New and Improved Daily Photoprotection: Microfine Oxide (Z-Cote®)

Recently, scientists have proven that ultraviolet A (UVA) radiation is a major culprit in photoaging and skin cancers. Unfortunately, most sunscreens do not protect against long-wave UVA. In addition, legally valid but scientifically misleading sunscreen labels—including the “broad-spectrum” and sun protection factor (SPF) designations—may provide users with a false sense of protection. Fortunately, a new technology has been developed that provides unmatched protection against UVA and ultraviolet B (UVB) damage—microfine zinc oxide (Z-Cote®, sunSmart, Wainscott, NY). However, until federal guidelines and regulations catch up with new sunscreen research and technologies, physicians and consumers need to know how best to achieve daily photoprotection and what to look for when choosing sunscreen and daily wear products.

Microfine Zinc Oxide

The new technology, Z-Cote®, is a 100-nm particle of microfine zinc oxide that is coated with a patented form of dimethicone. The coating process creates fine, uniform particles that are invisible to the eye and easy to formulate in both daily wear and sunblock skin care products. Microfine zinc oxide is an effective and safe sunscreen agent that provides true broad-spectrum protection, including protection from long-wave UVA. Zinc oxide is the only sunscreen agent that provides protection from UVB, short-wave UVA and long-wave UVA, uniformly protecting from 290 to 380 nm. Microfine zinc oxide is photostable and does not react with organic sunscreen agents under irradiation. It is easy to formulate with other sunscreen agents and can be used in both daily care and beach products.

Ultraviolet Radiation and the Need for Daily UV Protection

Ultraviolet radiation that reaches the earth and damages skin can be divided into three key wavelengths: UVB (280 to 320 nm), short-wave UVA (320 to 340 nm), and long-wave UVA (340 to 400 nm). UVB, which primarily reaches the top-most layer of skin, is believed to be responsible for acute photodamage, including sunburn, and some non-melanoma skin cancers. UVA rays, which penetrate deep into skin, are responsible for elastic tissue damage and photoaging and are believed to be important in triggering more aggressive skin cancers, including deadly melanomas.

UVB is strongest at the equator and during summer months, which may explain why sunscreen use is more prevalent during the summer and in very hot locales. In contrast, UVA is relatively more constant throughout the year, even penetrating glass and subjecting us to exposure at home and work, as well as in the car. However, most people do not consider the need for daily UV protection.

Scientists believe that 90% of perceived skin aging—including wrinkles, roughness, mottled pigmentation, and loss of skin tone—is due to broad-spectrum ultraviolet damage. Therefore daily use of a true broad-spectrum product that protects against UVB and both short- and long-wave UVA is necessary to prevent acute and chronic photodamage and premature aging.

New Evidence Supports the Need for Daily UVA Protection

Several recent studies support the importance of daily UVA protection to protect skin from photoaging and skin cancers. One study involving the irradiation of human skin shows that it takes only eight modest doses of UVA exposure to cause photoaging and that these changes occur before any sunburn or tanning is evident. In this study, a modest dose was defined as 1 hour of
summer midday sun, and photodamage measures included an increase in stratum corneum thickness, the deposition of lysozyme on elastin fibers (indicating alterations to elastic tissue), a depletion in Langerhans cells, epidermal hyperplasia, and dermal inflammatory infiltrates. Another earlier study also shows that low doses of repetitive UVA induce morphologic changes in human skin.8 A very important study pinpoints long-wave UVA (340 to 400 nm) as the culprit.9

Still another study, coauthored by Duke University biophysicist John D. Simon, PhD, is the first to show why photoaging happens and link it to UVA rays.10 Simon’s study shows that UVA sunlight is absorbed by urocanic acid, a natural molecule made by the outermost skin cells. The sunlight chemically changes urocanic acid and causes it to create singlet oxygen, a highly reactive molecule that can be damaging to cells and can activate specific enzymes that degrade collagen and elastin. This process accelerates photoaging.10

SPF Does Not Measure UVA Protection

SPF is only a measure of UVB protection. A similar rating system for UVA protection has not yet been agreed on or implemented. Therefore consumers must learn to read ingredients and not be misled by deceptive, albeit legal, “broad-spectrum” labels.

Use of sunscreens with SPF of 15 or higher may actually encourage patients to stay in the sun longer because they are not burning. However, if the sunscreen does not include a UVA protector, they will be exposed to even more UVA damage—and without ever burning! Until federal regulations are revised, consumers must not be misled by SPF, believing that the higher the SPF, the more total UV protection. Knowing which ingredients protect against UVA is the key to achieving optimal photoprotection.

Sunscreen Ingredients

Since the first reported use of sunscreens more than 50 years ago, much has been learned about sun protection. Early sunscreen products afforded only UVB protection; no burn, no harm was the mantra, and it was believed that protection from burning was sufficient. Today, most sunscreen products provide UVB and partial UVA protection. The Figure compares the UV spectrum-blocking capabilities of common UV sunscreen ingredients.

Common UVB sunscreen ingredients include octyl methoxycinnamate (OMC), octocrylene, octyl salicylate (OCS), octyl dimethyl paba (PABA). The most common short-wave UVA ingredient is oxybenzone (benzophenone-3). Titanium dioxide primarily provides protection against UVB and short-wave UVA, but not long-wave UVA.2

Only two sunscreen ingredients available in the United States—a chemical or organic ingredient, avobenzone, and the physical or inorganic ingredient, zinc oxide—provide protection against long-wave UVA rays. But only one—zinc oxide—provides comprehensive protection against UVB and both short- and long-wave UVA radiation.

Many companies combine both chemical and physical sunscreens to enhance a product’s SPF abilities (but remember SPF is only a measure of UVB protection). A
typical combination includes microfine zinc oxide and octyl methoxycinnamate for added UVB protection. One company (SkinCeuticals, Dallas, TX) encapsulates its chemical sunscreen ingredients, making for better sun protection products, using fewer chemicals, and still achieving better protection than is possible otherwise.

Avobenzone (Parsol 1789) Versus Microfine Zinc Oxide

Avobenzone, also known as Parsol 1789, is a chemical sunscreen agent that is absorbed through the epidermis. Although it blocks long-wave UVA, it does not block UVB or short-wave UVA radiation and must be combined with other sunscreen ingredients to yield a “broad-spectrum” product. One recently published in vitro study shows that avobenzone degrades in the presence of sunlight and is rendered ineffective within just 1 hour.\(^1\)\(^1\)\(^2\) Avobenzone also has been shown to degrade other sunscreen ingredients, with which it is combined, including the most common UVB ingredient, OMC, and a common short-wave UVA block, oxybenzone.\(^1\)\(^1\)\(^2\)

Zinc oxide is the closest thing to a total sunblock on the market today. It uniformly covers from 290 to 380 nm, thus protecting against UVB and most of the UVA spectrum. No other sunscreen ingredient provides broader protection. And unlike many chemical sunscreen agents, zinc oxide is never irritating. In fact, it is recognized by the Food and Drug Administration as a Category I skin protecting agent, meaning that it is safe for compromised skin, including skin that is damaged from sun, pollution, or inflammation.\(^3\) Zinc oxide has a more than 300-year history of safety, with no known adverse reactions (which is why it is often used to treat babies). Now, in its microfine form, it is ideal for use in sunscreens and daily moisturizers.

Titanium Dioxide Versus Zinc Oxide

Patients often believe that zinc oxide and titanium dioxide provide equally good photoprotection, but this is not true. Although both agents are inorganic sunscreens that have now been produced in microfine form, they provide different levels of photoprotection. Microfine titanium dioxide effectively attenuates UVB and short-wave UVA; however, it is much less effective than zinc oxide in protecting against long-wave UVA.\(^2\) In addition, titanium dioxide has a higher refractive index in visible light (2.6) than zinc oxide (1.9). Therefore titanium dioxide is whiter and more difficult to incorporate into transparent products.\(^3\)

Microfine Zinc Oxide: The Gold Standard for UVA/UVB Protection

The gold standard for protection against UVB and both short- and long-wave UVA is microfine zinc oxide, which is now available in both daily wear and beach products. Because current federal regulations allow sunscreens and daily moisturizers with sun protection to be labeled “broad spectrum,” even if they provide only partial UVA protection, consumers must look for microfine zinc oxide or Z-Cote\(^6\) as a key active ingredient.

Higher concentrations of microfine zinc oxide offer greater protection, so consumers should also determine the percentage of microfine zinc oxide in the product. Some manufacturers already list this information on the label, others do not; thus physicians and consumers may need to inquire to determine which products offer the highest concentrations. Currently available products contain Z-Cote\(^6\) concentrations ranging from 2% to 7%.

To summarize, choose a daily wear product that contains microfine zinc oxide and has an SPF of 15 or greater. Daily wear products typically are nongreasy and cosmetically elegant and can be worn either under make-up or without it. Waterproof products tend to be heavier and feel greasy, characteristics that are necessary to make such products waterproof but are needed for water sports.

Other “Safe Sun” Practices

Even the very best sunscreen still allows some UVA radiation to penetrate skin, so other “safe sun” practices are recommended, including wearing a broad-brimmed hat, protective clothing, and UV-blocking sunglasses and avoiding sun exposure during peak sun hours. For example, by staying out of the sun between the hours of 10:00 AM and 2:00 PM, one may avoid approximately two thirds of the daily UV radiation.\(^1\)\(^3\)

New evidence also indicates that topical vitamin C is a useful adjunct to sunscreens.\(^1\)\(^4\) This powerful antioxidant naturally protects skin by neutralizing damaging free radicals. When applied topically in a concentrated, stable form that the body can use (L-ascorbic acid), it is possible to target vitamin C directly to the skin, thereby providing additional protection against UVB, UVA, and pollutants.\(^1\)\(^2\)

Summary

So much has been learned about sun protection since the first reported use of sunscreens over 50 years ago. W
now know that protecting oneself from the sun is not just something to do occasionally when at the beach or skiing. Rather, it needs to be a daily habit to protect skin from UV radiation that wreaks havoc by generating reactive oxygen species that damage and destroy skin. After all, research shows that it is environmental damage—not time—that causes 90% of the visible signs of aging.¹⁵

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References

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