

Throwing a Light on Photosensitivity in Atopic Dermatitis

A Retrospective Study

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Abstract

Background: Photosensitivity in atopic dermatitis (AD) is a well known but ill-defined phenomenon.
Objectives: To determine the prevalence of photosensitivity in patients with AD, define its clinical characteristics, and analyze the photo provocation test (phototest) results.
Methods: A retrospective study of patients with AD who were phototested because of suspected photo-sensitivity at our department during the period 1994–2004.
Results: The total number of patients with AD seen in our department between 1994 and 2004 was 3804, of whom 145 patients (45 men and 100 women) were phototested. Photosensitivity was confirmed in 108 (74%) of these 145 patients (33 men and 75 women). The minimal erythema dose (MED) for UVB was decreased in eight of these 108 patients (7%) and the MED for UVA in five patients (5%). Two major clinical reaction patterns were observed: a polymorphic light eruption-type reaction in 51 patients (47%) and an eczematous reaction in 44 patients (41%). Seventy-two of the 108 patients (67%) had a pathologic reaction to UVA and UVB, 18 patients (17%) were only UVB sensitive, and 18 patients (17%) were only UVA sensitive. Photo-patch tests were performed in 125 patients (86%). Twenty-nine patients (23%) had a positive photocontact reaction to one or more substances.
Conclusion: Photosensitivity is found in approximately 3% of patients with AD and the majority are female. Photosensitivity in patients with AD consists of two clinical reaction patterns distinguishable by phototesting. Patients were diagnosed with either AD and co-existing polymorphic light eruption or photosensitive AD.

Background

Atopic dermatitis (AD) is a common inflammatory skin disease. The majority of AD patients benefit from sunlight or UV radiation therapy (UVB/UVA1/psoralen plus UVA). Unfortunately, a small group of patients experience an adverse reaction to sunlight or artificial UV radiation. An estimated 10% of patients with AD are reported to deteriorate after solar exposure.^[1,2] Although sunlight may improve or exacerbate AD, the effect of UV light on AD in clinical practice is often unclear, since the symptoms may also be explained by a host of unrelated circumstantial factors such as humidity, scratching, pollen exposure, psychological factors, skin care, and co-morbidities such as polymorphous light eruption (PLE).^[3] In the literature, photosensitivity in AD is reported as photo-aggravation of AD,^[1,4-16] photosensitive eczema,^[17-19] light

exacerbated eczema,^[20,21] photoexacerbated AD,^[22] and even chronic actinic dermatitis (CAD).^[23-26] There are also reports of co-existence of PLE with AD.^[1,3,13,27]

Although photosensitivity in AD has often been mentioned in the literature, a thorough description of this phenomenon is lacking. The description of the clinical picture is minimal and there are no phototest criteria. The aim of this retrospective study was to determine the prevalence of photosensitivity in patients with AD, define its clinical characteristics, and describe the outcome of phototests in this patient group.

Methods

All patients with AD who were phototested in the Department of Dermatology and Allergology, University Medical

Centre Utrecht, Utrecht during the period 1994–2004 were included in this study. Patients were tested because of a clinical suspicion of photosensitivity (patient's history and/or sun-exposed skin distribution of the lesions). The diagnosis of AD was made according to the criteria of Hannifin and Rajka.^[28] Diagnostic phototesting consisted of determination of the minimal erythema dose (MED) for UVB and UVA, provocation with these wavelengths, and photopatch tests.

Radiation Sources

The radiation sources used have been described previously by Boonstra et al.^[29] Briefly, the UVA source (Mutzhas UVASUN 3000S) consists of a high-pressure mercury arc with special filtering to filter out all UVB and short-wave UVA (UVA2), creating a UVA1 source (resulting in a 340–450-nm emission spectrum). The UVB source consists of four Philips TL20W/12 tubes with a continuous emission spectrum (280–360 nm) with a maximum of approximately 305 nm. These light sources for UVA and UVB were used for both MED and phototesting.

Doses of light were measured in J/cm² using a Waldmann UV detector device (Waldmann, Schwenningen, Germany). Because the Waldmann meter does not fully correspond with the emission of the Mutzhas lamp, it was calibrated with the spectro-radiometer, model 752 (Optronic Laboratories Inc., Orlando, FL, USA).

Phototesting Procedure

The MEDs for UVB and UVA were determined using a specially designed apparatus that simultaneously exposes a series of nine areas of skin of 3 × 10 mm to increasing doses. These doses are geometrically progressive with increments of 41% between successive skin fields. Irradiation was given in the morning and assessment was performed after 8 and 24 hours by an experienced observer. The MED is defined as the dose of UVB/A necessary to induce a just perceptible erythema with no marked borders. The MED was considered decreased if the skin was at least four times more sensitive than normal. The normal MED for UVB is about 50–70 mJ/cm² (Philips 20W/TL12). The lower limit of a normal MED for UVA is about 25 J/cm² (Mutzhas UVASUN 3000S). The upper limit of this UVA test is 40 J/cm².

Photo provocation is a useful method for reproducing photosensitive skin lesions. In this test, non-lesional skin is exposed on a daily basis to increasing doses of UV light. This is done separately for UVB and UVA on skin areas of 6 × 10 cm, starting with twice the MED to limit irritation of the skin and then increasing daily by 20–40%, depending on the reaction of the skin. Exposure is stopped as soon as a pathologic reaction occurs or

after six exposures. The photo provocation sites used in this study were the upper arms, lower arms, and the back. UVA and UVB provocation sites were always symmetrically distributed over the body. Observations were made by an experienced observer. Tests were carried out in a special temperature-controlled phototesting area at our photodermatology unit.

Photopatch tests were carried out in the standard fashion.^[30] Depending on the patient's history, personal skin care products and sunscreen products used by the patient were added to the fixed series used in the standard photopatch test.

Results

Between 1994 and 2004 our department tested 145 patients (45 men and 100 women) with AD and a clinical suspicion of photosensitivity. The average age of onset of complaints of photosensitivity was 37 years. The age of the patients at testing ranged from 4 to 65 years. The majority of the patients had Fitzpatrick skin types II or III. Only a few patients had Fitzpatrick skin type I. During the same period, 3804 patients were diagnosed with AD in our department.

Phototest Results

Pathologic photo-provoked reactions were observed in 108 (74%) of the 145 patients (33 men and 75 women). Thus, the prevalence of photosensitivity in our population of patients with AD was 3% (108/3804).

The MED for UVB was decreased in eight patients (7%). The geometric mean MED for UVB was 56 mJ/cm². A decreased MED for UVA was observed in five patients (5%).

The photo provocation tests identified two main clinical reaction patterns: an erythematous, papulous, and pruritic reaction in 51 patients (47%) and an eczematous reaction in 44 patients

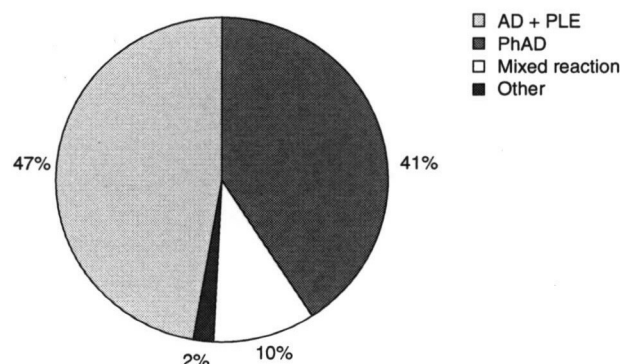


Fig. 1. Morphologic spectrum after photo provocation tests in patients with atopic dermatitis (AD). PhAD=photosensitive AD; PLE=polymorphous light eruption.

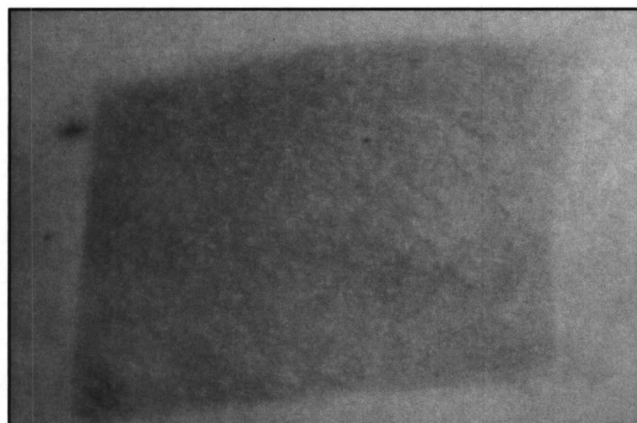


Fig. 2. Polymorphous light eruption-type reaction following 3 days of photo provocation testing in a patient with atopic dermatitis.

(41%) [figure 1]. Eleven patients (10%) manifested a combination of these two reactions. One patient (1%) showed a clinical picture of CAD, with a lowered MED for UVA and UVB and one patient (1%) had a lupus erythematosus-like provocation reaction. Histopathologic examination confirmed the diagnosis of lupus erythematosus in this patient. The erythematous, papulous, and pruritic reaction resembled the reaction seen in PLE provocations and was therefore called 'PLE type' (figure 2). This reaction developed within hours (0.5–48 hours) and resolved within days without scarring. These patients were diagnosed with AD and co-existing PLE. The provoked reaction was termed 'eczematous' when it displayed development of a pruritic erythematous and papulo-vesicular reaction within hours or days (0.5 hours to 5 days), subsequently resulting in a polymorphic confluent clinical picture with erythema, papules, scales, vesiculation, and excoriations (figure 3). The eczematous reaction, which was diagnosed as photosensitive AD (PhAD), took longer (days) to develop and the lesions had a more persistent character. The age of onset of complaints in the PLE-type group was 35 years (standard deviation [SD] 19.1) compared with 39 years (SD 17.8) in the eczematous group. In a smaller group of patients the reaction initially resembled the PLE-type reaction but eventually became a more 'chronic eczematous' reaction. This was termed a 'mixed reaction pattern.'

Sensitivity to both UVA and UVB was detected in 72 (67%) of the 108 patients, 18 patients (17%) showed only UVB sensitivity, and 18 patients (17%) showed only UVA sensitivity (figure 4). No difference in UV wavelength sensitivity could be detected between the PLE-type and eczematous reaction groups.

There were no significant differences between men and women. Three times as many women as men with AD were tested for photosensitivity and three times as many women as men demonstrated photosensitivity. No correlations between sex or age and

specific phototest results could be established in our analysis. No biopsies were taken from these photo provocation sites.

Photopatch tests were performed on 125 of 145 patients (86%). Positive reactions were predominantly elicited by sunscreen substances (48%), skincare products (16%), and fragrance mix (15%). Positive photocontact tests to one or more substances were found in 29 patients (23%). The sunscreen substances eliciting a positive (photo)contact reaction are shown in table I. We found no differences between the PLE-type and the eczematous groups with regard to the photopatch test results.

Treatment depended on the patient's history and the results of the phototests. Patients with severe photosensitivity, based on phototest results, and patients with unsatisfactory relief of complaints despite medical advice regarding sun exposure, use of sunscreen, and treatment with topical corticosteroids for symptomatic relief were treated with UVB hardening therapy.^[29] Patients were classified as having severe photosensitivity on the basis of a number of factors, that is, lowered MEDs, the number of provocations required to induce abnormal reactions, and persistence of these reactions. Twenty-six patients (24%) were treated with UVB hardening therapy (11 patients with PhAD, 11 patients with AD and PLE, and 4 patients with a mixed reaction pattern). Repeated photosensitivity tests to evaluate the effect of hardening therapy were not performed. UVB hardening therapy was clinically successful in 20 patients (77%) in terms of time spent outdoors. Treatment with UVB hardening was unsuccessful in six patients with severe AD and severe photosensitivity, all of whom were patients with PhAD. In these patients, the effect of UVB hardening was hindered by aggravation of existing AD lesions.

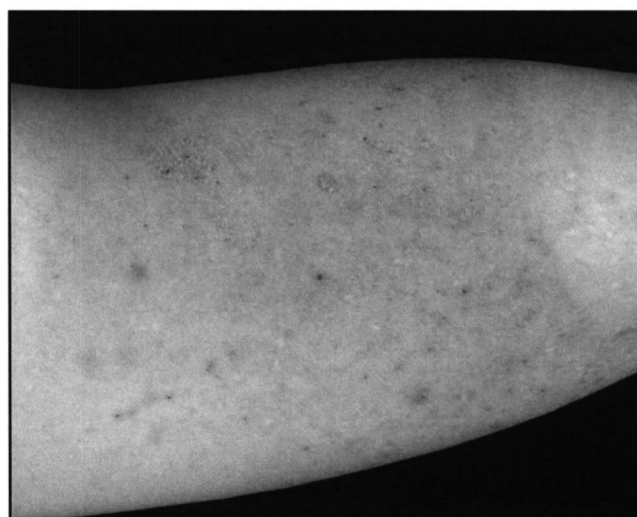


Fig. 3. Photosensitive atopic dermatitis-type reaction following 5 days of photo provocation testing in a patient with atopic dermatitis.

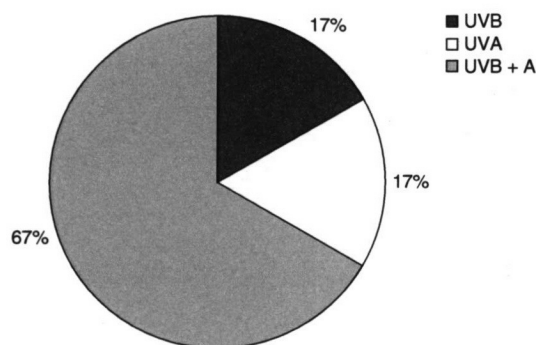


Fig. 4. UV spectrum sensitivity after photo provocation tests in patients with atopic dermatitis.

Discussion

AD has a complex etiology and many different factors influence the course of this disease. One of these factors is sunlight, in particular the UV spectrum, which can both improve and worsen the course of AD.

Approximately 3% of our population of patients with AD was photosensitive. Furthermore, the actual percentage might have been slightly higher because photosensitivity can easily be missed. Patients can easily overlook the correlation between complaints and (sun)light exposure, especially if they are sensitive to UVA only. In such cases, induction of skin lesions may occur even on cloudy days.^[23] Nevertheless, we believe that the prevalence of 3% identified in our study is the most precise estimate of photosensitivity in patients with AD to date and nearer to the true prevalence than earlier reports in the literature.^[1,2] This is because, first, our prevalence number was based on phototest results, and secondly, estimates in the literature include not only true photosensitivity patients but also patients with exacerbation of eczema due to heat intolerance,

drug-induced photosensitivity, and sunburn.^[1,2] However, it is also important to note that our group of patients was a selected secondary care population and may therefore not reflect the true prevalence of photosensitivity in AD in a general population.

Photosensitivity in patients with AD consists mainly of two clinical reaction patterns distinguishable by phototesting. Patients were diagnosed either with PhAD or AD and co-existing PLE. Differences in histology or histochemical analysis between these two clinical patterns could not be affirmed because no biopsies were obtained. Nevertheless, the two clinical patterns may represent different pathologic mechanisms and these mechanisms should be investigated more intensively. These two reaction patterns were first suggested 'in children with AD' by Frain-Bell.^[31] Tajima et al.^[13] also described patients with normal MEDs and abnormal reactions to UV irradiation and considered these patients as having PLE co-existent with AD or having a true exacerbation of their AD due to UV irradiation. The described co-existence of PLE and AD in our group of patients is in keeping with reports in previous publications.^[1,18,23,27]

A mixed reaction pattern was seen in a small number of patients. In these patients, an initial PLE-type reaction progressed to an eczematous reaction. We believe the eventual eczematous reaction is a 'Koebner-like' phenomenon following the initial PLE reaction.

Only one patient in this analysis qualified for the diagnosis of CAD. Patients with CAD have a chronic and infiltrated dermatitis with severe photosensitivity to UVB, UVA, and often visible light. Patients with this condition have reduced MEDs and (photo)contact allergies are often noted.^[32,33] We speculate that PhAD might be a preliminary stage of CAD that eventually results in this fierce persistent eczematous eruption. However, this possibility does not seem to exclude the existence of CAD at a young age.^[23,25,26,34]

Table I. Sunscreen substances eliciting a positive (photo)contact reaction (n=125)

Substance/product	No. of reactions (%)	
	photocontact	contact
4-tert-butyl-4-methoxy-dibenzoylmethane (Parsol® 1789, Eusolex® 9020)	7 (21)	0 (0)
Contralume® Ultra	5 (15)	10 (43)
Vichy® SPF 60	5 (15)	4 (17)
2-hydroxy-4-methoxy benzophenone (oxybenzone, benzophenone-3)	4 (11)	1 (4)
Roc Minesol® SPF 40 Bébé	4 (11)	1 (4)
2-hydroxy-4-methoxybenzophenone (benzophenone-4, MS-40)	3 (9)	4 (17)
Vision™ SPF 28	2 (6)	3 (13)
2-ethyl-p-methoxycinnamate (Parsol® MCX, Eusolex® 2292)	2 (6)	0 (0)
2-ethylhexyl-p-dimethyl-aminobenzoate (Escalol® 507, Eusolex® 6007)	2 (6)	0 (0)
Total no. of positive (photo)contact reactions with these substances	34	23

In our experience, advice and protection combined with local therapy is sufficient to treat most patients' complaints. UV hardening appears to be effective in most patients with AD and photosensitivity who experience persistent problems despite advice, protection, and local treatment.

Conclusion

Identifying photosensitivity, which we found in approximately 3% of our population of patients with AD, can be difficult in this patient group. Clinically, there are two reaction patterns: patients with PLE coexisting with their AD and patients with PhAD. So long as patients with PhAD and AD with co-existent PLE are given similar treatment, differentiating between the two patterns will not be necessary. However, phototesting of patients with AD should be considered if the history is not convincing, if there is a suspicion of photocontact allergy, or when patients have severe or persistent complaints despite photo protection and local treatment.

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