

Photoprotection: a public awareness

Dr. (Ms.) Meera Sridhar MD, DVD, DDV

Consultant Dermatologist, Dubai, United Arab Emirates

Sir,

Excessive solar ultraviolet radiation exposure of the skin has been associated with several skin disorders/diseases including premature aging of the skin and skin cancers. Avoiding exposure to sun is the best method but impractical. Public is informed through UV Index of the amount of harmful ultraviolet rays reaching the earth and choosing of the right SPF (Sun Protection Factor) is the practical and effective approach for photoprotection.

Increasing pollution levels (release of chlorofluoro carbon compounds) into the atmosphere over the last 20 years has resulted in gradual depletion of the ozone layer which in turn has resulted in greater amounts of UV radiations of the sun reaching the earth's surface as also global warming. The sun rays have been broadly classified into 3 groups based on the wavelength of the electro magnetic waves: Infra red (800 – 1700 nm), Visible light (400 – 800 nm) and Ultraviolet (UV) rays (290 – 400 nm). The UV rays are further classified as:

- 1. UVA (320 - 400 nm, long wave length, UVA1: 340 - 400 nm and UVA2: 320 - 340 nm)¹:** It is responsible for immediate pigment darkening of preformed melanin. It can cause severe phototoxicity in the presence of drugs like psoralens, doxycycline, sulfonamides, sulfonyleureas and chlorthiazides.
- 2. UVB (290 - 320 nm, mid wave length):** It causes sunburn. It also stimulates melanocytes to make new melanosomes causing a tan.
- 3. UVC (200 - 290 nm):** It is mainly absorbed by the ozone layer; what reaches the earth has germicidal effect.

Both UVA and UVB cause DNA damage by the generation of reactive free oxygen. Though UVB is mainly responsible for photo ageing, sun burn, carcinogenesis and cataract formation, UVA rays also play an additive role by production of photoproducts and suppressing the immune system.

Hence there is great need for public awareness of effect of UV radiations on the skin and the need for photoprotection. The UV Index is a program that informs the public about the amount of harmful ultraviolet rays reaching the

earth on a particular day and is a recognized part of the weather report in many countries.

FACTORS AFFECTING THE AMOUNT OF ULTRAVIOLET RADIATIONS REACHING THE EARTH'S SURFACE AT A PARTICULAR TIME AND PLACE ARE DEPENDENT ON:

- 1. Time of the day:** Two third of the total UVR reaches the earth between 10 am and 2 pm of which 10 % is UVB and 90 % UVA.
- 2. Surface reflection:**
 - Snow and ice reflect 80 % of UVR
 - Sand reflects 20 % of UVR
 - Most ground surfaces reflect < 10 % of UVR
 - Water reduces penetration of UVR by 50 %
- 3. Seasonal:** Maximum radiation occurs during summer and minimal in winter.
- 4. Altitude:** Every thousand meter above sea level increases UVR by 10%.
- 5. Latitude:** Higher irradiance at the Equator.
- 6. Cloud coverage:** Complete high cloud coverage reduces surface UVR by 50%.

PROTECTION FROM SUN:

Sun protection is provided by the following:

- 1. Skin:** The skin is naturally protected from the sun's radiation by the thickness of the epidermis, melanin, natural antioxidants, DNA repair mechanism, Urocanic acid and Fas ligand signaling.
- 2. Clothes:** The protection achieved by wearing clothes is called 'Ultraviolet Protection Factor'. Clothes with tighter weave, darker color, synthetic fibers² and loose fit provide greatest protection. Polyester is the best UV absorber, whereas cotton and rayon are the poorest.
- 3. Broad rimmed Hats and Umbrellas.**
- 4. Window Glass:** It provides protection from UVB, with tinted glass giving some additional protection from UVA as well.
- 5. Eye Protection:** Wrap around sun glasses that fit close and absorb upto 400 nm in UVA, UVB and blue light range.
- 6. Use of topical sunscreens:** They are used to protect the skin from the ultraviolet radiations of the sun. They contain a variety of chemical (organic) and physical

blockers each having differing protective range. Most of the chemical sunscreens are UVB blockers like:

- Para aminobenzoic acid (oldest sunscreen to be used, causes staining of clothes)
- Padimate O (ester derivative of PABA & most potent UVB absorber): PABA and its esters are more resistant to water & sweating compared to others
- Octyl Salicylate (octisalate)
- Octocrylene (used with avobenzene helps to improve overall stability)
- Phenyl benzimidazole sulfonic acid (ensulizole-is water soluble and hence less greasy)
- Benzophenones (oxybenzone absorbs UVB and UVA2), anthranilates, avobenzene and Bisethylhexyloxy phenol methoxy phenyl triazene (which gives photo stability to avobenzene) are UVA blockers³. Newer sunscreen like Padimate O & Parsol 1789 (major absorption at 360 nm) provide good UVA absorption.

Chemical sunscreens can cause photo allergic or contact dermatitis. Patients allergic to aminobenzoic acid should use sunscreens containing oxybenzone or cinoxate. Benzophenones can cause eye stinging.

Physical blockers or chemical free sunscreens contain tiny particles which scatter and reflect the UV rays and visible range. Coating these particles with silicone helps to absorb free oxygen radicals (which may be formed as some energy is absorbed) and is the basis of a product called Z-cote. Zinc oxide, Titanium dioxide, kaolin and Iron Oxide are physical sunscreens. They do not cause photo allergic or contact dermatitis and hence can be used in babies less than 6 months and people with sensitive skin. Disadvantage is that they may be visible on application (which is being overcome by use of ultra fine particles) and require repeated application as they are washed off by sweat and cannot be used for swimming.

The regular use of sunscreens reduces sun burns and incidents of non melanoma skin cancers. Continuous use of sunscreen may alter Vitamin D synthesis, which can be compensated by a normal diet.

HOW TO CHOOSE AND APPLY A SUNSCREEN:

SPF value of a sunscreen is the dose of UVR required to produce one MED on protected skin after application of the 2mg/cm² of the product to the UVR required to produce one

MED on unprotected skin⁴. An SPF of 15 gives 93% protection and SPF30 gives 97% protection. Sunscreens offer mainly protection against sunburn, the UVA protection provided by chemical sunscreens being about 10% of the UVB rating. The term substantivity refers to a product's ability to remain effective under conditions of prolonged sweating, swimming & exercise. So the patient should select a sunscreen which has an SPF of 15 - 30, has a broad spectrum of protection against both UVA and UVB radiations, is non-toxic, photo stable, water resistant, non staining, cosmetically acceptable and inexpensive.

For ideal protection, the sunscreen should be applied every morning till sunset or half hour before sun exposure. It has to be reapplied every 2 – 3 hours. Sun screens (even if water resistant) have to be reapplied after half hour to 1 hour of being in water. For the sunscreen to be effective, sufficient amount (0.5 mm layer) has to be applied on all exposed areas not protected by clothing including pinna and neck. An average adult requires approximately 35 ml of the sunscreen.

Sunscreen lotions are easy to apply and are non greasy. Products with higher SPF are usually oily. Silicone liquids added to these reduce the greasiness and increases water resistance. For acne prone individuals, water soluble oil free gel based sunscreen are preferred. Sticks containing lipid-soluble sunscreens are useful for application over small areas like nose, ears and under eyes. They are most water resistant. Aerosols and sprays are easy to use but there may be uneven distribution and skip areas. Also available are lipsticks containing sunscreens⁵. Currently available sunscreens are not substantive to the hair which is better protected by use of hat, scarf or umbrella.

Systemic sunscreens are oral agents that have been tried, include PABA, indomethacin, steroids, psoralens, retinol, antimalarials like chloroquine & HCQS and antioxidants. They are mainly used when there is an underlying skin or systemic disease being caused or exacerbated by sunlight –e.g. lupus erythematosus, PMLE, actinic keratoses, basal cell carcinoma etc.

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Dr. Meera Sridhar
PO 325, Dubai, United Arab Emirates
Email: meerasridhar@hotmail.com