - 10 year old FDA study of mice

- Concerns not supported by available literature

Safety of retinyl palmitate in sunscreens

- There is no published evidence to suggest that topical retinoids increase the risk of photocarcinogenesis.
- RP is regularly used in topical agents for >40 yrs
- Retinoids are used for chemoprevention of skin cancers in individuals at high risk, such as transplant populations and patients with xeroderma pigmentosum with no evidence for increased skin cancer risk
- Conclusions:
  - Based on currently available data from studies, there is no convincing evidence to support the notion that RP in sunscreens is photocarcinogenic.
  - In fact, clinical observations spanning over decades suggest that retinoids are helpful in skin cancer chemoprevention.
  - Correcting this false impression is an important and necessary step to ensure that the public continues to use sunscreen as a component of photoprotective strategy

Wang et al, JAAD, 2010
Are European sunscreens better?

Sunscreen Formulations

UVA Sunscreening Agents available in the US

UVA Sunscreening Agents not yet available in the US

New Sunscreening Agents

- Currently 19 approved in the US
- Multiple sunscreening agents that are available in Europe and Asia are not available in the US
- FDA using TEA format considering approval
- Conclusions:
  - Newer agents will be incorporated into future sunscreen formulations

<table>
<thead>
<tr>
<th>Geographic Region</th>
<th>Number of Approved Sunscreening Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>18</td>
</tr>
<tr>
<td>Europe</td>
<td>23</td>
</tr>
<tr>
<td>Japan</td>
<td>19</td>
</tr>
<tr>
<td>Australia</td>
<td>26</td>
</tr>
</tbody>
</table>
### Potential Sunscreen Agents

<table>
<thead>
<tr>
<th>Sunscreen Agent</th>
<th>Spectrum of Action</th>
<th>FDA Status</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinosorb S</td>
<td>UVB, UVA1, UVA2</td>
<td>Not approved</td>
<td>Very photostable, minimal skin absorption</td>
</tr>
<tr>
<td>Tinosorb M</td>
<td>UVB, UVA1, UVA2</td>
<td>Not approved</td>
<td>Fairly photostable</td>
</tr>
<tr>
<td>Micronyl K1</td>
<td>UVA2</td>
<td>Not approved</td>
<td>Not absorbed into skin</td>
</tr>
<tr>
<td>Uvinul T 100 (Oleiphene)</td>
<td>UVB</td>
<td>Not approved</td>
<td>Not water soluble, Water resistant and strong binding; May have endocrine effects; Help to stabilize avobenzone</td>
</tr>
<tr>
<td>Enzacamene (benzoxanzone)</td>
<td>UVB</td>
<td>Not approved</td>
<td>Not water soluble</td>
</tr>
<tr>
<td>Mexoryl XL</td>
<td>UVA1, UVA2</td>
<td>Not approved</td>
<td>Photostable, Water soluble</td>
</tr>
<tr>
<td>Uvinul T 150 (Octyltriazone)</td>
<td>UVB</td>
<td>Not approved</td>
<td>Not water soluble, Water resistant and strong binding</td>
</tr>
<tr>
<td>Enzacamene (Methylbenzylidene)</td>
<td>UVB</td>
<td>Not approved</td>
<td>May have estrogenic effect</td>
</tr>
<tr>
<td>Bisdisulizole</td>
<td>UV/1, UVA2</td>
<td>Not approved</td>
<td>Photostable, Water soluble</td>
</tr>
<tr>
<td>Amiloxate</td>
<td>UVB, UVA1</td>
<td>Not approved</td>
<td>Available in EU and Asia</td>
</tr>
<tr>
<td>Amiloxate (Neo Heliopan)</td>
<td>UVB</td>
<td>Not approved</td>
<td>Available in EU and Asia</td>
</tr>
<tr>
<td>Parsol SLX</td>
<td>UVB, UVA1</td>
<td>Not approved</td>
<td>Available in EU and Asia</td>
</tr>
</tbody>
</table>

### Sunscreen Innovation Act -2014

- Requires the Secretary to review any request regarding a sunscreen active ingredient or combination of ingredients that has been in use and that is not currently in the monograph.
- Requires the Director of the Center for Drug Evaluation and Research to complete a review of a filed request and determine the safety and efficacy of the sunscreen active ingredient within 300 days for new requests or a shorter timeframe for requests pending before enactment of this Act.
- Directs the Commissioner of Food and Drugs to make the determination if the Director does not make a determination in the allowed timeframe.
- Allows sponsors of eligible non-sunscreen OTC drug applications to request that the Secretary provide a framework for review of their application.
- Requires the Secretary to respond with framework options, including options that follow the review process set forth in this Act for sunscreen active ingredients.

### Sunscreen Innovation Act

Amends the Federal Food, Drug, and Cosmetic Act to establish a process for the review and approval of over-the-counter (OTC) sunscreen active ingredients.

- Of the original 8 filters up for review, the FDA concluded there was not enough data to approve 5 filters.
- The bill was approved by the House in July and different version of the bill was approved by the Senate in September.
- Signed into law by the President in December 2014.
- There is no final decision on whether there will be any regulations on high SPF or spray sunscreens.

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**Perspective**

A Spotlight on Sunscreen Regulation

In my view, Congress should try again and pass legislation establishing an alternative approval pathway that combines the flexibility of the new drug pathway with the ability to simultaneously approve multiple formulations and concentrations. The FDA should be able to negotiate with sponsors to get the right data without years of rulemaking, establish postmarketing data requirements, consult with other countries' regulators to establish consistent standards where possible, and move quickly in the event that safety concerns emerge. Congress should provide additional resources to facilitate timely analysis and review. That path is viable is evidenced by the fact that the one approval of a product with a new sunscreen ingredient in the past decade came through the new drug pathway.
Do sunscreens protect from other photodamage?

Effect of Sunscreen Application on UV-Induced Thymine Dimers
- Unexposed buttocks skin irradiated with UV with and without SPF 15 sunscreen
- When sunscreen application was omitted even once prior to irradiation, a statistically significant increase in TD formation was found
- Conclusion:
  - Unprotected UV exposure leads to increased TD formation

DNA Dosimetry Assessment for Sunscreen Genotoxic Photoprotection
- Sun Protection Factor for DNA (DNA-SPF) is calculated by using specific DNA repair enzymes, and it is defined as the capacity for inhibiting the generation of cyclobutane pyrimidine dimers (CPD) and oxidized DNA bases compared with unprotected control samples
- 5 commercial sunscreens and 17 sun protection formulations were tested
- All of the commercial brands of SPF 30 sunscreens provided sufficient protection against simulated sunlight genotoxicity
- Conclusions:
  - DNA dosimeter is an alternative, complementary, and reliable method for the quantification of sunscreen photoprotection at the level of DNA damage

Sunscreen and Prevention of Skin Aging Randomized Trial
- 903 adults younger than 55 years randomly selected from a community register. Random assignment into 4 groups:
  - daily use of broad-spectrum sunscreen and 30 mg of β-carotene
  - daily use of sunscreen and placebo
  - discretionary use of sunscreen and placebo
  - discretionary use of sunscreen and placebo
- Change in microtopography in the sunscreen and β-carotene groups compared with controls, graded by blinded assessors
- Skin aging from baseline to conclusion was significantly less in the daily sunscreen group than the discretionary group (OR=0.76)
- Conclusions:
  - Regular sunscreen use retards skin aging in healthy, middle-aged men and women.
  - No overall effect of β-carotene on skin aging was identified

Broad spectrum high-SPF photostable sunscreen with high UVA-PF can protect against cellular damage at high UV levels
- To evaluate if high-SPF sunscreen can protect skin at the cellular level under UV exposure doses (>50 MEDs) similarly to the SPF value
- Sunburn cells, Langerhans cells, thymine dimers, protein 53 (p53), and matrix metalloproteinase (MMP)-1 and MMP-9 endpoints were evaluated in biopsies from 12 subjects:
  - unprotected exposed to 0, 1 and 3 MED
  - SPF 55 protected exposed to 55 MED of UV radiation
- After 55 MEDs, sunscreen-protected sites showed either significantly less damage or no difference than the 1 MED-exposed unprotected sites
- Conclusions:
  - High-SPF sunscreen with high UV-A-PF can provide proportionately high protection against multiple cellular damage markers
Do sunscreens cause hormonal or allergy problems?

Hormonal issues?

- Oxybenzone – broad spectrum agent
  - absorbed into skin
  - carcinogen???
  - causes “hormone disruption” (estrogenic activity)
- Concerns not supported by available literature

Safety of Oxybenzone

- Oxybenzone widely used in sunscreens
- Study suggested uterotrophic effects in immature rats after oral administration of oxybenzone
- Amount of topical application in humans to reach same levels of absorption computed

Wang et al, Arch Dermatol, 2011

Safety of Oxybenzone

- Scenario 1: 100% body surface area (BSA) coverage at a standard dose of 2 mg/cm² would require 30 mL (10 950 mL/y with daily application).
- Scenario 2: 100% BSA coverage at a dose of 1 mg/cm² would require 15 mL (5475 mL/y).
- Scenario 3: 25% BSA coverage at a dose of 1 mg/cm² would require 3.75 mL (1369 mL/y).

Wang et al, Arch Dermatol, 2011

Years of Daily Sunscreen Application Required by an Average US Woman to Reach Systemic Levels of Oxybenzone per Unit of Body Mass Equivalent to Those Given to Immature Rats

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body surface area covered, %</td>
<td>100</td>
<td>100</td>
<td>25</td>
</tr>
<tr>
<td>Application dose, mg/cm²/d</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Application amount required, mL/d</td>
<td>30.00</td>
<td>15.00</td>
<td>3.75</td>
</tr>
<tr>
<td>Time required, y</td>
<td>34.6</td>
<td>69.3</td>
<td>277.0</td>
</tr>
</tbody>
</table>


Oral chemoprevention of skin cancer in mice by benzophenone sunscreens in drinking water

- 15 hairless mice (control and test groups) had skin tumors induced by a single dose of NOR-1 and 1 wk later application of TPA applied to skin tiw for 20 weeks as tumor promoter
- Benzophenone sunscreen agents were administered at 0.0025% to mice through drinking water starting 1 wk prior to and stopping 1 wk post tumor initiation
- Significant inhibition (p<0.001) of tumor incidence (50% and 60%, respectively) and tumor burden (papilloma inhibition/mouse, 50% and 70%) were observed when compared to the positive control group.
- Conclusions:
  - Skin cancer chemoprevention potential of orally-ingested benzophenone sunscreens in mice
  - Synergistic protection achievable by complementation of oral and topical sunscreen usage

Rao et al, Anticancer Res. 2013
Are patients really “allergic” to sunscreens?

- 1,527 with a concern about sunscreen allergy tested
- Only 4 patients had a positive reaction to a sunscreen chemical or to the product they were using.
- In addition, 8 of the patients who had no specific history of sunscreen allergy reacted to benzophenone-3.
- Other more common final diagnoses included ACD to excipients such as fragrances or preservatives and suspected photosensitive disorders
- Conclusion:
  - ACD to sunscreen was found to be very uncommon (0.8%).


Are nanoparticles in sunscreen a concern?

Are nanoparticles in sunscreen a concern?

Enhanced sun protection of metal oxide nanoparticles over conventional particles: an in vitro comparative study

- In vitro method to determine sun protection factor of the investigational sunscreen cream samples containing zinc and titanium dioxide with a varied range of particle size
- Comparative study conducted between metal oxide particles, conventional as well as nanoparticles
- Nanoparticle formulations had better spreadability and better SPF values by a 2X margin
- Conclusions:
  - Good texture, better spreadability and enhanced in vitro SPF proved the advantageous role of nanoparticles in sunscreens


Dermal absorption and short-term biological impact in hairless mice from sunscreens containing ZnO nanoparticles

- Sunscreens containing tracer 68ZnO were applied to the backs of virgin or pregnant hairless mice over four days.
- Control groups received topical applications of the sunscreen formulation containing no ZnO particles, or no treatment.
- Major organs were assessed for changes in 68Zn/64Zn ratios, 68Zn tracer and total Zn concentration
- Increased concentrations of 68Zn tracer were detected in internal organs but blood levels normal
- Conclusion:
  - ZnO nanoparticles in sunscreen did not elicit an adverse biological response following short-term topical application

Osmond-McLeod et al, Nanotechnology, 2013

Gold nanoparticles as novel agent to enhance SPF of commercial sunscreens

- Latex fabricated gold nanoparticles were analyzed by different analytical techniques such as UV-Vis spectroscopy, Fourier transforms infrared spectroscopy, zeta potential, transmission electron microscopy and X-ray diffraction
- Transmission electron microscopy and UV-Vis spectroscopy techniques were used to get insight into mechanism by which AuNPs enhance sunscreen SPF
- Adding gold nanoparticles to commercial sunscreens increased the SPF from 2 to 24
- Gold nanoparticles enhance the SPF of commercial sunscreens due to reflection and scattering of UV
- Conclusions:
  - Gold nanoparticles are a potent alternative to traditionally used TiO2 and ZnO nanoparticles


Titanium dioxide and zinc oxide nanoparticles in sunscreens: Focus on safety and effectiveness

- Microsized TiO2 and ZnO have been increasingly replaced by TiO2 and ZnO nanoparticles
- Use of TiO2 and ZnO NPs makes the undesired opaqueness disappear
- Leads to incorporation of TiO2 and ZnO NPs in the stratum corneum
- Sunscreen NPs induce (photo)cyto- and genotoxicity which have been sporadically observed in viable skin layers
- Conclusions:
  - Caution should still be exercised when new sunscreens are developed
  - Research that includes sunscreen NP stabilization, chronic exposures, and reduction of NPs' free-radical production should receive full attention

Smijs et al, Nanotechnol Sci Appl. 2011
New Formulations...

UV induced Free Radical formation

Sun Protection and Anti-oxidants
- Generation of reactive oxygen species (ROS) and other free radicals by UV radiation is counteracted by antioxidants to prevent oxidative stress
- Lead to genetic alterations that include DNA damage, mutations, and genomic instability
- Antioxidants scavenge free radicals but also have other anticarcinogenic properties, which include modulating signal transduction pathways such as nuclear factor-kappa beta and beta-catenin

Sunscreen + Antioxidants = More Effectiveness??

Sunscreen photoprotection: antioxidants add value to a sunscreen
- Polyphenols such as (-)-epigallocatechin-3-gallate (EGCG) has been shown to protect against UV-induced DNA damage even when added to low SPF formulations
- The addition of botanical antioxidants and vitamins C and E to a broad-spectrum sunscreen may further decrease UV-induced damage compared with sunscreen alone
- Conclusion:
  - Non-sunscreen materials such as botanical extracts, antioxidants, and DNA repair enzymes can contribute value when applied topically to human skin in vivo
**Sun Protection and Anti-oxidants**

- Vitamin E
- Vitamin C
- Polyphenols (Green tea) epigallocatechin-3-gallate (EGCG)
- Genistein (soybeans)
- Resveratrol (grape skins, peanuts, and red wine)
- Lycopene (an isomer of beta carotene - red fruits and vegetables, such as tomatoes, watermelons)
- Combinations may be synergistic

Junkins-Hopkins et al, JAAD, 2010

**Protective effects of a topical antioxidant mixture with vitamin C against UV-induced photodamage**

- 10 subjects (age, 18-60 years; Fitzpatrick skin types II and III) were randomized and treated with antioxidant product or vehicle control on the lower back for 4 days
- Significant increases in sunburn cell formation, thymine dimer formation, MMP-9, and p53
- All changes were attenuated by the antioxidant

**Conclusions:**
- Confirms the protective role of antioxidants containing vitamin C

Oreagio et al, J Cos Dermatol, 2008

**UV photoprotection by combination topical antioxidants vitamin C and vitamin E**

- An aqueous solution of 15% L-ascorbic acid (vitamin C) and 1% alpha-tocopherol (vitamin E), applied for 5 days after UV exposure
- Measured antioxidant protection factor, erythema, sunburn cells, and thymine dimers.
- Combination of vitamins C and E provided protection against thymine dimer formation

**Conclusions:**
- Appreciable photoprotection can be obtained from the combination of topical vitamins C and E


**Sun Protection and Anti-oxidants**

**Vitamin C and E**

- Could a stable topical formulation of 15% L-ascorbic acid, 1% alpha-tocopherol, and 0.5% ferulic acid (CEFer) could protect human skin in vivo from substantial amounts of solar-simulated UV radiation?
- Applied to separate patches of normal-appearing human skin for 4 days then exposed to 2-10 MEDs of UV
- Provided substantial UV photoprotection for skin by reducing thymine dimer mutations.

**Conclusions:**
- Mechanism of action is different from sunscreens and would be expected to supplement the sun protection provided by sunscreens.

Murray et al, JAAD, 2008

**Polypodium leucotomos**

**Decreases UV induced skin damage**

- Investigated Photoprotective effects of oral administration in 9 patients
- Measured erythema (MED) and biopsied skin and measured sunburn cells, pyrimidine dimers, dermal mast cell infiltration and Langerhans cells
- All of these measures were improved with the administration of polypodium

**Conclusion:**
- Effective systemic chemoprotective agent against UV radiation exposure skin damage

Middelkamp-Hup et al, J Am Acad Dermatol, 2004
Polypodium leucotomos

- Polypodium leucotomos is a natural fern leaf extract with antiinflammatory and antioxidant (AO) properties.
- The administration of oral P leucotomos to a group of high-risk patients with MM or DNS led to a significant reduction in sensitivity to UVR in all patients.
- Other studies have found that oral administration of 480 to 1200 mg daily of this extract can prevent polymorphous light eruption lesions in patients with PMLE.
- Has been shown to reduce the known effects of UVR, including minimal erythema dose, minimal phototoxic dose, UV-induced epidermal proliferation, development of DNA damage, and the generation of ROS.


Benefits of oral Polypodium Leucotomos extract in MM high-risk patients

- 61 pts (25 familial and/or multiple MM, 20 sporadic MM and 16 with DNS without history of MM) were exposed to varying doses of artificial UVB radiation before and after oral administration of a total dose of 1080 mg of PL.
- Oral PL treatment significantly increased the MED mean in all groups.
- Conclusions:
  - Oral PL leads to a significant reduction of sensitivity to UVR (p<0.05) in all patients in study.

Aguilera et al, JEADV, 2013

Key Principles in Developing New Sunscreens

- Photostabilization of avobenzone (achieved by most products):
  - Active UV filters (Octocrylene)
  - Non-UV filters (DEHN, Oxynex ST, Caprylyl glycol)
- New generation of photostable UV filters (pending TEA approval)
- Antioxidants
  - Protect against UV-induced DNA damage, immune suppression & depletion of Langerhans cells
- New technologies
  - Light Scattering additives: beads to scatter UV photons (made from non-active polymers)
  - Encapsulation: transparent, inert shell entrapping UV filters to improve filter stability and avoid direct contact with skin

Answering Our Patient's Questions
**Assessment of dermal absorption of DEET-containing insect repellent and oxybenzone-containing sunscreen**

- Concerns about oxybenzones increasing the dermal absorption of DEET
- Sought to determine the best way for concurrent use of these two products without extra absorption of either
- 4 dermal application methods were used: DEET only, OBZ only, DEET on top of OBZ, and OBZ on top of DEET
- Applying OBZ over DEET on the skin lead to significantly higher absorption of DEET. Using both products in reverse order, did not result in extra DEET absorption significantly
- **Conclusions:**
  - Enhancement of DEET absorption is confirmed for OBZ being applied after DEET application on the skin;
  - Applying sunscreen (OBZ) first and then insect repellent (DEET) with a 15-min interval is recommended


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**Accumulation of sunscreen in human skin after daily applications**

- Sunscreen applied to the skin provides a considerable SPF even after 8 hrs.
- Sunscreen use for consecutive days may therefore result in an accumulation of the product.
- This study investigated the consequences of accumulation skin surface SPF measurements
- 2 SPF 30 Sunscreens (organic and inorganic) applied to the skin qd vs tid for 5 days and then SPF measured
- Qd use made showed no improvement but tid usage had an average of SPF 2 improvement of baseline at 5 days
- **Conclusions:**
  - Tid sunscreen application on consecutive days prior to UVR exposure may result in an improved basic skin protection

Bodekær et al, Photodermatol Photoimmunol Photomed. 2012

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**Does artificial UV use prior to vacation protect from vacation related sunburns ?**

- Examined associations in college students between potential risk factors and the development of one or more sunburns during spring break
- Risk of obtaining a sunburn increased with: time spent in the sun during spring break; light complexion, as assessed by various sun-sensitivity factors; and lack of sunscreen use.
- Tanning using an artificial UV source during the 10 weeks prior to spring break was not associated with reduced risk of sunburns during spring break, but rather with an increase in this risk
- **Conclusion:**
  - Maintaining a tan may not provide protection from sunburns.
  - Public health messages need to address this misconception, stating clearly that a tan does not protect against or reduce the chances of developing a sunburn

Dennis et al, Photodermatol Photoimmunol Photomed. 2013

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**Evaluation of a sunscreen during a typical beach period**

- UV protection is strongly dependent on the properties of these sunscreen agents, it is very important to ensure their stability at the typical higher temperatures of summer
- Sunscreens tested in vitro for a period of time intended to simulate a beach period of 15 days, with regard to the maintenance of its SPF.
- No significant alterations were observed during the considered period under the specific conditions of this study
- **Conclusions:**
  - Sunscreen protection does NOT degrade at outdoor summer temperatures during a typical vacation period

Rego et al, J Pharm Bioallied Sci. 2010

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**Stability of sunscreens following exposure to extreme temperatures**

- 9 commercially available sunscreens after an 8-hour exposure to a range of temperatures including −20°C, 4°C, 21°C, 30°C, and 60°C
- Phase separation and failure to rehomogenize on shaking
- **Conclusions:**
  - Extended exposures to high temperatures can degrade sunscreen


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**Evaluation of a sunscreen during a typical beach period**

Rego et al, J Pharm Bioallied Sci. 2010
Evaluation of a sunscreen during a typical beach period

Do you really have to wait 15-20 minutes for sunscreen protection?

- Sunscreen testing protocols mandate drying times of 15-20 minutes before SPF testing can begin: mandatory labeling reflect this instruction
- UV Protection is actually instantaneous
- Water resistance MAY require more drying time

Re-application is Important

- Re-application after 2 hours is mandatory labeling by FDA
- Based on JAAD paper, 2011, AAD comment to FDA
- Photostable sunscreens do not "wear out" and will continue to protect as long as they are on the skin
- Re-application is advisable to assure proper application level and to hit "missed spots," and after toweling or wiping off

Rules of Sunscreen Application

- Patients tend to "rub in" sunscreens – so you can’t see it anymore. Does “rubbing in” assure best protection? NO!
- Best protection is achieved by having uniform film on the surface of the skin
  - Spread lightly on the skin and let it be...
  - For inorganic filters (ZnO, TiO2) it is even more important not to "rub" it till you can’t see it
  - For Spray products – spray the surface until it glistens "wet" and then gently spread to make sure all spots are covered
  - Best to spray in sheltered area so the sunscreen is not blown away

What are Dermatologists views, beliefs and recommendations?

Dermatologists’ Perceptions Recommendations and Usage of Sunscreen

Dermatologists’ Views

- Lower skin cancer risk
- Reduces photodamage
- Rec to friends/family
- Its not too thick

N = 156
What is the Best Sunscreen?
The best sunscreen is the one a patient will use regularly and as recommended

Protect your largest organ...

Your skin from the Sun

When your patients ask about...
Photoprotection

- Photoprotection important and lowers melanoma risk
- SPF >50 is efficacious
- We don’t have answers to all of the questions and formulations can still be improved
- Formulations evolving in future with new agents and other ingredients
- The best sunscreen is the one that a person will use
- Learn what your pts are hearing and have the answers ready