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Treatment of psoriasis with a 311-nm UVB lamp

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Summary In a left–right comparative study, the Philips TL-01 sunlamp, a new UVB fluorescent lamp, was evaluated in 15 patients with symmetrical psoriasis. One half of the body was treated in a cabin containing TL-01 lamps, and the other half in a cabin containing TL-12 lamps. The patients were treated three times/week, and the study was conducted in a randomized, double-blind fashion. The percentage response of psoriatic lesions was determined on the tenth and twentieth exposures. The therapeutic effect of the TL-01 lamps was superior to that of the TL-12 lamps, and treatment was better tolerated, particularly with regard to episodes of burning. This new lamp appears to provide more effective and safer phototherapy for psoriasis.

UVB phototherapy has an established role in the treatment of psoriasis and is still being improved. The first experiments with phototherapy were carried out by Alderson in the 1920s,[1] and confirmed by Goeckerman.[2] The effectiveness of UVB, when not combined with a photosensitizing agent, was originally questioned by Epstein,[3] and more recently by Young,[4] but results were imprecise because of the radiometric and dosimetric parameters used. However, in 1976 Fischer[5] demonstrated the effectiveness of UVB alone in the treatment of psoriasis, and this was confirmed by Parrish.[6,7] The study of Parrish and Jaenicke[7] in 1981 still constitutes the most precise information available on the therapeutic action spectrum in psoriasis. It revealed that UVC and short wavelength UVB are ineffective, and that the most beneficial wavebands in psoriasis are situated near 313 nm (Fig. 1). In view of these results, Van Weelden and Van Der Leun[8] proposed the development of a light source excluding shorter wavelength, erythemogenic UVB.

The Philips TL40W/01 lamp, a new fluorescent lamp, which produces a peak narrow-band emission at 312 nm and a minor peak at 305 nm (Fig. 2), should therefore be theoretically more effective in the treatment of psoriasis than the Philips TL40W/12 lamp, which is a conventional broad-band UVB lamp emitting a considerable amount of irradiation in the wavelength range below 300 nm (Fig. 3). We attempted to confirm the superiority of the TL-01 lamp in a comparative study.

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Methods

The study was carried out at Montpellier (France) from January to June 1990. Twenty-one patients were enrolled, but only 15 completed the study (seven females, eight males; age range 24–81 years, mean 46·5). Informed consent was obtained from all patients. Two patients defaulted without notification, and four for personal reasons.

Patients had plaque-type (6), plaque/guttate (5) or guttate psoriasis (4), which was widespread and symmetrical. The mean duration was 11·8 years (range 4 months–28 years). Patients with a history of photoaggravated psoriasis were excluded. None had received UVB treatment, photochemotherapy (PUVA) or retinoids for 3 months prior to the study. All photosensitizing medical treatment, and all topical treatment, apart from pure vaseline or 1% salicylic acid in petrolatum was prohibited.

Light sources

Twelve Philips TL40W/01 lamps were installed in an ordinary UVB cabin provided by Dixwell Laboratory (17–19 rue Mazagran, 69007 Lyon). The average irradiance was 1·4 mW/cm^2 measured by a calibrated UVB meter (Photometer type DF series DFX Silicon photovoltaic detector).

Twelve Philips TL40W/12 lamps were placed in an identical cabin. The average irradiance in this cabin, measured by the same UVB meter, was 2·1 mW/cm^2.

The irradiances were checked with a Waldmann AG UVB detector (Schwenningen, Germany).

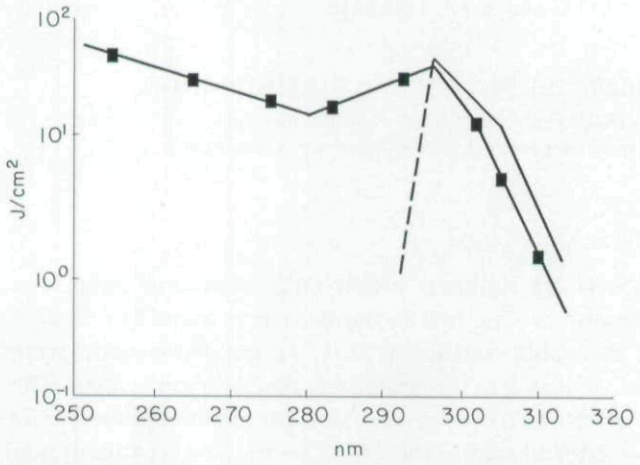

Figure 1. Erythema action spectrum mean (—■—); phototherapy action spectrum mean (——); (- - -) shows the steep decline in therapeutic effectiveness at wavelengths less than or equal to 290 nm.

Treatment schedule

One vertical half of the body, chosen randomly, was treated in the cabin containing the TL-01 lamps, and the other half treated in the cabin containing TL-12 lamps. During irradiation of one half of the body, the other half was shielded by a thick material preventing penetration of the UV rays (photometric verification).

A conventional therapeutic schedule was employed in treatment with the TL-12 lamps. The first exposure was 70% of the average MED estimated from the patient's skin type (average MED of skin type II, 80 mJ/cm^2; III, 120 mJ/cm^2; IV, 150 mJ/cm^2). Subsequent doses were given on the basis that, if the previous exposure had induced no perceptible effect, the exposure time was increased by 40%. If there was slight erythema, the exposure time was increased by 20%, and if marked erythema occurred, the same exposure time was used again. Doses were decreased by 20% in cases of minor burning, and by 40% in cases of mild burning. Treatment was temporarily stopped if severe burning occurred.

For treatment with TL-01 lamps, the initial exposure dose was identical to that used in the TL-12 cabin. The same exposure schedule was employed. In this way the applied doses in each cabin were not associated with the same risk of erythema, and were not therefore equierythemogenic. In fact, the erythemogenic doses of the TL-01 lamps were 4–6 times longer than those of the conventional UVB phototherapy lamps.[9,10] The maximum

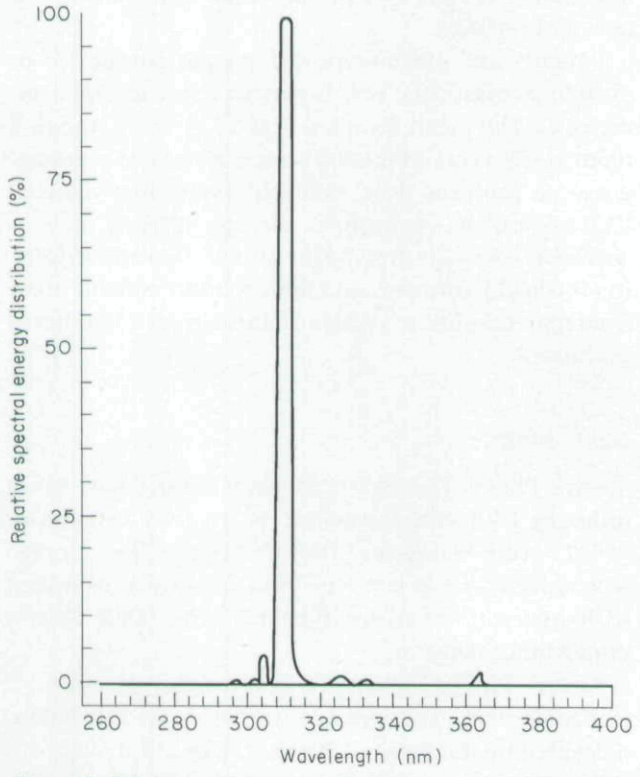

Figure 2. Relative special energy distribution of the Philips TL-01 fluorescent lamp.

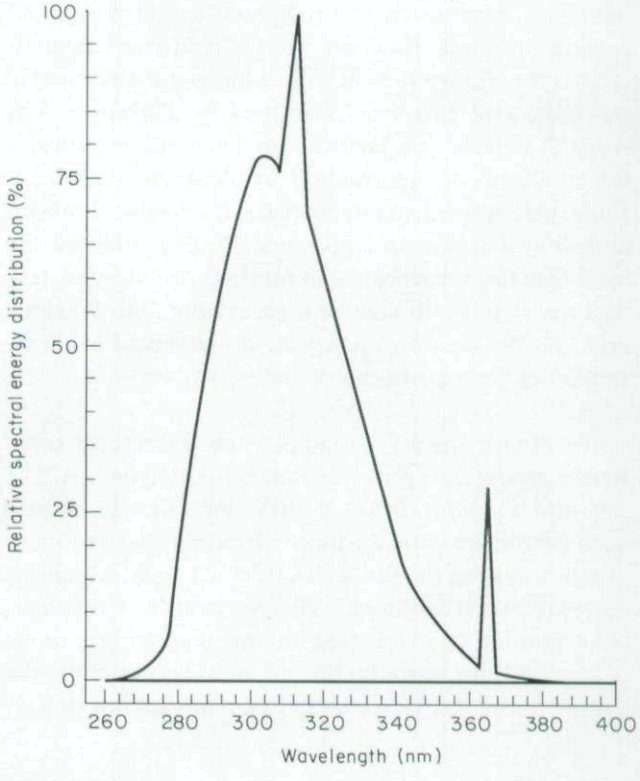

Figure 3. Relative spectral energy distribution of the Philips TL-12 fluorescent lamp.

exposure time of each half of the body was fixed at 16 min. The patients were treated three times/week for a maximum of 10 weeks.

Therapeutic evaluation

An assessment of erythema, scaling, infiltration and extent of the lesions was carried out prior to treatment. The intensity of erythema, desquamation and infiltration was rated according to the following scale: 3, severe; 2, moderate; 1, mild; 0, absent. In addition the percentage of involved surface area was recorded. The severity of disease was evaluated by means of the psoriasis area and severity index (PASI) score based on the above parameters. An initial score of the severity of psoriasis was thus determined (S_0).

The therapeutic effects were assessed at the tenth and twentieth exposure (S_{10} and S_{20}) by another experienced clinical observer using the same scoring system. This observer had no knowledge of which therapy was administered to which side of the patient. On the tenth and twentieth exposure the percentage response of psoriatic lesions was determined:

$$\left(\frac{S_0 - S_{20}}{S_0} \times 100\right).$$

At the time of the last exposure, patients were asked about their preference with regard to effectiveness.

Adverse effects such as burning, pigmentation or pruritus were evaluated by semiquantitative scoring (0, no symptoms; 1, minimal symptoms; 2, moderate; 3, severe symptoms).

Statistical analysis

All analyses were carried out with a VAX/VMS statistical package, using the BMDP programme. The Wilcoxon test was adapted for this study.

Results

The percentage overall improvement for the TL-01 and TL-12 lamps at the twentieth exposure were 78·5 and 73·9%, respectively. Hence, psoriasis cleared to a greater extent with TL-01 lamps than with TL-12 lamps, and this difference was significant ($P<0·05$). No significant difference between the two lamps was found at the tenth exposure (Table 1). In seven patients the TL-01 lamps gave superior results, in one patient the TL-12 lamps were more effective, and there was no significant difference in the remaining seven patients.

Table 1. Comparison of UVB phototherapy with Philips TL-01 and TL-12 lamps

	TL-01	TL-12	*P*
Mean S_0	27·9	27·6	NS
Mean S_{10}	12·9	12·5	NS
Mean S_{20}	6·6	7·8	<0·01
% mean response of psoriasis $\left(\frac{S_0 - S_{20}}{S_0} \times 100\right)$.	78·5	73·9	<0·01
Mean total cumulative dose at the twentieth exposure (J/cm^2)	15·5	7·6	—
Mean score burning	0·33	2·1	<0·001
Mean score pigmentation	1·46	1·60	NS

The mean total cumulative dose of UVB was $15·1 \pm 3·8$ J/cm^2 (range 8·7–21·7 J/cm^2) for the TL-01 lamps and $7·6 \pm 4·2$ J/cm^2 (range $2·14 - 14·5$ J/cm^2) for the TL-12 lamps.

Adverse effects were assessed separately. Pigmentation was practically identical with both lamps. Burning episodes occurred less frequently with the TL-01 lamps, and the difference was significant ($P<0·001$). Itching did not occur after use of either lamp.

Twelve patients preferred TL-01 therapy, and three had no preference.

Discussion

In this study, UVB phototherapy using TL-01 lamps was more effective than treatment with conventional UVB TL-12 lamps. These findings are supported by previously published studies[9,11–13] which showed superior efficacy of the TL-01 lamps with equierythemogenic schedules. Doses from the TL-01 lamps were therefore multiplied by a factor of 4–6 compared with the TL-12 lamps. Our study is the first using a non-equierythemogenic schedule, and we established that the TL-01 lamps were effective with an infra-erythemogenic regime.

At the twentieth exposure the mean total cumulative dose from TL-01 lamps received by our patients was approximately twice that from the TL-12 lamps. This is because of the rarity and mildness of episodes of erythema caused by TL-01 lamps, which allowed a regular progression of doses up to 40%. TL-12 lamps often produced erythema, and therefore the progression with these lamps was slower and less regular.

No moderate or serious burning occurred with TL-01 lamps while using this therapeutic schedule. Only minor burning was noticed. On the other hand, episodes of burning with the TL-12 lamps were relatively common. This short-term innocuousness of TL-01 lamps results in better treatment compliance, and the avoidance of a possible Koebner phenomenon. It also explains the patients' preference. In addition, TL-01 lamps appear not only safer in the short term, but probably also in the long term. A study[13] carried out on animals revealed that TL-01 lamps were slightly less carcinogenic than TL-12 lamps, using an equierythemogenic schedule. However, a recent study[14] produced contrary results. Differences in several parameters make comparison difficult, but we are surprised that in the study by Flindt-Hansen *et al.*[14] the ratio of the MED of mouse skin between the two lamps was 11, compared with 5·8 in the study by Van Weelden *et al.*[13] Although further studies may be necessary, the suppression of short-wavelength UVB has the theoretical advantage of being less carcinogenic.

We have shown that the Philips TL-01 lamps have superior efficacy and tolerance. Further studies will be required to confirm these findings and to determine the optimum therapeutic schedule, but our results appear very convincing. Another recent study[10] concluded that phototherapy with narrow-band UVB is as effective as photochemotherapy (PUVA), which is more complicated and inconvenient.

The value of this new therapy should be assessed in other dermatoses where conventional broad-band UVB phototherapy is effective, for example, in atopic dermatitis, severe pruritus associated with chronic renal failure, polymorphic light eruption, and solar urticaria.

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