Shedding Light on Sun Care Formulations: Deciphering Ingredients and Exploring Advances

Beyond FDA-mandated label revisions, clinicians and consumers have been spotting other changes on bottles: a host of new ingredients and technologies intended to optimize the patient experience.

BY JEANNETTE GRAF, MD

In skin care, each new ingredient has the possibility of being a skin savior. I started researching ingredients more than 20 years ago, and the advancements clearly show the lengths we have reached. Yet, imagine the overwhelming feeling a patient would have if we only suggested they start using sunscreen. Imagine the choices! By categorizing a patient’s needs and then examining ingredients, we can recommend the right product the first time around.

The new requirements the US Food and Drug Administration (FDA) announced for over-the-counter sunscreens as well as cosmetics and moisturizers claiming to provide Broad Spectrum or Sun Protection Factor (SPF) 15 (or higher) protection go into effect this summer. The label revisions are supposed to make it easier for consumers to understand their UV protection options, and potentially confusing claims about durability are being eliminated. But at the same time, advancements in product formulation and dispensing are creating new product features, leading to a host of new messaging on labels. While many of these new sunscreen developments may confer benefits for patients, everything new is not necessarily better.

With these changes comes an educational opportunity for patients. By understanding new formulation features and potential benefits of new ingredients, dermatologists can make meaningful product recommendations to their patients.

ANTIOXIDANTS

The body’s natural mechanisms of defense against free radical damage are not sufficient to counter the oxidative stress or immunosuppression that UV exposure can trigger. It has been suggested that up to 50 percent of the cutaneous damage caused by UV exposure is via free-radical formation. Recognizing this fact, sunscreen formulators have moved beyond simple photoprotection to the realm of repair. Topically applied antioxidants are shown to provide protection from endogenous and exogenous oxidative stresses by free radicals. Studies demonstrate a dose-dependent effect of mineral sunscreens and a relationship between SPF and genomic protection. Botanical ingredients may also confer repairing and anti-aging effects. By limiting the accumulation of UV-induced damage on DNA, mineral sunscreens could limit the mutation frequency. Peptides have been a trend in topical anti-aging therapies, and there is some good science to support their use. These agents have been shown to provide specific anti-aging benefits, perhaps by signaling fibroblasts to generate collagen.

TAKE HOME TIPS

Sunscreen formulators have moved beyond simple photoprotection to the realm of repair. Topically applied antioxidants are shown to provide protection from endogenous and exogenous oxidative stresses by free radicals. Studies demonstrate a dose-dependent effect of mineral sunscreens and a relationship between SPF and genomic protection. Botanical ingredients may also confer repairing and anti-aging effects. By limiting the accumulation of UV-induced damage on DNA, mineral sunscreens could limit the mutation frequency. Peptides have been a trend in topical anti-aging therapies, and there is some good science to support their use. These agents have been shown to provide specific anti-aging benefits, perhaps by signaling fibroblasts to generate collagen.
have moved beyond simple photoprotection to the realm of repair. Topically applied antioxidants are shown to provide protection from endogenous and exogenous oxidative stresses by free radicals, and there are studies suggesting the potential benefit of topical antioxidants when incorporated into sunscreens and skin care products.1,3,5,6

It is important to recognize that the ultimate value of any finished topical product will depend on the quality of ingredients used, good manufacturing and packaging practices, and, of course, patient use. It is also worth noting that research indicates that specific combinations of topically applied antioxidants, such as vitamin E and vitamin C, may provide greater photoprotective and radical scavenging effects than the constituents alone.3

The Avon Anew Solar Advance line includes a sunscreen combined with topical antioxidants to help repair recent damage. A rice sterol, algae extract, and soy fragments are supposed to help activate natural antioxidant enzymes in the body and also help improve repair enzymes inside the cell, correcting some DNA damage. There is some evidence, though not specific to this product, to suggest that algae extracts have bioactivity, including both antioxidant and even antimicrobial effects.7 Soy extracts have become increasingly popular in topical formulations, and they are associated with antioxidant effects.4 The increasing interest in soy’s ability to regulate pigmentation through inhibition of keratinocyte protease-activated receptor 2 suggests a possible added benefit for soy within a sunscreen product.7

Glytone Sunscreen Spray Mist SPF 50 also has an antioxidant complex with Broad Spectrum UVA/UVB technology. Delta-tocopherol glucoside, a prodrug of vitamin E, provides delivery of free tocopherol; its use at a low concentration has shown the capability of the skin to metabolize the prodrug, making this gluco-conjugated vitamin E an excellent candidate for continuous reinforcement of antioxidants in the skin.9

La Roche-Posay created both the Anthelios 30 and 60 Ultra Light Sunscreen Lotion Spray lines with high UVA protection (PFA 29 and PFA 30) and SPF 30 and 60, respectively, for outdoor use. The CELL-OX Shield additive in this line features a proprietary blend of antioxidants. Senega alata leaf extract antioxidant in combination with sunscreen provides high photoprotection; in a study, the levels of thymine dimer formation, MMP-9 protein production, and p53 protein expression were reduced significantly by the antioxidant, but the formula containing sunscreens and the antioxidant complex was most protective.10

For the face and neck, Jan Marini Skin Research Antioxidant Daily Face Protectant includes what the company calls PhytoMelanin plant extract technology, providing natural photoprotection with antioxidant and anti-inflammatory activity. Studies demonstrate that when applied topically, PhytoMelanin, a derivative of date palm fruit that is intended to mimic human melanin, delivers beneficial antioxidant and free radical scavenger properties to the skin, including protection from sunburn cell formation, lipid peroxidation, erythema, and inflammation.11

MINERALS AND BOTANICALS
Studies demonstrate a dose-dependent effect of mineral sunscreens and a relationship between SPF and genomic protection. By limiting the accumulation of UV-induced damage on DNA, mineral sunscreens could limit the mutation frequency.12,13

La Roche-Posay created Anthelios 50 Tinted Mineral Ultra Light Sunscreen Fluid, a 100 percent mineral, non-chemical sun filter with universal tint technology. Products like these offer uniform application without the need for foundation or makeup after. With a “greasy” feeling being a common patient complaint with most sunscreens, Obagi Nu-Derm Healthy Skin Protection SPF 35 uses a non-greasy formulation that has been described as almost able to “disappear” once on the skin.16 One of its main ingredients is micronized zinc oxide (9%). Micronized zinc particles are thought to lay more evenly on the skin and produce better coverage than larger zinc particles. Furthermore, micronized zinc produces none of the white residue associated with some older formulations. Since the skin does not absorb micronized zinc oxide, there is no risk of toxicity through the skin.15,16

Fallene Cosmeceuticals LTD has a formula known as CoTZ Pure, a mineral sunscreen containing no synthetic ingredients, preservatives, chemical sunscreens, oils, or
**15 COMMON SUNSCREEN GEL, CREAM, AND LIQUID INGREDIENTS**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Purpose</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisabolol</td>
<td>Preservative</td>
<td>Often used for its anti-inflammatory properties.</td>
</tr>
<tr>
<td>Colorants</td>
<td>PVP</td>
<td>Components for color stability.</td>
</tr>
<tr>
<td>Fragrance</td>
<td>Stearalkonium Hectorite</td>
<td>Promotes stability.</td>
</tr>
<tr>
<td>Glycerin</td>
<td>Titanium Dioxide</td>
<td>Helps moisturize skin.</td>
</tr>
<tr>
<td>Glyceryl Stearate</td>
<td>UV Filter</td>
<td>Often used for its sun protection properties.</td>
</tr>
<tr>
<td>Mineral Oil</td>
<td>Water</td>
<td>Enables spreading of the sunscreen.</td>
</tr>
<tr>
<td>PEG-30 Glyceryl Cocomate</td>
<td>Zinc Oxide</td>
<td>Acts as an emulsifier.</td>
</tr>
<tr>
<td>PEG-30 Hydrogenated Castor Oil</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Fragrance. The CoTZ Balanced Mineral Complex blends to match skin tone and is gentle on various skin types.

Post treatment, the previously mentioned Obagi Nu-Derm Healthy Skin Protection SPF 35 and the NIA24 Sun Damage Prevention UVA/UVB Sunscreen SPF 30 have been recommended and generally well tolerated. EltaMD UV Clear SPF 46 contains a dimethicone-coated micronized form of zinc oxide (9%), resulting in a more elegant moisturizing product than other zinc oxide formulations. In addition, it is well tolerated in skin of color, which is not always true with many zinc and titanium dioxide preparations.17

NIA24’s oil-free product contains its Pro-Niacin molecule with the goal to improve skin tone, texture, fine lines, wrinkles, sunspots, and hyperpigmentation. Topical niacin has been explored as an anti-aging treatment, with beneficial effects on epidermal thickness and reduction of trans-epidermal water loss.18 Pro-Niacin is a proprietary niacin compound that the company says helps to fuel natural repair processes to renew healthy skin cells and stimulate the release of leptin, a hormone known to activate the skin’s natural wound-healing response. The product also contains antioxidant vitamin E and blueberry extract.

Another option in the field of combined repair and prevention is Pro+TherapyMD Advanced Ultra Light Day Repair SPF 30 (Valeant), which offers “sheer zinc,” a form of the physical sunscreen the company says can be used even on dark skin tones. The product also features a proprietary blend of ceramides for moisturization and botanically derived Kinetin and Zeatin. Zeatin is a plant-derived growth factor that may obviate some dermatologists’ concerns about the effects of human growth factors that are available in some other formulations. Proprietary data show that Zeatin improved skin roughness by 86 percent, while Kinetin improved redness, roughness, and blotchiness, associated with rosacea by 80 percent.

Since makeup alone is insufficient protection, combination products can offer a supplement to already applied sunscreen. Colorescience Pro Sunforgettable Brush SPF 50 dusts over makeup when reapplying sunscreen. In addition, the Jane Iredale Powder-Me SPF Dry Sunscreen SPF 30, containing titanium dioxide and a natural sun-dried clay, comes in “Translucent” or “Tanned” finishes and can be used on the body and face for sun protection. I typically recommend the High Protection Tinted Compact SPF 50 by Avène, which is formulated with 100 percent mineral sunscreen (titanium dioxide and zinc oxide) and the company’s patented Pre-Tocopheryl (photo-stable vitamin E) for antioxidant effects. The compact is available in “Beige” and “Honey” shades to provide Broad Spectrum UVA and UVB protection across skin types. The Zo Skin Health Eclipse Sunscreen + Primer offers multi-purpose support to patients wanting an all-in-one sunscreen, primer, foundation, and tinted moisturizer. Peter Thomas Roth Instant Mineral SPF 30 serves as a mineral makeup and a translucent powder. While not ideal for primary protection, patients will request these all-in-one or combination products to aid in supplementing their makeup coverage.

On the cosmetic side, the Shiseido Benefiance WrinkleResist 24 line is formulated to help block the enzyme heparanase that is stimulated by UV rays and aids in forming wrinkles. Its Mukurossi and gambir-plant extracts are said to neutralize the activity of heparanase and inhibit elastase. I see this as a breakthrough in skin care; by addressing the heparanase issue, the product still has wrinkle-smoothing properties, but patients can get the preventive measures as well, including slowed tissue breakdown.19,20

**PEPTIDES**

Peptides have been a trend in topical anti-aging therapies, and there is some good science to support their use.21-23 These agents have been shown to provide specific anti-aging benefits, perhaps by signaling fibroblasts to generate collagen.24

In light of the limited number of published direct comparative studies, we generally presume these products do not have clinical efficacy comparable to that of prescription topical therapies.25 However, these cosmetic options are generally well tolerated and, as they grow in sophistication, can become a viable option for patients.

Revision Intellishade SPF 45 is an anti-aging tinted moisturizer that evens skin tone, hydrates, and provides sun protection. The line offers an original “Radiant” or “Matte” finish, which is formulated to minimize pores. Both formulas include a wrinkle-reducing peptide, serve as a foundation alternative, and provide Broad Spectrum UVA/UVB protection.
Avobenzone, highly unstable when exposed to sunlight, was stabilized using oxybenzone and DEHN by Neutrogena in a compound called Helioplex that provides better, longer protection from UVA rays. The Neutrogena Wet Skin sunscreen screen line boasts Helioplex technology in a water-repellent formula, allowing Broad Spectrum ingredients to adhere to skin, wet or dry, and not run or streak. Products like these encourage our patients to reapply immediately after swimming, a common pitfall of sun bathers. 1

1. Palm MD, O'Donoghue NN. Update on photoprotection. Dermatologic Therapy. 2007; 20:360-76.

PATIENTS FIRST

As a creator of high-performing anti-aging skin care, I know the demand for multi-purpose products among our patients. However, there are some ingredients that deserve a second look, particularly when it comes to safety. The FDA itself has acknowledged that current ingredients, including nanoparticles that contain zinc and titanium oxides, have not been safety tested using modern techniques. 26-27 Yet despite the controversy, new research shows these particles of zinc and titanium in sunscreen do not penetrate the skin past the stratum corneum and are safe to use. 28-31

We must attest that sunscreen benefits far outweigh their risks. In a 12-year study of more than 1,600 adults, regular sunscreen use led to a 50 percent decrease in melanoma and a 73 percent decrease in invasive melanoma. 32 Plus, the increasing use of antioxidants in these products cannot go unnoticed. Antioxidants are able to prevent the damage created by UV-generated free radicals. 33,31,33,34

Our biggest challenge is not selecting the “right” sunscreen, but rather instructing our patients on how to best use these products. Proper sunscreen use is crucial, year round; it’s not just for when patients are in the sun. Research shows that UV is still high on cloudy days. 35 We must instruct our patients to avoid the peak sun hours (10am to 2pm) and to wear wide-brimmed hats, protective clothing, and sunglasses with UV-ray protection. In addition, patients should apply at least one and up to two shot-glasses worth of sunscreen to cover the whole body 30 minutes before exposure, and it should be reapplied every two hours or after swimming or excessive sweating. 1,2,36

Patients should also be reminded to apply to the face, ears, neck, and hands.

Dr. Graf has been a consultant for Allergan, Medicis, Merz, Johnson & Johnson, Aveeno, Neutrogena, and Roc and sells her own skin care line on HSN.

Jeannette Graf, MD, is an Assistant Clinical Professor of Dermatology at Mount Sinai School of Medicine in New York City and is in private practice in Great Neck, New York.

28. Mack MG, Stamatatos GN, Honorez P. Microcrystalline sunscreen particles were not shown to penetrate beyond the stratum corneum on human skin in vivo. J Am Acad Dermatol. 2011; 64(2) (suppl 1):AB188.