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Photochemotherapy in Psoriasis Vulgaris —A Simplified Method for Determining the Intensity of Ultraviolet Light—

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We have used high itensity ultraviolet light (black light) and 8-methoxypsoralene to treat psoriasis vulgaris. New ultraviolet lamps steadily decrease in output for the first 100—200 hours, and we have developed a simple method to determine the intensity of UV output before each use which involves exposing color film through a projection print scale for different length of time, then noting the exposure time necessary to render the color film transparent. This will eliminate the need for determining MED for a patient before each treatment while UV energy output of the treatment lamp is decreasing.

(Key Words: Ultraviolet Light, MED, Psoriasis)

Recently, new methods have been developed for the treatment of psoriasis vulgaris, which utilize therapeutic dosages of 8-methoxypsoralen (8-MOP) and irradiation with long wave length ultraviolet light (UV) (1, 2, 3, 4, 5, 6, 7). We are presently utilizing a modification of the method of Mizuno et al (1) in the treatment of this condition. Following topical application of 0. 1—0. 3% 8-MOP to psoriatic lesions, the patient is irradiated with 2—3 times the minimal erythemal dosage (MED) of UV. In treatment of this sort, the MED for each patient must be determined for 8-MOP and UV prior to the initiation of phototherapy.

The high intensity UV lamps used for this therapy decline steadily in UV energy output for the first 100—200 hours of use, before UV output reaches a constant value. Since the normal UV exposure during treatment is only a few minutes, we felt that it would be wasteful to not be able to use the lamps for phototherapy during the first 100—200 hours, yet, because of the change in UV intensity, it became necessary to redetermine the MED for each patient before each treatment, which seems even more wasteful. MED is an exposure to UV which can be expressed as the product of UV intensity and time of exposure, and the higher the intensity, the shorter the time

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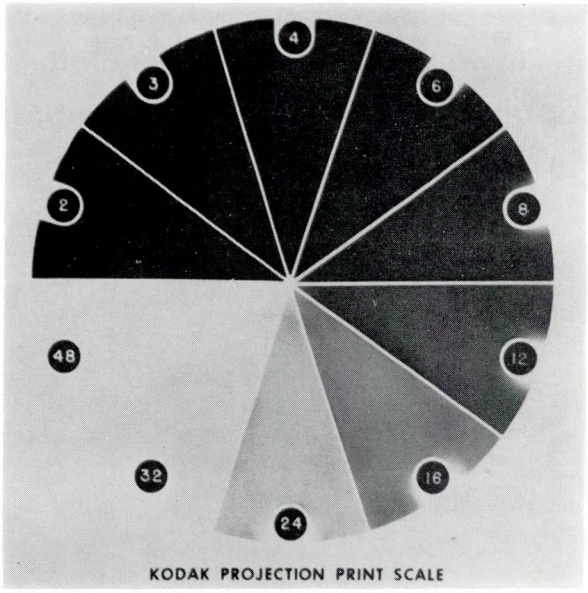

Fig. 1 The density scale

of exposure. If there were some easy means of determining intensity, then, as intensity decreases, increasing the time of exposure proportionately should give the same MED.

To overcome the difficulty of constantly redetermining MED, we have developed a simple method of determining UV intensity, which involve exposing color film to the output of a UV lamp through a projection print scale. This method measures the intensity of UV with good precision, and is inexpensive, simple and rapid.

MATERIALS AND METHODS

The light source used in these experiments consisted of 10 UV tubes (Toshiba FL 20 S BLB : Toshiba Iryohin Co., Tokyo, Japan) which radiate UV from 300—430 nm, with maximum output at 352 nm. The density scale used was a Kodak projection print scale (Figure 1) (Eastman Kodak Co, New York, New York, U. S. A.). The color film was Sakura color foil TP–250 film (Konishiroku Shashin Kogyo, Tokyo, Japan). Density of the exposed film was measured with a densitometer that is calibrated in optical density (O. D.) units (Macbeth densitometer TD 100 A, Macbeth, Newberg, New York, U. S. A.). Incident UV radiation was measured in mW/cm^2 with a UV radiometer (Toshiba UVR–365, Tokyo Kogaku Kikai Co., Tokyo, Japan).

In detail, the method that we used, was to expose color film to UV under identical conditions for determining MED (20 cm from the light source, at exposure of 30, 60, 90, 120, 150, 180 and 240 sec.) but covered by the projection print scale. After exposure, the film was developed for 10 minutes under saturated ammonia vapor. After development, the density of exposed film was measured with the densitometer. Concurrently with exposure, the intensity of UV was measured with the UV radiometer.

RESULTS

Since transparency color film was used, the OD of the exposed film

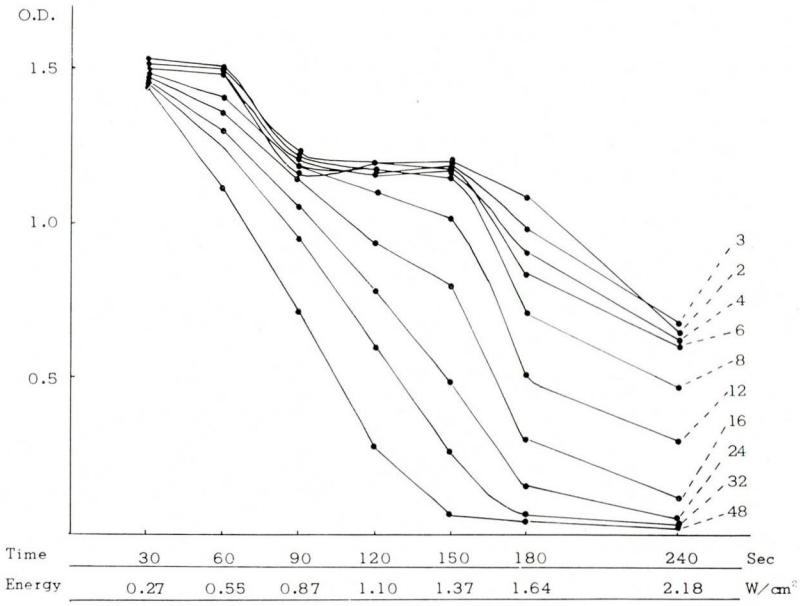

Fig. 2 The relationships between OD of each scale number of developed films and the time of exposure to UV.

decreases with increasing exposure. In other words, color transparency film is direct positive film, therefore, overexposed film would be transparent and underexposed film would be quite dark.

Figure 2 shows the OD of each sector of the color film exposed under the print projection scale plotted as a function of time of exposure to UV. The actual energy of irradiation was calculated as the product of 9. 1 mW/cm² (measured) times the actual time of exposure.

As one might predict, the measured OD of each sector of the exposed film decreased as time of exposure increased, although the decrease in OD was not always linear. OD values below 0. 07 appear transparent to the unaided eye. Thus, in Figure 2, the portion of film under sector 48 of the projection print scale required 150 sec. exposure (1. 37 W/cm²) in order to appear transparent.

DISCUSSION

It is necessary to determine MED on patients receiving 8-MOP and UV treatment for psoriasis. Since the intensity of UV lamps decreases over the first 100—200 hours of use, it becomes necessary to redetermine MED for each patient and for each treatment during that time. We have managed to overcome this problem as follows: the treatment lamp is calibrated with a UV radiometer and by a series of exposures of color transparency film through a projection print scale. The film is developed and examined to see how long an exposure is needed to just render the film transparet to the unaided eye under a specific sector or sectors of the scale. This time of exposure is now rated in UV energy. In this way, UV energy output can be determined when determining MED for a patient, and whenever a treatment is indicated. This will eliminate the need for determining MED for a patient before each treatment while UV energy output of the treatment lamp is decreasing.

Table 1. The exposure time of UV needed to make color film to be transparent under each density scale

No. of density scale	Exposure time	Energy	O. D.
	sec	W/cm²	
48	150	1.37	0.07
32	180	1.64	0.06
24	240	2.18	0.05

For example: the average MED for patients undergoing treatment in our clinics is 2.9±1.2 min (1.64 W/cm²). If the MED for a specific patient was 3 min (1.64 W/cm²) at the initiation of a series of treatments, the MED exposure of UV as the lamp output diminishes in intensity would be that exposure (Figure 2) which would just render the film under section 32 (Table 1) of the projection print scale to be transparent.

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REFERENCES

1) Mizuno N: New problems on photosensitivity (in Japanese). J. Jap. Med. Association 70: 53, 1973.
2) Ozawa A, Matsuo I, Niizuma K, et al: 8-Methoxypsoralen and black light therapy combined with steroid ODT for the treatment of psoriasis vulgaris. Nishinihon J. Derm. 38: 311, 1976.
3) Parrish J A, Fitzpatrick T B, Tanenbaum L, et al: Photochemotherapy of psoriasis with oral methoxsalen and longwave ultraviolet light. New Engl. J. Med. 291: 1207, 1974.
4) Swanbeck G, Thyresson-Hök M, Bredberg A, et al: Treatment of psoriasis with oral psoralens and longwave ultraviolet light. Acta Dermatovener. 55: 367, 1975.
5) Walter J F, Voorhees J J: Psoriasis improved by psoralen plus black light. Acta Dermatovener. 53: 469, 1973.
6) Weber G: Combined 8-methoxpsoralen and black light therapy of psoriasis. Brit. J. Derm. 90: 317, 1974.
7) Willis I, Harris D R: Resistant psoriasis. Combined methoxsalen anthralin therapy. Arch. Derm. 107: 358, 1973.