

ISSUE

June 21st marks the official first day of summer. Canadians at home and abroad will receive more sun exposure during the next 4 months than for the rest of the entire year. The ultraviolet spectrum (UVB+UVA) at wavelengths 290-400 nm accounts for 5% of total sunlight. Sunscreens are supposed to absorb, scatter, or reflect this entire range of invisible UV energy. UV is divided into UVB (290-320nm) and UVA (320-400nm), which is split into shortwave UVA (UVA-II at 320-340nm) and longwave UVA (UVA-I at 340-400nm). Most Canadians will be using sunscreens that filter UVB and provide little or no protection to harmful UVA radiation, particularly in the UVA-I band.

This advisory is both timely and urgent.

- Most available sunscreens use photochemical filters that delay sunburn due mostly to UVB and minimally to UVA-II (290-340nm) measured by the SPF number. High SPF sunscreens prevent sunburn but do not provide important protection against UVA-I if they contain no effective filters.
- A minority of the products available in Canada or the USA provide adequate protection against the deeper penetrating UVA-I (340-400nm).
- In North America > 80% of products claim or imply UVA absorption by labels such as “broad-spectrum or extra UVA protection” despite containing no effective UVA filters or filters that do not cover the entire UVA spectrum.
- Consumers are lured into assuming that they are being protected from the entire solar UV spectrum (290-400nm), and are distracted by high SPF numbers into mistakenly believing that their sunscreen is reducing all the risks of sun damage.
- Sunscreens that absorb mainly UVB denoted by the SPF number reduce the risk of sunburn but may be detrimental by allowing you to stay out longer. You do not burn but you actually increase your risks from UVA injury- immune suppression, premature photoaging, and some types of skin cancer.
- A few of our sunscreens offer some UVA filtering but most fail to provide the minimum UVA protection required in Europe.
- There is a critical need for The FDA and Health Canada to enact mandatory rules for UVA testing and labelling to ensure that the sunscreen industry can only develop and sell products with proper UVA protection to North American consumers. In the meantime physicians and their patients need to: **SCREEN YOUR SUNSCREEN!**

PHOTOBIOLOGY

- Although sunburn and its earliest sign- erythema (redness) is a visible sign of sun damage, the absence of a sunburn does not mean there is no injury to your skin.
- Wavelengths < 290nm are absorbed by the ozone layer formed by oxygen from plants interacting with UV radiation. Sunburn and the erythema effect (the visible warning sign of UV skin damage) is caused almost entirely by UVB and UVA-I (290-340nm).
- Unprotected white skin (Type I) can show mild erythema and sunburn after 10-15 minutes under the tropical summer sun at noon. Sunburn actually occurs more frequently in sunscreen users, since the duration of intentional sun exposure is longer.
- Skin cancer is the most common human cancer, accounting for 50% of all cases in North America. Fair skinned people, living north or south of 45 degrees latitude, are at highest risk. Actinic keratoses (AK) and squamous cell carcinoma (SCC)

are probably stages of the same disorder, related to long-term excessive sun exposure. Basal cell carcinoma (BCC) and melanoma are more associated with intense exposure and sunburn, particularly early on in childhood and the teenage years. There are genetic and hereditary factors; an entire family may be affected. Melanoma is common with fair-skin, blonde or red hair, and a tendency to freckle and sunburn. One severe sunburn may double the risk of melanoma, which accounts for 10% of skin cancer, occurs at younger ages than other forms, and can be a lethal cancer.

- Skin cancer is a major public health issue affecting 2% of Canadians. There are over 1 million cases of skin cancer in the USA annually- 90% are non-melanoma (SCC + BCC). Patients in the USA make over 5 million visits to physicians and cost the health care system > \$1billion annually.
- Skin cancer has increased in North America by 50% in the past 20 years The incidence of melanoma is rising more than any other cancer in the world. All types of skin cancer can occur in areas never exposed to the sun, but the majority are related to effects of UV radiation. It is estimated sun damage causes 90% of non melanoma skin cancer and 65% of melanomas, and most are potentially preventable.
- The upward trend continues in North America, Australia, Hawaii and New Zealand, despite the use of sunscreens and public education programs. Global ozone depletion, cyclic sunspot activity, and lifestyle trends to more outdoor activity, may all be involved. Sunscreens that protect only against sunburn without adequate UVA-I filters may contribute to the rising rates. Without proper UVA protection, measurable prevention of skin cancer and photoaging is likely to be elusive.
- Prudent protection requires that your sunscreen must contain effective UVA filters. UVA radiation may be more harmful than UVB with a wider scope of skin damage- immunosuppression, accelerated photoaging, and skin cancer. UVA as a longer wavelength penetrates deeper than UVB. 20 times more UVA reaches fragile proliferating cells in the basal layer of the epidermis and harmful effects even extend below the dermis.

INGREDIENT ANALYSIS

A practical and simple approach to “screening your sunscreen” is to consider the protection against sunburn first. This is easily assessed by the SPF number and selecting a sunscreen that uses effective and low hazard UVB filters.

UVB Filters

The list of agents absorbing UVB (290-320 nm) used in North America is based on approval in the FDA Monograph from 1999:

1. Aminobenzoic acid.
 2. Cinoxate.
 3. Oxybenzone, dioxybenzone or sulisobenzone (Also absorbs UVA2 or 320-340nm).
 4. Ensulizole (Phenylbenzimidazole Sulfonic Acid).
 5. Homosalate.
 6. Octisalate (Octyl Salicylate), Trolamine Salicylate.
 7. Octocrylene.
 8. Octinoxate (Octyl Methoxycinnamate).
 9. Titanium dioxide and zinc oxide – both physical agents – titanium having UVA2 and UVB, zinc having both UVA2/UVA1 with UVB activity.
- Many of these agents are criticised by environmental groups and deemed ‘high hazard’ because there are rare causes of irritation and photoallergy. The risk is low for most organic UVB chemical filters but is used by many consumer groups to condemn an agent.

- Oxybenzone is a known photoallergen, which we recommend avoiding, although the risk is < 1% in patients seen for contact dermatology, and is obviously lower in the general population.
- It is also important to avoid products with multiple active ingredients, often as many as 5-6 for UVA and UVB coverage, as a “cocktail” of chemicals is more likely to irritate. We recommend single agent effective UVB absorption as provided by encapsulated octinoxate or titanium dioxide (micronized or nanoparticles).
- Octinoxate is a time-tested effective, low hazard UVB absorber. Encapsulation virtually eliminates the already low risk of irritation and improves function. Regrettably, labels do not differentiate between the old and new encapsulated versions.
- Titanium dioxide is a good agent for UVB protection and has UVA2 activity in its micronized form.

UVA Filters

The crucial issue in selecting your sunscreen is to ensure the best in available UVA-I protection. A summary of important considerations are:

- Avobenzone (Parsol 1789) is UVA-I absorber but is not photostable. It breaks down when exposed to sunlight (photodegradation), particularly if combined with the popular and effective UVB filter octinoxate. After degradation, it is no longer able to absorb UV light and becomes a photosensitizer that may react with UVA to generate free radicals that mediate DNA and cellular damage. It could enhance UVA damage unless stabilised with oxybenzone and octocrylene. It has no UVA2 activity and peaks at 365nm with less effect after 370nm. It requires use of other chemicals to extend its action spectrum and to avoid UV induced degradation. Formulations with avobenzone inevitably use a “cocktail” of organic chemicals to provide truly broad spectrum coverage that we prefer to avoid where possible.
- Drometrizole Trisiloxane (Mexoryl XL™) is a patented synthetic UVA filter developed by the cosmetic giant L’Oreal. It has a synergistic effect if used with Ecamsule (Mexoryl SX™), each present in a 3-4% concentration for improved UVA activity. It absorbs mainly UVA2 with less activity in the longer UVA1 spectrum. It is frequently combined with avobenzone, octocrylene, and oxybenzone to improve UVA coverage, exposing the user to higher chemical loads.
- Tinosorb S/M (S=bemotrizinol, M=bisotrizole) are filters for the UVA and UVB spectrum, with similar range to zinc oxide up to 400nm. The M-form is a hybrid of a chemical and physical sunscreen used in nanoparticles. The S-form is a chemical agent and both are stable in sunlight. Both are available in Canada and Europe but not approved for use in the USA. It appears to be safe but no long-term data is yet available. Both forms are combined in formulations, but the action spectrum for this organic/physical hybrid is achieved by zinc oxide alone.
- Zinc oxide is a time-tested physical filter with efficacy across the full UVB and UVA spectrum. It forms a surface barrier with no intake by the skin, giving the same gentle and soothing protection afforded to newborn skin by diaper creams. Zinc oxide up to 25% makes for an excellent, truly broad spectrum sunscreen. Micronized titanium dioxide and zinc oxide are less visible for better cosmesis, but can still look ‘white’ if used above 7%. Nanozinc provides an effective physical barrier to absorb UV photons that forms a uniform transparent sunscreen film. With proper formulation there is no chance for penetration of nanoparticles and studies confirm the safe use in sunscreens. Labels do not identify micronized and nanoparticles, so you should consult other sales material. Zinc oxide also provides anti-inflammatory activity and is ideal for oily or acne-prone skin.

A SUNPROTECTION PROGRAM

- Use a comprehensive approach, particularly if you burn easily, are in a high risk category for skin cancer, are photosensitive or on drugs that are photosensitizers (consult your physician), or have a condition aggravated by sunlight – such as melasma, lupus or dermatomyositis etc.

- A comprehensive program includes sun avoidance, sun protective clothing, and using a sunscreen with effective UVB and UVA activity over the entire band of 290-400nm
- Do not use a sunscreen to prolong your intentional sun exposure. Remember the SPF number is a measure of how much longer it will take to burn as compared to exposure without a sunscreen. If you burn with unprotected exposure in 15 minutes, an SPF 15 prolongs that under ideal use to almost 5 hours. Do not “do the numbers” and simply calculate your burn time assuming this gives you ‘license’ to stay out that long. Use the SPF number as an index of the longer time it takes to sustain the same degree of skin damage.
- A tan is now part of the fashion lexicon. Some become “addicted” to sun exposure. Urocanic acid on the skin is isomerised by UV to activate receptors and pathways to mediate a “high” similar to drugs, eating, and exercise. A tan is a protective defence mechanism to reduce skin damage. A tan does prevent cancer and photoaging. UV tanning lamps are more dangerous than the sun, and are associated with skin cancer and photoaging, since they deliver mainly UVA, the longer more penetrating rays. People of colour should use sunscreen, despite the very low risk of skin cancer, as sun exposure causes uneven pigmentation and accelerates aging.
- Sun exposure reduction is important for photosensitivity or conditions aggravated by light. Solar protective apparel and limited sun exposure with no unprotected exposure is mandatory for any patient with extremely sensitive or fair skin. Unprotected exposure of face and arms to sunlight for 10-20 minutes twice weekly is suggested to avoid Vitamin D deficiency in colder latitudes. For individuals at risk for Vitamin D deficiency, we believe diet and supplements are preferable to intentional unprotected sun exposure and its harmful effects.
- Stay indoors, particularly at peak exposure between 10 am and 4 pm in the tropics or during the summer in Canada, when the sun is overhead and UVB radiation is highest. UVA is constant anywhere on the planet during daylight hours. UVA above 320nm penetrates glass and travelling in a car facing the sun is a source of radiation.
- Remember clothes protect against UVA and UVB equally. Solumbra™ from Sun Precautions Inc. offers apparel ideal for recreational sun exposure and as an aid to sunscreen use. A hat with a 4” brim to protect the entire face and neck is crucial for those at high risk for cancer and photoaging.
- Solar UV radiation is cumulative and breaks during sunbathing do not lower your radiation dose or skin damage. Shade trees are helpful but deceptive, whereas umbrellas can give better protection.
- Up to 80 or 90 % of the UV band penetrates clouds and sunburn can occur on a cloudy summer day. Water is not a sunscreen and UV penetrates up to 1 meter. Water, sand, snow, concrete and reflective surfaces can increase your UV exposure.
- Sun avoidance is the best form of protection for those with fair skin, who burn easily and tan poorly, and those with photosensitive skin or medical conditions.

USING YOUR SUNSCREEN

- Sunscreens should be viewed as a therapy for which there is a benefit with very low risk, and not as a cosmetic. Remember sunscreens are used to prevent sunburn and invisible sun damage. The risks from sun damage far outweigh any known risk of applying a sunscreen.
- Sunscreens require proper use especially for outdoor and recreational exposure. Apply 15-30 minutes before exposure to allow for the protective film of a physical sunscreen to develop or for organic chemicals to bind. An average sized adult requires a shot glass full (30-35 ml or 1oz) to cover the entire body. Apply more liberally to the face and avoid missing the back of the neck, the ears, and scalp exposed by loss of hair. Re-apply every 2 hours and immediately after swimming or heavy sweating. Apply a sunscreen once every morning to face and exposed areas for work and regular activity without sweating. Everyone, particularly those with fair skin or photosensitivity, or women with melasma should use stringent daily sunscreen protection on the face, all year round.

SELECTING YOUR SUNSCREEN

- There is no sun block or total protection from a sunscreen. If used correctly, an SPF of 15-25 usually protects people with 'normal' or olive skin from sunburn. Those who always burn can select an SPF 30-45. There is no advantage to a higher SPF unless the product is selected for its long wave UVA-I protection. Focus on UVA absorption, ensure that the protection is adequate and extends above 370nm.
- Remember adequate long wave UVA-I protection is provided by a select few agents:
1. Avobenzone 3% 2. Mexoryl™ SX/LX 3-4% of each. 3. Tinosorb™ M/S 5-10% of each. 4. Zinc oxide 15-20%. (Nanozinc at 15% gives adequate UVA-I absorption).
- We prefer to avoid avobenzone as it requires addition of other agents for stability and to extend its range of UVA coverage. It is frequently combined with oxybenzone, octocrylene, Mexoryl™, and Tinosorb™. Avoid those products with oxybenzone.
- In choosing your product with effective UVA-I protection select the product with the lowest number of active ingredients and the lowest total ingredient load. The ideal formula combines one UVB with one UVA filter. Many products use 4-5 active ingredients and usually have 30-60 total ingredients. However, the important issue is:

CAN YOUR SUNSCREEN WITHSTAND THE LIGHT OF DAY- DOES IT GIVE PROPER UVA-I COVERAGE?

The principle of using single agent coverage from low hazard effective UVB filters, such as encapsulated octinoxate, or micronized or nanoparticle titanium dioxide, with a single agent that extends coverage to 400nm, is rarely applied in product formulation. There is no perfect UV filter, but as single agent, zinc oxide above 15% provides the most ideal coverage against UVB and UVA rays. There are products available with regular zinc oxide, but in adequate concentrations they appear white on the skin. However, protection is more important than esthetic considerations, if you fall into the at-risk group, or for young children.

We recommend using as few actives and total ingredients wherever possible. Products with Tinosorb™ are difficult to find in Canada and are not available in the USA. They include ROC Minesol Protect SPF 60 from Johnson and Johnson. Products with Mexoryl™ SX/LX include various formulas from L'Oreal- their La Roche-Posay Anthelios XL SPF 60 and others from their Vichy line- Capital Soleil SPF 60. Both give acceptable UVA-I absorption, but use Mexoryl SX and LX in less than the ideal 3-4% concentration, where they could provide proper UVA coverage on their own. They add avobenzone that needs octocrylene for stability, and end up with a "cocktail" of 5 actives. La Roche-Posay Anthelios XL SPF 60 provides broad spectrum coverage with 5 actives and 28 total ingredients- one of the better formulas, as many others have >40 total ingredients.

We support the precept: **less chemicals-more efficacy-Please (www.cyberderm.ca)**. To fill the void for a formula with only 2 actives and low total ingredient load (ideally < 25), CyberDERM Laboratories developed a formula using octinoxate and nanozinc oxide - only 2 actives with 24 total ingredients. Although Health Canada and the FDA do not require UV testing, the product was voluntarily tested using the UK-Boots Star rating method. It was confirmed to give adequate UVA coverage (3+ stars, UVA/UVB ratio > 0.60). The next version will further increase the UVA coverage to approach the maximum attainable level.

Daily use of a truly broad spectrum sunscreen is one part of a sensible protection program. Sun exposure is inevitable and satisfying. It is risky, particularly if sunburn occurs in children and teenagers. Infants 1-2 years should receive no direct sun exposure, with clothing as the primary method of protection, and sunscreen use avoided if feasible, until after 1 year. Everyone should avoid the mid-day sun if possible, and wear photoprotective sunglasses. Those at higher risk should wear a wide-brim hat and sun protective clothing, while limiting their direct exposure to the sun. Pay attention to ingredients and look for adequate UVA-I protection. SCREEN YOUR SUNSCREEN. BE SUN-SAFE & SUN-SMART ALL YEAR ROUND, ESPECIALLY IN THE SUMMER AND IN THE TROPICS.