The weaker antimycotic 8-MOP alone, can hardly according to the findings of others (2, 9), compete with the numerous other antimycotic agents on the market.

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Effect of UV-B Erythema of Psoralen, Trimethylpsoralen, and 8 Methoxypsoralen[1]

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Abstract. The MED for UV-B was measured 2 h and 24 h after oral intake of Psoralen (P) 0.49 mg/kg in 10 healthy volunteers. MED was increased when UV exposure had taken place 2 h after intake. The same increase was observed after 0.24 mg/kg and 0.98 mg/kg, with a non-significant dose dependence. This effect was not detectable when UV exposure had taken place 24 h after oral intake of the drug. In a second experiment the effects of oral intake of both trimethylpsoralen (TMP) and 8 Methoxypsoralen (8 MOP) mg/kg, were assessed in 29 subjects. While TMP increased MED when taken 2 h before UV exposure ($p<0.001$), 8 MOP had the opposite effect ($p<0.01$). TMP effect was observed mainly in fair-haired people ($p<0.05$) and 8 MOP effect mainly in females ($p<0.05$).

Key words: Trimethylpsoralen; 8 Methoxypsoralen; Psoralen; UV erythema; UV-B

In a previous paper (1) we have shown that trimethylpsoralen (TMP) significantly increased the MED for UV-B during the few hours following oral intake. This effect was dose dependent and probably related to the absorption of UV-B by the drug while it was present in the skin. In order to know whether this property belongs to TMP alone or to all of the psoralen group, similar experiments were conducted with Psoralen (P), 8 methoxypsoralen (8 MOP), and again with Trimethylpsoralen (TMP). The protective effect of TMP against UV-B erythema was confirmed. A similar effect of P was found while, on the contrary, 8 MOP displayed a sensitizing action.

MATERIALS AND METHODS

The UV-B source was a 150 W XBO high-pressure xenon lamp. The spectrum had been adjusted to the sun spec-

Abbreviations: MED=minimal erythemal dose; UV-B=ultraviolet B rays

[1] Presented in part at the meeting of the French Dermatological Society, Biological Session, Paris 6-8-78, and at the second European Workshop on Mammalian Melanin Pigmentation, London 21 and 22-11-79.

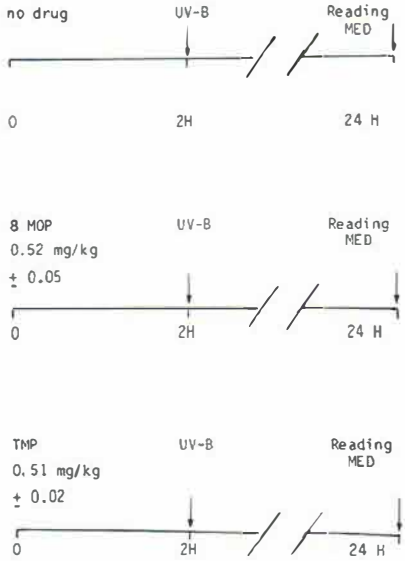

Fig. 1. Experiment with Psoralen (10 subjects).

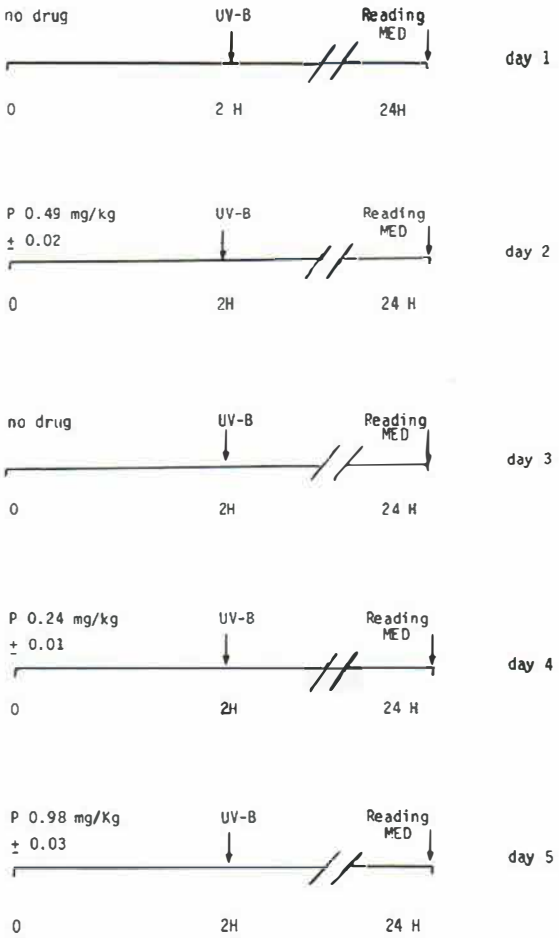

Fig. 2. Comparative experiment with TMP (29 subjects) and 8 MOP (22 subjects).

trum by the addition of a Schott WG 320 filter to suppress wavelengths below 290 nm. JUNG's apparatus (2) was used, which permits maintenance of a constant distance between the lamp and the skin. The surface of the irradiated area was about 0.8 cm². At the skin surface, the energy received in UV-B was equal to 1 mW/cm² measured with a Sunburn Ultraviolet Meter (Solar Light Co. Philadelphia, USA), and in UV-A equal to 15 mW/cm² measured with a Puvameter (Herbert Waldmann, Schwenningen, West Germany). UV exposures were made on the buttocks, i.e. the body area least exposed to the sun, at more than 2 cm from the intergluteal sulcus.

Experiments with Psoralen (P). The experiments were made in five steps (Fig. 1) in each of 10 volunteers of both sexes, aged 19–29 years. Skin types were I–IV (4). MED for UV-B was measured without any drug, then after oral intake of P 0.49 mg/kg, then again without drug, then after oral intake of P 0.24 mg/kg, and finally after intake of 0.98 mg/kg. MEDs were read 24 h after irradiation. P was taken 2 h before UV exposure.

Comparison between TMP and 8 MOP. The experiments were made in three steps (Fig. 2) in 29 subjects of both sexes, aged 20–65 years, of whom 7 were given only TMP and 22 ran the entire schedule shown in Fig. 2. MED for UV-B was measured without drug, then after oral intake of 8 MOP 0.52 mg/kg, then after oral intake of TMP 0.51 mg/kg. An interval of one day was allowed between the last two steps. MEDs were read 24 hours after irradiation. The drugs were taken 2 h before UV exposure.

The statistical analysis was made using *t*-test for paired comparisons and χ^2 test.

Table I. *Compared effects of TMP and 8 MOP on MED, in 22 subjects (means and standard deviations of distributions)*

	Without drug	After TMP	After 8 MOP
Mean MED, mJ/cm²	17.9	20.09	16.73
±s.d.	±3.73	±4.51	±3.52
Mean difference		±2.18	−1.18
±s.d.		±2.21	±1.92
p		<0.001	<0.01

RESULTS

1. *Experiments with Psoralen* (P)

An increase in MED was observed in most cases when UV exposure had taken place 2 h after oral intake of P. The differences from MEDs without P intake were statistically significant ($p<0.001$) for

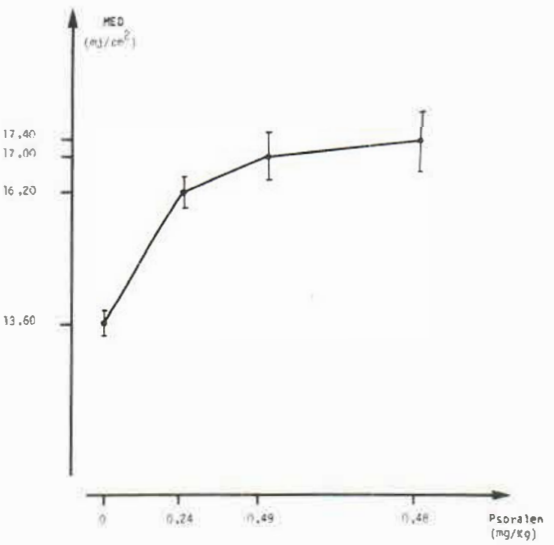

Fig. 3. Changes in MED after oral intake of Psoralen, related to dosage of the drug. Range bars indicate standard error of the mean.

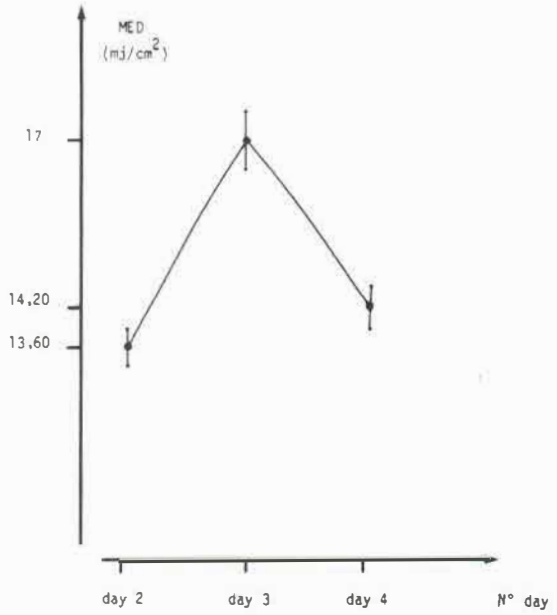

Fig. 4. Duration of the effect of Psoralen on MED. Day 2: MED obtained without drug intake. Day 3: MED obtained when UV-B was given 2 h after drug intake. Day 4: MED obtained when UV-B was given 24 h after drug intake. Range bars indicate standard error of the mean.

the three dosages used. The increase in MED was dose dependent (Fig. 3) but not statistically significant.

When the exposure took place 24 h after oral intake of 0.49 mg/kg P, only 3 out of 10 subjects showed an increased MED, and this was very slight and non-significant (Fig. 4).

2. *Comparison between TMP and 8 MOP*

An increase in MED was observed in most subjects given TMP 2 h prior to UV exposure, whereas a decrease in MED was observed in the majority of patients given 8 MOP (Table I). In the 22 subjects given the two drugs sequentially, the average increase in MED with TMP was 12.3% and the average decrease in MED with 8 MOP was 6.6% (Table II). The patients whose MED were increased with TMP had mostly blond or fair hair ($p<0.05$). The decrease in MED with 8 MOP was more noticeable in women than in men ($p<0.05$). This was not found with TMP.

Table II. *Compared changes in MED after Psoralen (P), Trimethylpsoralen (TMP) and 8 methoxypsoralen (8 MOP) at common dosages*

	Number of patients	% changes	*p*
After P	10	+25%	<0.001
After TMP	29	+12.30%	<0.001
After 8 MOP	22	−6.6%	<0.01

DISCUSSION

In this work the previously found protective effect of TMP against UV-B erythema (1) was confirmed. It was also found mainly in fair-haired subjects. The latter finding could be due to a filter effect, as if a sunscreen were applied on to the skin.

Psoralen also increased MED for UV-B, although the dependence was not statistically significant at the dosages used. By contrast, 8 MOP sensitized the skin to UV-B, especially in women. The latter finding could be related to the thinner skin of females.

The dose of UV-A given simultaneously was in the range of 280 mj/cm², i.e. less than 1/100 of the erythemogenic dose without psoralen and less than 1/5 of the initial dose in PUVA treatments. Only in the case of 8 MOP could a photoaddition have occurred to produce UV-B erythema at the 24th hour (5).

The possibility of absorption of UV-B by the drug while it was in the epidermal interstices and/or in-

tracellular fluid could explain the effect of TMP and P, as both have a strong absorption band in UV-B, at 335 nm for TMP and 329 nm for P (3). 8 MOP displays an absorption band at 303 nm (3), i.e. closer to the lower limit of UV-B. Accordingly the lack of protective effect of 8 MOP could be related to the cutting Schott WG 320 filter having excluded a great part of these shorter wavelengths. In this respect the effect of psoralens on UV-B erythema would be the result of a balance between an initial filter effect and a sensitizing effect occurring later on. Work is in progress to verify this theory.

ACKNOWLEDGEMENT

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Protective Effects of Various Types of Clothes Against UV Radiation

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Abstract: The UV protection factors of twenty commonly used textiles were determined. Protection factors varied between 1.3 and 1700, which shows the importance of giving careful advice to light-sensitive and psoralen-sensitized patients, regarding suitable clothes.

Key words: Photo protection; Sunscreening agents; Ultraviolet rays

Many photosensitive patients show light reactions not only on unprotected skin but even on skin protected by clothes. This fact implies that UV radiation is capable of penetrating through textiles. We have been unable to find any current reports on the UV-protective effects of clothes. This prompted the present study of the UV transmission characteristics of twenty different textiles.

MATERIALS AND METHODS

The UV light sources and light-measuring equipment used were described by Fischer & Alsins in 1975 (1). The light transmission measurements were made with the 313, 365 and 436 nm bands and were repeated with two different effects of the lamps. Twenty samples of textiles were chosen from patients' hospital garments and from commonly used mens' and womens' clothing: cotton 9, velvet 1, wool 1, various synthetic and semisynthetic materials 9. Five of the materials had multicoloured patterns with two to four colours; the others were monotone, in varying shades.

The weight of each materal was determined in g/m^2. Protection factors are given as the inverted value of the transmission.

RESULTS

The UV transmission values of a representative selection from the twenty materials tested are summarized in Table I. In fourteen of the materials the transmission varied by a maximum of 10% at the three wave length bands examined. In six dark-coloured materials, protection factors were somewhat higher at 313 nm than at 365 and 436 nm.

These differences are small and imply that it is possible to use the absorption of visible light as a measure of the UV-protective effect of textiles. One simple way of comparing the UV protection afforded by different textiles would therefore be to make a visual estimation of the light penetrating the material in front of an ordinary lamp bulb.

UV protection varied less with the weight than the structure of the material. The highest and lowest absorption values were found in blue denim and womens' tights respectively. In one and the same material, dark colour protected about twice as well