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Sun Protection

Introduction

A suntan is the holiday goal for many travellers. However, prolonged and unprotected exposure to the sun can cause skin damage. A suntan is the visible effect of that damage which can lead to skin ageing and melanoma.

Ultraviolet radiation

Ultraviolet (UV) radiation is a small component of sunlight and consists of non-visible wavelengths. These UV wavelengths are subdivided into three types: UVA, UVB and UVC. Approximately 90-99% of the UV radiation that reaches the earth is UVA, and 1-10% is UVB [1]. UVC radiation is completely absorbed by ozone in the atmosphere and does reach the earth's surface [2].

Exposure to UVA radiation is the most important cause of skin ageing, and also a cause of photosensitivity.

Although UVB radiation accounts for a small percentage of the overall light, it is mainly responsible for sunburn and melanoma, and causes skin ageing.

Factors affecting UV radiation levels

- **Time of day**

The highest levels of UV light are received when the sun is at its highest point in the sky and has the shortest distance to travel before reaching the earth's surface. This usually occurs between the hours of 10.00 and 15.00 when sun exposure should be kept to a minimum.

- **Season**

UVA and UVB levels vary greatly between winter and summer in temperate regions but are more constant between seasons in areas closer to the equator.

- **Latitude and altitude**

Sunlight has a shorter distance to travel in order to reach the earth's surface in areas closer to the tropics; UV radiation levels will therefore be higher in these areas because there is less dissipation of the rays as they travel to earth. The level of UV radiation also increases with altitude as the atmosphere becomes thinner and there is less absorption of radiation.

- **Cloud cover and wind**

Clouds have less effect on UV radiation levels than they do on temperature because their water content absorbs heat more efficiently than UV radiation. It is therefore possible to experience the damaging effects of the sun on cool cloudy days.
A cool wind also has a falsely reassuring effect because UVB levels remain unchanged on windy days.

- **Surface reflection**

White surfaces such as snow or sand reflect UV radiation resulting in more of it reaching the skin and therefore an increased risk of sunburn. Rippling water and rough seas also reflect more UVB radiation than calm open water.

Effects of UV radiation

Some UV radiation is immediately reflected by the skin's surface, but the majority will penetrate the skin. It then passes into tissues and can be absorbed by certain molecules including DNA.

- **Skin tanning**

UVA radiation stimulates production of melanin pigment in cells of the upper layers of skin, causing it to tan.

UVB radiation leads to a darker and longer-lasting tan. It also stimulates skin cells to produce a thicker epidermis in order to defend the skin against further UV damage. Skin tanning is therefore a sign that the skin has been damaged [3].

- **Sunburn**

When UVB penetrates the deeper skin layers, it is absorbed by DNA and damage to the cell occurs. As a result the cell attempts to repair itself by releasing chemicals [1]. Sunburn is a visible reaction to this repair process. In some cases the damage to the cell is so severe that it dies resulting in skin peeling and blistering.

Sunburn is characterised by erythema, warmth and pain of varying degrees. In more severe cases swelling, blistering and weeping of the skin can occur.

Oral fluids, analgesia and non-steroidal anti-inflammatory medication can be useful in relieving these symptoms.

- **Photo-ageing**

Photo-ageing is the cumulative effect of skin damage by UV radiation and is caused by both UVA and UVB radiation. The damage causes the skin's structure to

deteriorate resulting in the skin becoming drier, rougher and thicker. In some people the skin becomes thin and fragile.

- **Skin cancers**

Skin cancers are divided into non-melanoma skin cancers (NMSC) and melanomas; NMSC include basal cell and squamous cell carcinomas.

UV radiation is the major reason that people develop skin cancer [3]. Skin cancers occur when skin cells have undergone malignant transformation due to UV radiation damage to their DNA. These cells reproduce independently and can infiltrate neighbouring tissues or spread via the bloodstream to organs distant from the skin.

Skin cancers are usually treated by surgical excision, although in some circumstances radiotherapy or systemic chemotherapy may be necessary.

Non- melanoma skin cancers
Between 2 to 3 million cases of NMSC occur worldwide each year [4]. In 2007, 84,500 cases were reported in the United Kingdom [5]. NMSC are rarely fatal, but can be painful and disfiguring. They usually occur on parts of the body that are more exposed to the sun: ears, face, neck and forearms. This implies that prolonged and repeated sun exposure is a major risk factor for NMSC.

Basal cell carcinomas are the most common form of NMSC, accounting for 80% of all cases [6]. They most commonly occur in elderly men, but cases in young women are increasing [7]. Basal cell carcinomas rarely metastasise but can be associated with disfigurement and morbidity [6]. They present as slow growing pearly papules or nodules and often have a rolled edge [6].

Squamous cell carcinomas are less common but potentially more serious than basal cell carcinoma. These tumours typically present as firm, slightly tender, persistent nodules on sun-damaged skin.

Melanomas
Malignant melanomas are the most serious form of skin cancer. Approximately 10,670 cases were reported in the United Kingdom in 2007 and the incidence has risen more than four times since the 1970s [5]. Most skin cancer deaths are caused by malignant melanoma and it is the second most common type of cancer amongst 15-34 year olds [5].

The link between sun exposure and melanoma is less clearly understood compared with NMSC. Melanomas can occur on areas of the body not usually exposed to sun including the palms of the hand and soles of the feet [8]. It is thought that intermittent exposure to strong sunlight resulting in sunburn is a risk factor [9].

Treatment of melanomas consists of wide excision of the lesion and chemotherapy or radiotherapy for metastatic disease.

UV radiation as a result of sun bed use is also a risk for the development of both melanoma [10] and NMSC [11]. First exposure to sun beds under the age of 35 years significantly increases the risk of melanoma [10].

- **Photosensitivity**

Certain persons have an abnormal skin reaction to UV radiation known as photosensitivity. This can also be caused by certain topical or systemic medications. A photosensitive reaction can occur within minutes of sun exposure and typically occur on the face, back of the neck and upper chest. Medications that can cause photosensitivity include the malaria prevention tablet doxycycline.

- **Photokeratitis and photoconjunctivitis**

Photokeratitis is inflammation of the cornea, whilst photoconjunctivitis is inflammation of the conjunctiva. Both conditions are comparable to sunburn of the tissues of the eye. They are very painful, but are reversible and are not associated with long-term damage.

An extreme form of photokeratitis is snow blindness which can occur in skiers and climbers who are exposed to extreme UV levels due to high altitude and strong sun reflection from snow. Blindness occurs as a result of inflammation of the conjunctiva and cornea. These damaged tissues usually renew quickly and sight is restored within a few days. However, very severe snow blindness can result in chronic irritation [3].

Prevention

All travellers are at risk of the damaging effects of the sun, including those with dark skin. Certain persons are at particular risk including babies, infants, immunocompromised individuals and those taking certain medications such as cancer treatment.

The main method of avoiding UV-induced risks is to reduce the amount of exposure to the sun. It is still possible to enjoy the benefits of the sun, but extra precautions should be taken.

Topical sunscreens are one of the most common methods used to protect skin against the damaging effects of the sun. They contain chemicals that absorb various wavelengths of UV light. Sunscreens are rated by their sun protection factor (SPF). The SPF refers to the relative protection against sunburn that one receives after applying the sunscreen compared to not using it. Sunscreens with higher SPF ratings give higher levels of protection. As an example, if it takes 10 minutes for a person to become sunburned, applying a sun cream with an SPF of 15 means that it will take 15 times as long, or 150 minutes, to develop sunburn. Broad spectrum sunscreens block UVA radiation as well as UVB. The 'star' system is used in the United Kingdom to determine the amount of UVA protection a sunscreen offers, 0 being the lowest and five the highest.

Physical sunscreens containing titanium oxide or zinc oxide are also able to reflect both UVA and UVB rays.

- Avoid sun exposure when the sun is at its highest point in the sky (10.00-15.00)

- Always apply a correct amount of sunscreen; most persons apply too little which reduces the effectiveness. About 2 tablespoons of sunscreen will be needed to protect an average adult; however, the manufacturer's instructions should be followed for individual products.
- Always use a broad spectrum sunscreen with a high SPF (usually 15 or higher) which blocks both UVA and UVB radiation. They may need to be used even on cloudy days.
- Sunscreen should be applied at least 30 minutes before exposure to the sun. It should be reapplied about every two hours, and also after swimming and vigorous exercise.
- Ensure lips are protected with a sun block.
- Wear a wide-brimmed hat to protect the head and face.
- Cover as much skin as possible with sun-protective clothing if exposure during peak times is unavoidable.
- Children are particularly vulnerable to the damaging effects of sunlight. Babies under 6 months of age should never be placed out in direct sunlight and young children should always have a high SPF applied.
- Sunglasses, or goggles for skiing or climbing, will help protect the eyes from sun damage and glare. Staring directly at the sun is dangerous and should be avoided.

Changes to an existing mole, such as increasing size, itchiness or bleeding or oozing, or a new mole that develops very quickly, are potential signs of melanoma. Any such moles should be examined by a doctor.

References

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cutaneous malignant melanoma and other skin cancers: A systematic review. Int J Cancer. 120:1116-22, 2007.
11. Karagas MR, Stannard VA, Mott LA, et al. The use of tanning devices and risk of basal cell and squamous cell skin cancers. J Natl Cancer Inst. 94:224-6, 2002.

Links

- Cancer Research UK Sunsmart
- Health Protection Agency Sunsense
- World Health Organization Ultraviolet radiation and health
- World Health Organization Sun protection