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Solar Simulators: Modifications for Testing with Visible Light

H. C. Wulf and H. Brodthagen

Department of Dermatology, The Finsen Institute, 49, Strandboulevarden, DK-2100 Copenhagen Ø, Denmark

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Abstract. The Berger Solar Simulator is designed to test light-sensitive patients for their sensitivity to ultraviolet light. The present modification was performed to make testing with UV and visible light possible. The modification consists in replacing the dicroic mirror with a beam splitter (BSP 580) and the filters with a WG 340 allowing 340–565 nm to pass. Subdivision of that spectrum is performed by inserting a Wratten 12 (500–565 nm) or a Wratten 2B (400–565 nm). Infrared is excluded by a KG3 filter.

Key words: Solar simulator, filter modifications; Light-sensitive patients; Tests with UV-light; Tests with visible light

Solar simulators are widely used in testing light-sensitive patients for their sensitivity to ultraviolet (UV) light. Some UV-sensitive patients are sensitive to visible light too and a few patients will only react to visible light (3).

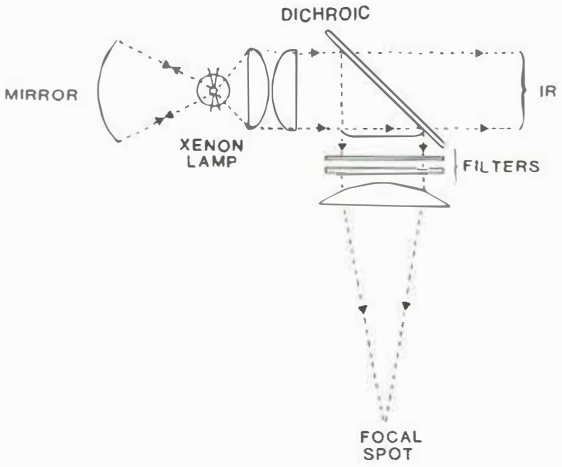

Fig. 1. Light path in the Berger Solar Simulator.

In the following we describe a modification of the filters used in a Berger solar simulator (1) whereby the emission spectrum is widened to include visible light.

METHODS

The light path in the solar simulator is seen in Fig. 1 (1). The light source in a solar simulator is a xenon arc lamp. In our solar simulator the UV is reflected from an angled dicroic mirror and the reflected light is cut off by a Corning blue filter (3 mm) and by a WG 320 filter (1.5 mm) to give an UV-spectrum comparable to sunlight. Only UV-A is transmitted when a WG 340 is inserted into the light path. The reflection curve for the dicroic mirror and the transmission curves for the filters are shown in Fig. 2, together with the resulting light output at different wavelengths.

Modifications (Fig. 3). When the dicroic mirror was replaced by a beam splitter (BSP) 580, some UV and visible light up to about 565 mm (50% transmission) was reflected. The reflection below 350 nm was minimal and difficult to measure, and is not given in Fig. 3. We consider that the UV-B is better excluded in order not to disturb the evaluation of the reaction to longer wavelengths. This was obtained by placing a WG 340 filter in the light path. Not all infrared (IR) passed the mirror, but some was reflected. The reflected IR could be absorbed by means of a KG 3 (3 mm thick) filter (Fig. 3).

A subdivision within the visible spectrum was chosen by inserting a Wratten 12 (Kodak) into the light path, giving 500–565 nm only, or a Wratten 2B giving 400–565 nm (Fig. 3) only.

RESULTS AND DISCUSSION

Irradiation with the modified solar simulator of subjects with different skin types gave a weak bluish skin colour within 4–10 min of irradiation

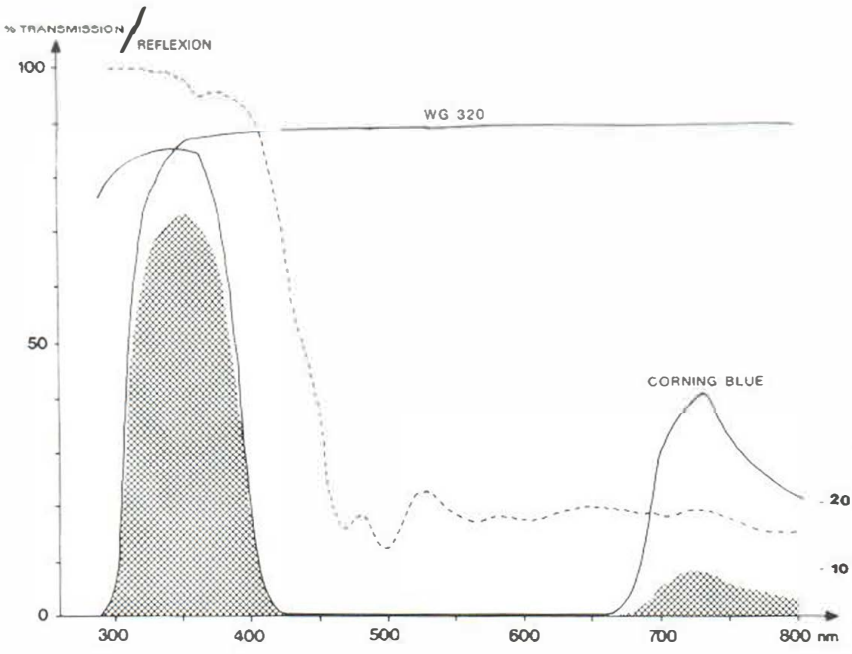

Fig. 2. Reflection from the dicroic mirror (---) and the transmission (—) of the filters used in the *unmodified* solar simulator. The grey areas show the resulting irradiation.

(with a 3 mm thick KG 3 in the light path) which disappeared within 5–15 min.

In people with an abnormal reaction to light the reaction could come very quickly and be a deep purple, very intense and lasting for several hours.

The users of our modification must set their own standards, since the reactions will depend on the specific skin type of the individual.

For the testing of light-sensitive patients we find it appropriate to use both UV and visible light.

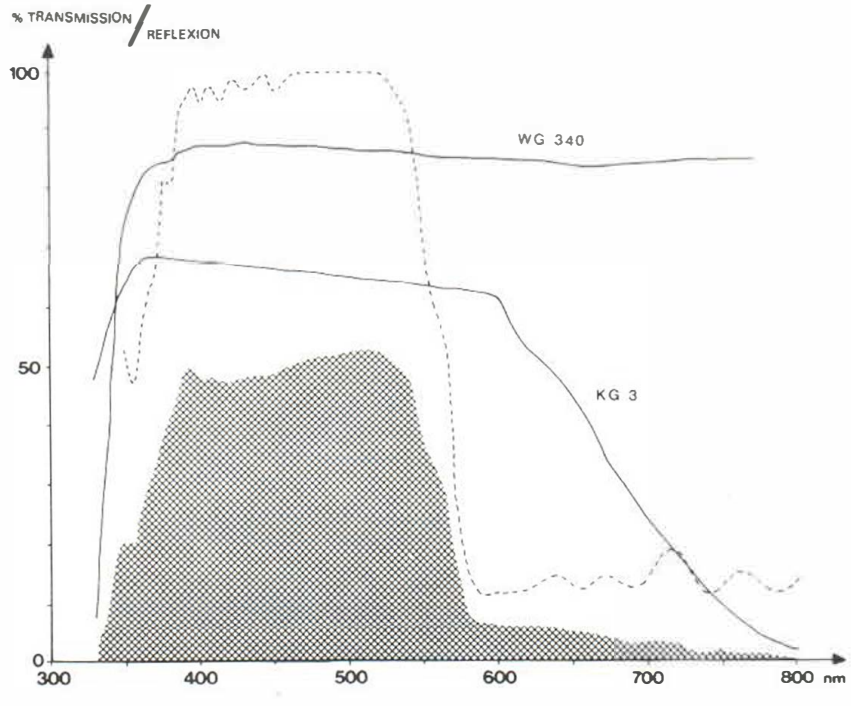

Fig. 3. Reflection from the PSP 580 (---) and the transmission (—) of the filters used in the *modified* solar simulator. The grey area shows the resulting irradiation.

This might be useful for photopatch testing (photoallergy), and testing of patients with porphyria cutanea tarda, solar urticaria and polymorphic light eruptions (2).

We obtained the BSP 580, the KG3 and the WG 340 from the Optisk Laboratorium, the Technical University of Denmark, Lyngby, and the Wratten gelatin filters from Kodak.

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Leukocyte Inhibitory Factor (LIF) in Granuloma annulare: A Comparative Study between the Generalized and the Localized Types

R. Friedman-Birnbaum, A. Gilhar, S. Haim and D. T. Golan

Department of Dermatology, Rambam Medical Center and Clinical Immunology Service, Rotschild Hospital, and Technion Faculty of Medicine, Haifa, Israel

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Abstract. Leukocyte inhibitory factor (LIF) was investigated in 9 patients with localized granuloma annulare and 8 patients with the generalized form of the disease. The control group consisted of 10 matched, apparently healthy subjects. LIF values were significantly higher in patients with granuloma annulare of both groups than in controls ($p<0.05$ and 0.01). However, no significant difference was revealed between the two groups of patients. Though the results seem to speak for a cell-mediated immune response in granuloma annulare, they do not add a further support to the previously demonstrated differences between the two forms of granuloma annulare.

Granuloma annulare (GA) is a chronic skin disease, characterized histologically by necrobiotic epithelioid granulomas surrounded by a palisade of histocytes, lymphocytes, epithelioid and giant cells (3). Two main forms of the disease are recognized, the localized (LGA) and the generalized (GGA) (7).

In previous studies we pointed out the differences between the two forms of GA regarding age distribution, their relationship to diabetes (8), frequency of microangiopathy (9) and frequency of HLA-Bw 35 (7).

There are conflicting reports concerning the possibility of a defective cell-mediated immune response in patients with GA (3, 12). We found it of interest, therefore, to investigate the leukocyte inhibitory factor (LIF) in patients with GA and, furthermore, to search for a possible difference in this regard between the two forms of the disease.

MATERIAL AND METHOD

Nine patients with LGA and 8 with GGA were included in this study. The LGA group consisted of 7 females and 2 males aged 31 to 60 years. In the GGA group there were 8 females aged 50 to 65 years. The diagnosis of GA was confirmed in each case by histological examination. Ten apparently healthy matched controls were simultaneously and similarly tested. The test of leukocyte migration inhibition was adopted from Erard (6) with a slight modification. 5 µl of 1×10^7 leukocyte-containing lymphocytes with and without PPD were placed in Petri dishes containing 2% agarose, medium M 199 and fetal calf serum. The Petri dish preparations were incubated overnight, fixed with methanol and stained with Giemsa. Images of migration area were projected with an overhead view projector. The areas of migration were measured and the inhibition index was calculated as follows:

$$100 - \frac{\text{Area migration} + \text{Ag}}{\text{Area migration} - \text{Ag}} 100$$

RESULTS

The index of inhibition for each of the three tested groups is shown in Table I. Our data reveal that the index of inhibition in controls was significantly lower than in patients with LGA and GGA as well ($p<0.05$ and 0.01 respectively). No difference was observed between the two types of the disease.

DISCUSSION

Epithelioid granulomas have been considered to be an expression of delayed hypersensitivity reaction to an obscure antigen (2). In support of a similar mechanism in GA we found reports on the development of GA-like histological changes after intradermal injection of tuberculin (1) and lymphogranu-