

Photopatch test method: influence of type of irradiation and value of day-7 reading

B. POLLOCK AND S. M. WILKINSON

Department of Dermatology, The General Infirmary, Leeds LS1 3EX, UK

118 consecutive patients were photopatch tested with 5J UVA and 10mJ UVB. In addition, day 7 readings were taken. Testing with UVB and performing late readings conferred no advantage. The current recommendations of the British Photodermatology Group regarding photopatch testing remain the most recent guide to photopatch test methodology.

Key words: photopatch testing technique; photoallergy; photosensitivity. © Munksgaard, 2001.

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Photoallergic contact dermatitis (PACD) presents as an eczematous eruption predominantly affecting light-exposed sites. In contrast to phototoxic reactions, the pathogenesis of PACD is thought to be a form of cell-mediated hypersensitivity and ultraviolet (UV) radiation is required to both induce and elicit the immune response. The concept of photopatch testing for the diagnosis of PACD and the development of its technique started in the 1950s (1, 2). Some of the first photoallergens uncovered by this technique were the halogenated salicylanilides used as antimicrobials in cosmetics and deodorant soaps (3). Photopatch testing has developed into one of the main investigations in those presenting with an eczematous eruption in a light-exposed distribution or with a history of worsening following sun exposure.

The British Photodermatology Group published a workshop report in 1997 with guidelines on photo-patch testing technique (4). This recommended UVA as the radiation source and suggested the compounds for a series of photocontact allergens. No firm recommendations were made for timing of irradiation or patch test readings. There still exist a variety of protocols presently in use with little information as to which method is most reliable or discriminatory.

In an attempt to clarify the best photopatch test technique, we performed photopatch tests on 118 patients using both UVA and UVB light sources, and extended the reading time to 7 days (5 days post-irradiation).

Patients and Methods

118 patients (77 female, 41 male) with suspected photoallergic contact dermatitis were photopatch tested between February 1997 and August 1999. Patients either had a history of an eczematous eruption exacerbated by sunscreen or an exposure-pattern distribution to their eczema. A photopatch series containing 15 allergens was used (Table 1). On day (D) 0, 3 sets of the allergens (1 set for UVA irradiation, 1 set for UVB irradiation and 1 as a non-irradiated control) were placed on either side of the midline of the upper back avoiding the immediate paravertebral skin. Standard Finn Chambers were used, held in place by Scanpor tape. On D2, patches were removed, read, and UVA (5J cm⁻²) was irradiated to 1 set, UVB (10 mJ cm⁻²) irradiated to 1 set and the 3rd left as a control. A Waldmann UV800 K machine was used containing Philips performance 40W PUVA tubes and TL20W/12RS broadband tubes. The light source was located 15 cm from the patient's back. The metering and output of the UV sources was carried out using a Type 585 100 Waldman UV 21 meter calibrated at Dundee. Patients returned for a further reading at D4 and an initial 40 consecutive patients attended for reading at D7. The remaining 78 patients were asked to return at D7 if they developed a late reaction.

A positive photopatch test consistent with photoallergic contact dermatitis was defined as a positive allergic skin reaction present at an ir-

Table 1. Photopatch test series

musk ambrette	5% pet.
thiourea	0.1% pet.
6-methylcoumarin	1% pet.
PABA (p-aminobenzoic acid)	10% pet.
octyl dimethyl PABA	10% pet.
isoamyl p- methoxycinnamate	10% pet.
octyl methoxycinnamate	10% pet.
methylbenzylidene camphor	10% pet.
butyl methoxydibenzoylmethane	10% pet.
benzophenone	10% pet.
benzophenone-3	10% pet.
benzophenone-4	5% pet.
benzophenone-10	2% pet.
phenylbenzimidazolsulfonic acid	10% pet.
homosalate	5% pet.

radiated site but absent at the control site. Reactions consistent with photoaggravation were reported as contact allergy.

Results

7 patients showed photoallergic reactions (6%). Reactions were to butyl methoxydibenzoylmethane (1 case), benzophenone (3 cases), benzophenone-3 (3 cases), benzophenone-10 (1 case), phenylbenzimidazolsulfonic acid (1 case) and musk ambrette (1 case). Details of these 7 patients are summarized in Table 2.

In 4 cases, the reactions occurred solely at the UVA-treated site but, in the other 3, reactions were seen at both the UVA- and UVB-irradiated sites. In only 1 of these 3 reactions did the intensity of the reaction differ between the UVA- and UVB-treated sites (musk ambrette: UVA ++; UVB +). No reactions occurred only at the UVB-irradiated site. No reactions were seen at D7 that were not already apparent at D4.

11 other patients reacted to all sites (irradiated and control) in keeping with an allergic contact dermatitis. These reactions were to PABA (1 case),

4-methylbenzylidene camphor (2 cases), octyl dimethyl PABA (4 cases), benzophenone-10 (1 case), butyl methoxydibenzoylmethane (1 case), benzophenone (4 cases) and benzophenone-4 (1 case).

6 patients had reactions consistent with a photosensitivity: to UVA in 5 cases and UVB in 1 case. 1 patient had numerous reactions thought to represent an 'angry back'.

Discussion

The 1st attempts at standardizing the method for photopatch testing were by the Scandinavian Photodermatitis Research Group in 1982 (5). Since then, other groups have evaluated their experience and described certain protocols (6, 7). However, there remain a variety of protocols being used at different centres, with no information as to which method if any is superior. Traditionally, the choice of irradiation has been UVA, on the assumption that the dose of UVB required to give photoallergy would be greater than that required for a sunburn response (8).

Duguid et al. (9) demonstrated that 5 J cm^{-2} of UVA was appropriate as the standard elicitation dose in photopatch testing. Higher doses were likely to increase the possibility of adverse reactions in photosensitive patients, increase the incidence of phototoxic reactions and make the procedure more time consuming.

However, whereas most photoallergens are active in the UVA wavelengths (315–400 nm), it is known that there are rare exceptions to this rule and that some compounds have their action spectra in the UVB wavelengths. 2 examples of such compounds are sulfanilamide (10) and diphenhydramine (11). There are also reports of photoallergic reactions to drugs with an action spectrum strictly limited to UVB (12). It is therefore possible that, by not photopatch testing with UVB, some photoallergic reactions could be missed. Similarly,

Table 2. Results in 7 patients with positive photoallergic patch tests

Age (years)	Sex M/F	Primary site	Duration (months)	Positive reaction(s)	D2	D4	D7	Reaction with UVA or UVB	Relevant
42	F	exposed sites	2	benzophenone	–	++	NT	UVA	yes
				benzophenone 3	–	++			
				benzophenone 10	–	+			
				phenylbenzimidazolsulfonic acid	–	+			
66	F	exposed sites	24	benzophenone	–	+	NT	UVA & UVB	yes
63	F	exposed sites	48	butyl methoxy- dibenzoylmethane	–	+	NT	UVA	possibly
48	F	periocular	10	benzophenone-3	–	+	NT	UVA & UVB	possibly
53	M	face, hands	120	musk ambrette	–	++	++	UVA	no
						+		UVB	
27	F	face, neck	10	benzophenone-3	–	+	NT	UVA	possibly
70	F	exposed sites	2	benzophenone	–	+	+	UVA	yes

NT=patient did not return. having noticed no additional reactions.

it might be expected that UVB plays a rôle in sunscreen photoallergy, especially in those sunscreens that actively absorb UVB. It was this rationale that led us to test our patients with UVB to see if any reactions did occur solely at the shorter wavelengths. 10 mJ was arbitrarily chosen as a dose that was a ratio of the UVB minimal erythema dose (MED) similar to 5 J of UVA to the UVA MED. As no such reactions did occur (although in 3 cases, the UVB-irradiated site proved positive along with the UVA-irradiated site, demonstrating photosensitivity), we do not recommend photopatch testing with UVB.

It is worth noting that the action spectra of our 2 UV light sources do overlap with the UVB source containing amounts of UVA and vice versa. It is therefore possible that reactions seen at both UVA and UVB sites may not be a true response to both types of irradiation, but due to the overlap in the action spectra. However, in our study, patients did react to UVA alone, suggesting that the overlap in spectra is not relevant. Indeed, the action spectra of the 2 sources do not overlap at their half-power points, and it is likely the energies at the overlapping spectra are effectively too low to elicit a photoallergic response.

With standard patch testing, it is recognized that up to 30% of positive reactions can become apparent between D2 and D4 (13). In photoallergy, the formation of the allergen does not occur until after exposure to the UV irradiation. Although no protocols to date have recommended readings past D4 (2 D post irradiation), it seems logical that photopatch tests should be read up to 4 D post-irradiation to ensure that late reactions are not missed. We carried out readings at D7 (5 D post-irradiation) to test this theory. No reactions were apparent at D7 that were not clearly detectable at D4 and our findings do not support this hypothesis.

Our cases also highlight the fact that positive photopatch tests do not always mean that photoallergy is the main contributing factor to the patient's skin condition. As with all patch testing, the relevance of a positive reaction is determined by the clinical history and examination.

The 6% pick-up rate of photoallergic contact dermatitis in our 118 patients is similar to that of other studies (6, 7). As the ingredients in topical

agents are continually being updated and new photoallergens being discovered, it is important that the photopatch test series of allergens is continually being reviewed and altered accordingly, as some compounds get less important and new causes for photoallergy emerge. However, on the basis of these results, we see no need to alter the recommendations of the BPG and, in particular, see no benefit in extending the reading time past D4 or irradiating with UVB.

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Address:

B. Pollock
Department of Dermatology
Leeds General Infirmary
Leeds LS1 3EX
UK