

Photopatch Testing Among Members of the American Contact Dermatitis Society

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Background: Photopatch testing is an important diagnostic tool in evaluating patients with suspected photoallergic contact dermatitis. Although protocols for photopatch testing have been described, there are no consensus recommendations by the American Contact Dermatitis Society (ACDS).

Objectives: The aims of this study were to examine the common practices of photopatch testing among ACDS members and to review and compare commonly used photoallergen series.

Methods: We conducted a questionnaire-based survey among ACDS members via e-mail to inquire about their photopatch test methods. We compared the results with the European consensus methodology and reviewed photoallergen series reported by the respondents.

Results: Of the 791 members contacted, 112 members (14%) responded to the survey. Among these, 50 respondents (45%) perform photopatch testing, approximately half of whom (48%) determine minimal erythema dose before the test using UVA with or without UVB irradiation. Respondents use a total of 13 photoallergen series, alone or in any combination, as well as customized series.

Conclusions: These results have potential to aid clinicians in identifying photoallergen series best suited for their patients and suggest a need for consensus recommendations by the ACDS.

Photoallergic contact dermatitis (PACD) is a hypersensitivity reaction to a photoallergen that occurs in the presence of generally harmless levels of UV and/or visible light.¹ These reactions are delayed type IV hypersensitivity reactions and therefore require presensitization to the culprit photoallergens or chemicals that cross-react with them.² The main investigative technique to diagnose PACD is photopatch testing, in which 2 identical sets of test agents are applied to the skin, and one set is irradiated with UVA to provoke photoinduced processes to differentiate from allergic contact dermatitis.¹ The frequency and relevance of positive photopatch test reactions to specific photoallergens can change over time and vary significantly depending on culture, geographic location, and personal

care product use. The main causes of PACD have shifted from antimicrobial agents in the 1960s and 1970s to fragrances in the 1970s and 1980s and to sunscreens and topical nonsteroidal anti-inflammatory drugs (NSAIDs) since the 1980s.³

Although the prevalence of PACD in the general population is unknown, it is estimated that approximately 2% to 10% of patients referred for evaluation of photodistributed dermatitis have PACD.⁴ However, the true prevalence of PACD may be higher because it may not be suspected clinically, or photopatch testing may not be available.⁵ A recent survey of members of the American Contact Dermatitis Society (ACDS) revealed that only 64 (55%) of 117 participants performed photopatch testing.⁶ This study also demonstrated variability in methodology. For example, the duration of patch placement was equally split between 1 (31/64 [48%]) and 2 days (30/64 [47%]), whereas the dose of UVA irradiation varied from 5 J/cm² (15/64 [23%]) to 10 J/cm² (24/64 [38%]) to 50% minimal erythema dose (MED; 17/64 [27%]).⁶ Based on these results, it can be argued that consensus recommendations for photopatch testing in the United States may improve the consistency and reliability of results and lead to better recognition of PACD in the United States. In Europe, on the other hand, the European Taskforce for Photopatch Testing representing the European Society of Contact Dermatitis and the European Society for Photodermatology established a European consensus methodology⁷ in 2004 and recently reported the European photopatch baseline series (20 allergens) and extended series (15 additional allergens) based on a European multicenter photopatch test study.^{4,8}

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J.S.T. has consulted for Johnson & Johnson, Bayer, Kao Brands, and Equinox Group; received royalties from Decision Support in Medicine; and owns noncontrolling shares of common stock in AstraZeneca, Cigna, Johnson & Johnson, Merck, and Opko Health; a nondependent child is an employee of Pfizer. He is a member of the Steering Committee of the Cosmetic Ingredient Review. The other authors have no funding or conflicts of interest to declare.

DOI: 10.1097/DER.0000000000000535

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This study assesses the variability in photopatch testing practice among ACDS members through a survey, in which we inquired about indications for photopatch testing and MED determination, with a focus on photoallergen series used. We compared the reported methods with the European consensus methodology and analyzed photoallergen series used by the respondents. We present an overview of photopatch test practices in the United States and provide a reference resource that may aid clinicians in identifying appropriate photoallergens for their patients.

METHODS

Target Population and Survey Administration

This questionnaire-based cross-sectional study was conducted among the ACDS members from February 2015 to March 2015. A survey composed of 8 questions was generated using an online survey tool (<https://www.surveymonkey.com/>; last accessed May 21, 2019). After approval by the ACDS executive committee, the questionnaire was distributed to 791 unique individuals via e-mail. No additional e-mails were sent to the recipients. A complete list of questions and responses is shown in Table 1.

Comparison of Photoallergen Series

Full lists of test agents for “Photoallergen Series” by Dormer Laboratories Inc (Toronto, Ontario, Canada), “North American Photopatch Series” (NA-D), “Sunscreen Series” (SS-D), “Plant Series,” “European Photopatch Extended Series” (EE-D), and “European Photopatch Baseline Series” were obtained from the manufacturer's web site (<http://www.dormer.com>, last accessed May 23, 2019). Likewise, lists of test agents for allergEAZE “Photoallergen Series” (PA-A), allergEAZE “Sunscreen Series,” and allergEAZE “Photochemical Series” by SmartPractice Canada (Calgary, Alberta, Canada) were acquired from the manufacturer's web site (<https://www.smartpracticecanada.com/>, last accessed May 23, 2019). The most recent photoallergen panel recommended by the North American Contact Dermatitis Group (NACDG) for photopatch testing (NACDG Photoallergen Series) was also included.⁹ Lists of test agents for the NACDG standard patch test series¹⁰ and the Brazilian Standard Battery¹¹ are available in the literature.

RESULTS

Survey on Photopatch Testing Practice

Among the 791 dermatologists contacted, 112 (14.2%) participated in the survey, 102 (90.2%) of whom answered all questions in the questionnaire. Ten respondents who partially completed the questionnaire were also included. Results are summarized in Table 1.

Approximately half of the participants (54/112 [48%]) practice in private offices, followed by academic centers (45/112 [40%]) and multispecialty group practices (13/112 [12%]). Overall, fewer than half of the respondents (50/112 [45%]) perform photopatch testing. Academic centers perform more photopatch testing (34/45 [76%])

compared with multispecialty group practices (4/13 [31%]) and private offices (12/54 [22%]). Using χ^2 test to compare the academic centers with each of the other practice settings reveals a significantly higher volume in academic centers ($P < 0.0001$). In terms of the frequency of photopatch testing, approximately half of the respondents perform fewer than 10 times a year (54%), followed by 10 to 20 times a year (25%). A vast majority (95%) agree that history of photosensitivity without intrinsic causes prompts photopatch testing. Other common indications for photopatch testing include involvement of face (65%), neck/upper chest (60%), and upper extremities (49%).

In terms of photoallergen series, NA-D was the most commonly used panel (51%), followed by SS-D (30%) and PA-A (14%). The participating dermatologists also use other commercially available or published photoallergen series, whereas 6 respondents (14%) used customized series that contain patients' products and common allergens, such as sunscreens. Roughly half of those who perform photopatch testing (21/44 [48%]) determine MED before photopatch testing. Among these clinicians, all but one (18/19 [95%]) use UVA, several of whom also use broadband UVB (11/18 [61%]) or narrowband UVB (2/18 [11%]). One respondent uses narrowband UVB as the sole light source. Common reasons for not performing photopatch testing were the lack of equipment (70%), insufficient skills (49%), rare clinical suspicion (43%), and cost (41%).

Analysis of Commonly Used Photoallergen Series

The interrelationship between the 3 most commonly used photoallergen series—NA-D, SS-D, and PA-A—is shown in a Venn diagram (Fig. 1). Also included is EE-D, which closely mirrors the European Photopatch Taskforce recommendations,⁸ although infrequently used in the United States based on our survey. As expected, we observed significant overlap between series. For example, 6 compounds—octinoxate, oxybenzone, sulisobenzene, avobenzone, *p*-aminobenzoic acid (PABA), and padimate O—are included in all of the 3 commonly used series, five of which are also present in EE-D. In addition, SS-D, composed mostly of sunscreen agents, has the most overlap with other series. Of 21 test agents, 17 compounds are included in PA-A, whereas all but one chemical (padimate O) are covered in EE-D.

Figure 1 illustrates that each series (except for SS-D) offers unique allergens that are not present in others. North American Photopatch Series contains 8 unique chemicals, such as sandalwood oil, 6-methyl coumarin, and petroleum, whereas 10 allergens, such as fragrance mix and sulfanilamide, are specific to PA-A. Among the 8 unique allergens in EE-D are 2 of the European Photopatch Test Baseline Series⁸ (etofenamate, benzydamine) and 6 of the European Photopatch Test Extended Series⁸ (polysilicone-15, ibuprofen, diclofenac, dextketoprofen, fenofibrate, olaquinox).

We found that practitioners use several other photoallergen series for photopatch testing. A comprehensive list of test agents included in each of these allergen series is in Table 2. Sunscreen Series by allergEAZE contains 18 test agents, all of which are also included in PA-A. In contrast, Plant Series by Dormer and Photochemical

TABLE 1. Variability in Photopatch Testing Methodology Among the Respondents

Questions and Responses	n (%)			
	Private Office	Academic Center*	Group Practice	Total
Primary practice setting (n = 112)	54 (48)	45 (40)	13 (12)	112
Performs photopatch testing (n = 112)				
Yes	12	34	4	50 (45)
No	42	11	9	62 (55)
Average no. photopatch test per year (n = 44)				
<10	6	17	1	24 (54)
10–20	3	7	1	11 (25)
21–30	1	2	0	3 (7)
>30	1	5	0	6 (14)
Clinical presentation for which to consider photopatch testing† (n = 43)				
History of photosensitivity without intrinsic causes	11	28	2	41 (95)
Face involvement	7	20	1	28 (65)
Neck, upper chest involvement	6	19	1	26 (60)
Upper extremity involvement	5	15	1	21 (49)
Lip involvement	2	10	1	13 (30)
Only if all sun-exposed areas are involved	2	4	1	7 (16)
Allergen series used‡ (n = 43)				
North American Photopatch Series (NA-D)‡	4	17	1	22 (51)
Sunscreen Series (SS-D)‡	2	11	0	13 (30)
Photoallergen Series (PA-A)§	3	3	0	6 (14)
Sunscreen Series§	3	1	0	4 (9)
Photochemical Series§	2	1	0	3 (7)
Plant Series‡	1	2	0	3 (7)
European Photopatch Extended Series (EE-D)‡	0	2	0	2 (5)
NACDG Photoallergen Series	0	1	1	2 (5)
NACDG Standard Series§	1	1	0	2 (5)
Brazilian Standard Battery	1	1	0	2 (5)
Custom	2	4	0	6 (14)
Other	1	4	0	5 (12)
MED assessment before photopatch test (n = 44)				
Yes	2	19	0	21 (48)
No	9	12	2	23 (52)
Light source for MED assessment† (n = 19)				
UVA	1	17	0	18 (95)
Broadband UVB	0	11	0	11 (58)
Narrowband UVB	0	3	0	3 (16)
Solar simulator	0	2	0	2 (11)
Reasons for not performing photopatch test† (n = 61)				
Lack of equipment	31	6	6	43 (70)
Insufficient skills	20	3	7	30 (49)
Rare clinical suspicion for PACD	17	4	5	26 (43)
Cost or low cost-effectiveness	15	4	6	25 (41)
Other‡	1	3	0	4 (7)

*Includes 2 Veterans Affairs Medical Centers.

†Participants can select multiple answer choices.

‡Available from Dermier Laboratories Inc.

§Available from SmartPractice Canada (allergEAZE).

¶European Photopatch Baseline Series by Dermier (n = 1), TRUE test (n = 1), North American Extended Series by Dermier (n = 1), others as indicated (n = 1), and unknown (n = 1).

#Clinically evident by examining products (n = 1), replace organic UV absorbers with physical blockers (n = 1), availability of another practitioner in the community who performs photopatch testing (n = 1), and doubtful validity and reliability of photopatch testing (n = 1).

EE-D indicates European Photopatch Extended Series (Dermier); NA-D, North American Photopatch Series (Dermier); NACDG, North American Contact Dermatitis Group; PACD, photoallergic contact dermatitis; SS-D, Sunscreen Series (Dermier).

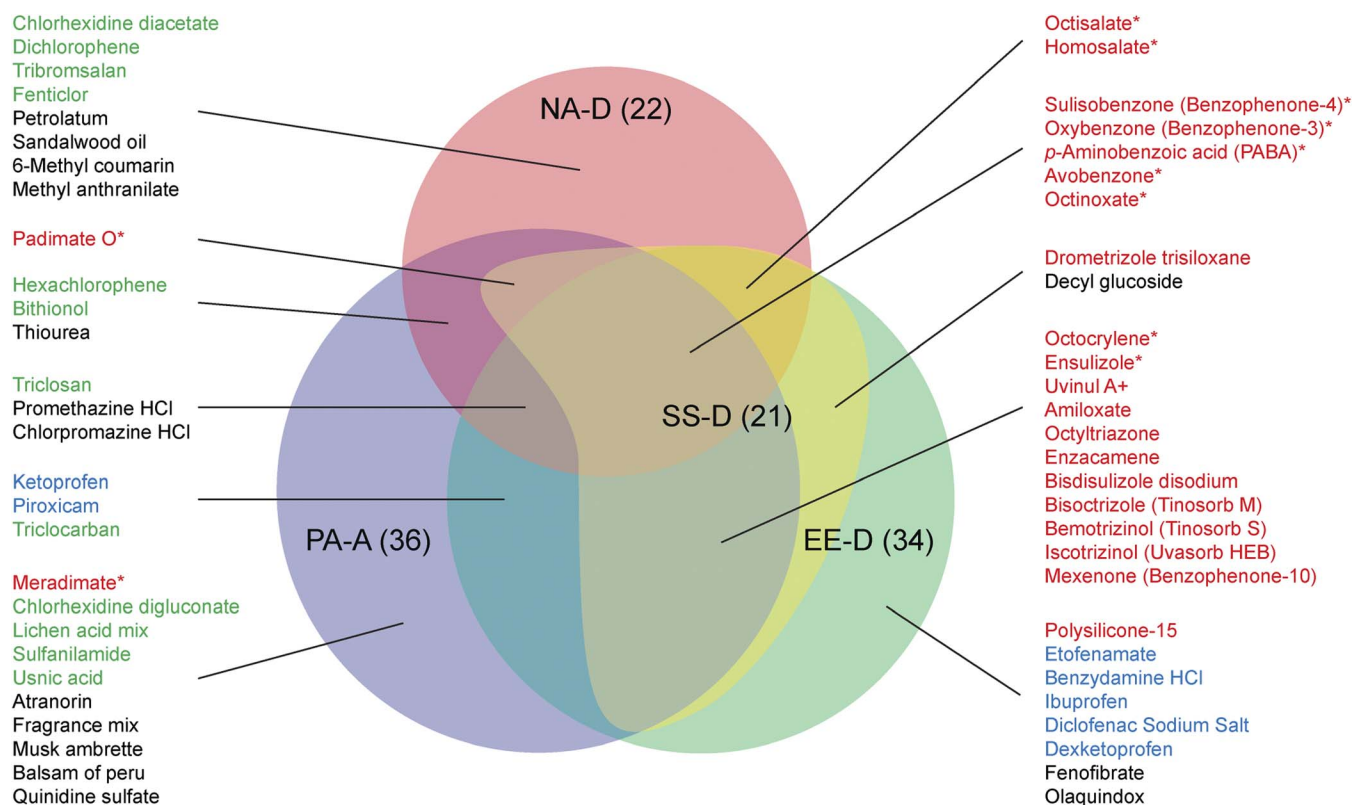


Figure 1. Venn diagram of commonly used commercially available photoallergen series and their test agents. Numbers in parentheses indicate the number of different allergens. Test agents are color coded by class: red, UV absorbers; blue, topical NSAIDs; green, antimicrobials/disinfectants; black, other. Asterisk denotes FDA-approved UV absorbers. See Table 2 for commonly used alternative names for the UV absorbers. NA-D indicates North American Photopatch Series (Dormer); PA-A, Photoallergen Series (allergEAZE); SS-D, Sunscreen Series (Dormer); EE-D, European Photopatch Extended Series (Dormer).

Series by allergEAZE, each of which is used by 7% of the respondents, offer 18 and 20 unique test agents, respectively, which are not included in any of the 4 series in Figure 1. Interestingly, several respondents report using allergen series that are typically used for patch testing, such as the NACDG Standard Series ($n = 2$), the Brazilian Standard Battery ($n = 2$), North American Extended Series by Dormer ($n = 1$), or the TRUE test ($n = 1$). The NACDG Standard Series contains a total of 70 test agents, only 6 of which overlap with the 4 photoallergen series in Figure 1. Similarly, of the 30 test agents included in the Brazilian Standard Battery, only 4 are present in these 4 photoallergen panels.

DISCUSSION

The current study demonstrates variability in photopatch testing methodology among US dermatologists and provides a reference point for identifying appropriate photoallergen series.

Our survey reveals that 50 (45%) of the 112 respondents perform photopatch testing, a majority of whom (79%) perform the test fewer than 20 times a year. Respondents at academic centers are significantly more likely to perform photopatch testing than those in private or group practices. The low use of the test is due to cost, lack of equipment or skills, and small patient population with suspected

PACD. These results are consistent with the low use of photopatch testing compared with patch testing and may explain its greater use at tertiary referral centers. One respondent attributed the low use of photopatch testing to the doubtful validity and reliability of the test, suggesting a need for a consensus protocol for the test analogous to the European standard methodology.

Indications for photopatch testing used by the respondents are largely in agreement with the European standard protocol, including dermatitis predominantly affecting exposed areas and photosensitive eruption without an obvious diagnosis.⁷ The European protocol also recommends photopatch testing for patients with chronic actinic dermatitis, a photosensitivity disorder defined by a persistent eczematous reaction of at least 3 months' duration on sun-exposed areas, positive phototest results, and dermal infiltration of lymphocytes and macrophages.^{7,13}

We observed that roughly half of those who perform photopatch testing determine MED using UVA with or without UVB. The European methodology advises that MED should be determined for patients with abnormal UVA sensitivity before photopatch testing using the same UVA source, such as psoralen and UVA lamps, whereas it does not address the use of UVB.⁷ On the other hand, the Scandinavian standard protocol includes phototesting with UVA and UVB for all patients.¹⁴ Interestingly, respondents at academic

TABLE 2. Comparison of Test Agents Between Photoallergen Series

Class	Test Agent	NA-D	SS-D	PA-A	SS-A	PC-A	PL-D	EE-D*	NACDG- Photo	NACDG- Std†	BR‡
Older organic UV absorbers	Oxybenzone (benzophenone-3)‡§	+	+	+	+			+	+	+	
	Sulisobenzene (benzophenone-4)‡§	+	+	+	+			+	+	+	
	Avobenzone (butyl methoxydibenzoylmethane)‡§	+	+	+	+			+	+		
	Octinoxate (ethylhexyl methoxycinnamate)‡§	+	+	+	+			+	+		
	PABA‡§	+	+	+	+			+	+		
	Padimate O (ethylhexyl dimethyl PABA)‡§	+	+	+	+				+		
	Enzacamene (4-methylbenzylidene camphor)§		+	+	+			+	+		
	Amiloxate (isoamyl <i>p</i> -methoxycinnamate)		+	+	+			+	+		
	Octocrylene‡		+	+	+			+	+		
	Ensulizole (phenylbenzimidazole sulfonic acid)‡§		+	+	+			+	+		
	Mexenone (benzophenone-10)		+	+	+			+	+		
	Homosalate‡§	+	+					+	+		
	Octisalate (ethylhexyl salicylate)‡ §	+	+					+	+		
	Meradimate (menthyl anthranilate)‡			+	+				+		
	Trolamine salicylate (triethanolamine salicylate)								+		
	Dioxybenzone (benzophenone-8)								+		
	Benzophenone-2								+		
	Bemotrizinol (<i>bis</i> -ethylhexyloxyphenol methoxyphenyl triazine, Tinosorb S)		+	+	+			+	+		
	Uvinul A+ (diethylamino hydroxybenzoyl hexyl benzoate)		+	+	+			+	+		
	Iscotrizinol (diethylhexyl butamido triazone, Uvasorb HEB)		+	+	+			+	+		
Newer organic UV absorbers	Octyltriazone (ethylhexyl triazone)		+	+	+			+	+		
	Bisocotrizole (methylene <i>bis</i> -benzotriazolyl tetramethylbutylphenol, Tinosorb M)		+	+	+			+	+		
	Bisdilulazole disodium (disodium phenyl dibenzimidazole tetrasulfonate)		+	+	+			+	+		
	Drometrizole trisiloxane (Mexoryl XL)		+					+	+		
	Polysilicone-15							+			
	Ecamsule (terephthalylidene dicamphor sulfonic acid, Mexoryl SX)								+		
	Ketoprofen			+				+	+		
	Piroxicam			+				+			
	Etofenamate							+			
	Benzydamine HCl							+			
Topical NSAIDs	Ibuprofen							+			
	Diclofenac sodium salt							+			
	Dexketoprofen							+			
	Triclosan§	+		+				+	+		+
	Hexachlorophene§	+		+					+		
Antimicrobials/ disinfectants	Bithionol§	+		+							
	Chlorhexidine diacetate§	+							+		
	Lichen acid mix			+			+				
	Chlorhexidine digluconate			+						+	

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TABLE 2. (Continued)

Class	Test Agent	NA-D	SS-D	PA-A	SS-A	PC-A	PL-D	EE-D*	NACDG- Photo	NACDG- Std†	BR†
Medications/alternative medicine	Usnic acid			+			+				
	Triclocarban§			+				+			
	Fenticlor§	+									
	Dichlorophene§	+									
	Tribromsalan§	+									
	Quinoline mix										+
	Sulfanilamide§			+							
	Neomycin										+
	Glutaraldehyde					+					
	Benzyl alcohol					+					
	Promethazine HCl§	+		+				+			+
	Chlorpromazine HCl§	+		+				+			
	Propolis						+			+	
	Parthenolide						+			+	
	Benzocaine									+	+
Fragrances/flavoring agents	Quinidine sulfate			+							
	Fenofibrate							+			
	Fragrance mix			+						+	+
	Balsam of Peru			+						+	+
	Sesquiterpene lactone mix§						+		+	+	
	Atranorin			+			+				
	Musk ambrette§			+					+		
	6-Methyl coumarin§	+									
	Sandalwood oil§	+									
	Methylanthranilate§	+									
Dyes	Diallyl disulfide§						+				
	Fragrance mix II									+	
	p-Phenylenediamine					+				+	+
	Pyrogallol					+					
	p-Aminophenol					+					
Preservatives	Quaternium-15									+	+
	Paraben mix									+	+
	Formaldehyde 2%									+	+
	Sodium disulfite					+				+	
	Propylene glycol									+	+
Plant derivatives	Formaldehyde 1%									+	
	Colophony									+	+
	<i>Chamomilla recutita</i>						+				
	Alantolactone§						+				
	<i>Arnica montana</i> §						+				
	<i>Chrysanthemum cinerariaefolium</i> §						+				
	<i>Tanacetum vulgare</i> extract§						+				
	Evernic acid						+				
	<i>Anthemis nobilis</i> extract						+				
	<i>Taraxacum officinale</i>						+				
	<i>Achillea millefolium</i> extract						+				
	α-Methylene-γ-butyrolactone						+				
	2-Methoxy-6-n-pentyl-4-benzoquinone						+				
	Thiourea	+		+					+		
	Decyl glucoside		+					+		+	

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TABLE 2. (Continued)

Class	Test Agent	NA-D	SS-D	PA-A	SS-A	PC-A	PL-D	EE-D*	NACDG- Photo	NACDG- Std†	BR‡
	Hydroquinone					+				+	+
	Ethylenediamine 2HCl					+				+	+
	Thiuram mix									+	+
	Mercaptobenzothiazole									+	+
	Ammonium persulfate					+				+	
	Carba mix									+	+
	Potassium dichromate									+	+
	Petrolatum§	+									
	Olaquinox							+			
	Zinc chloride					+					
	Triphenyl phosphate					+					
	Triethanolamine					+					
	Tricresyl phosphate					+					
	Tin (II) chloride					+					
	Chromium (III) potassium sulfate					+					
	Drometrizole					+					
	Hydrazine sulfate					+					
	Disodium edetate					+					
	Diethanolamine					+					
	Benzotriazole					+					

Photoallergen series are shown from most commonly used (left) to least commonly used (right). Test agents are listed in decreasing order of the number of photoallergen series that contain each chemical.

*Contains 34 of 35 photoallergens included in the European baseline and extended series⁸ (ecamsule removed).

†See the study by DeKoven et al¹⁰ and Lazzarini et al¹¹ for the rest of test agents not shown here: NACDG-Std (44 additional unique chemicals) and BR (11 additional unique chemicals).

‡UV absorbers approved by the US FDA.

§Positive photopatch test reactions reported in North American studies.^{3,5,12}

BR indicates Brazilian Standard Battery; EE-D, European Photopatch Extended Series (Dormer); NA-D, North American Photopatch Series (Dormer); NACDG-Photo, NACDG Photoallergen Series; NACDG-Std, NACDG Standard Series; NSAIDs, nonsteroidal anti-inflammatory drugs; PA-A, Photoallergen Series (allergEAZE); PC-A, Photochemical Series (allergEAZE); PL-D, Plant Series (Dormer); SS-A, Sunscreen Series (allergEAZE); SS-D, Sunscreen Series (Dormer).

centers (18/30 [60%]) are more likely to perform MED assessment than those at private or group practices (2/13 [15%]). Considering 13 (76%) of 17 academic practitioners who use UVA for MED determination also use UVB irradiation, it seems that practitioners at academic centers tend to perform photopatch tests in accordance with the Scandinavian protocol. Consistent with the wide use of UVB irradiation observed in our study, Asemota et al⁶ previously reported that 63% and 34% of practitioners use broadband and narrowband UVB, respectively, for phototesting.

A close analysis of commonly used commercially available photoallergen series reveals several important findings. First, despite the significant overlap, each allergen series offers a unique set of test agents. European Photopatch Extended Series provides several topical NSAIDs given their frequent association with PACD in European countries. For example, benzydamine was reported to cause PACD of the lips and hands in Spain and Portugal,^{15,16} whereas diclofenac, a popular NSAID that is also used to treat actinic keratosis, has been associated with PACD in several European studies.^{4,8,17,18} On the other hand, NA-D and PA-A contain unique antimicrobials and fragrances, such as 6-methyl coumarin, sandalwood oil, and chlorhexidine, which have caused positive photopatch test reactions in recent North American studies.^{3,5,12} North American Photopatch Series

also includes petrolatum, a commonly used vehicle in photopatch testing that was reported to cause positive reactions in rare cases (0.2%–1.1%).^{4,5,12}

In addition, 11 of 16 sunscreen agents approved by the US Food and Drug Administration (FDA) are included in the 3 most commonly used series as a whole (NA-D, SS-D, PA-A). Especially, 4 of those reported to cause positive photo patch test reactions in recent North American studies^{3,5,12}—oxybenzone, PABA, avobenzone, padimate O—are included in all 3 series. Among the 5 agents not included in these series are 2 inorganic UV filters (titanium dioxide, zinc dioxide) and 3 organic UV absorbers (cinoxate, dioxybenzone, trolamine salicylate). Inorganic (physical) UV filters are chemically and biologically inert and therefore unlikely to cause skin irritation or sensitization.¹⁹ Cinoxate is a less commonly used UVB filter that did not produce photopatch test reactions in any of 76 subjects in a US study,³ whereas dioxybenzone, which cross-sensitizes with oxybenzone, has been shown to cause ACD, but not PACD.²⁰ Trolamine salicylate is a UVB filter primarily used for water-soluble sunscreen products and hair preparation.²¹ The FDA recently announced that of the 16 sunscreen agents, titanium dioxide and zinc dioxide are generally recognized as safe and effective, whereas PABA and trolamine salicylate are not generally recognized as safe and effective for use in

sunscreens because of safety concerns.²² Of note, trolamine salicylate and dioxybenzone are included in the NACDG Photoallergen Series (Table 2), which is used by 2 respondents (5%) in our survey.

We found that several photoallergen series include newer UV absorbers, not approved by the FDA. These compounds are currently used in many parts of the world including the European Union and have been reported as the causes of positive photo patch test reactions.⁴ In particular, bemotrizinol (Tinosorb S) and bisoctrizole (Tinosorb M) are combined UVA/UVB filters that are increasingly used because of their excellent photostability and broad-spectrum protection.²¹ In support of this, a survey of 337 sunscreens available in the United Kingdom found that bemotrizinol and bisoctrizole were present in 58.5% and 32% of the products, respectively.²³ Considering the globalization of sunscreen and cosmetics industries and the easy accessibility of personal care products from all over the world, clinicians should maintain an index of suspicion for non-FDA-approved sunscreen agents when evaluating for PACD.

Our survey demonstrates that a total of 6 respondents (14%) use allergen series typically used for patch testing. Two respondents use them, in addition to commercially available (NA-D, SS-D) or customized photoallergen series, presumably to expand their battery of test agents when indicated. It is not clear why the other 4 respondents report using patch test allergen series instead of photoallergen panels. However, this may not be surprising, considering that clinicians often perform patch tests concurrently with photopatch tests on patients with photodistributed dermatitis because they may have both PACD and ACD. As expected from the low overlap between photoallergen and nonphotoallergen series, the NACDG Standard Series contains only 3 (8%) of 37 chemicals—oxybenzone, sulisobenzene, and sesquiterpene mix—that have caused positive photopatch test reactions in 3 North American studies,^{3,5,12} as shown in Table 2. In comparison, the NACDG Photoallergen Series, NA-D, and PA-A include 15 (41%), 21 (57%), and 16 (43%) photoallergens, respectively. These results demonstrate that although it can be beneficial to include patch test allergen series in photopatch testing as an adjunct to photoallergen series, patch test allergen series should not be used alone to identify culprits in patients with suspected PACD.

There are several limitations to this study. First, only 14% of the contacted ACDS members participated in the study, resulting in a relatively small sample size. Second, the geographic practice location was not collected in this study, which could have provided valuable insights into possible regional patterns of photopatch testing methodology and preferred photoallergen series. Finally, a pilot study would have been helpful in identifying and addressing the previous limitations.

CONCLUSIONS

A consensus methodology with standard photoallergen series has existed in Europe for several years. The current variation in photopatch testing practices among ACDS members, most of whom are dermatologists in North America, suggests a need for consensus recommendations, followed by prospective outcome studies. In particular,

clinicians use a number of photoallergen series—alone or in any combination—including those generally used for patch testing. Despite considerable overlap, each series provides unique test agents that may prove valuable, depending on the patient's exposure history and clinical presentation. This study sheds light on the breadth of photoallergen series in use and provides a reference point that may aid clinicians in identifying photoallergen series best suited for their patients.

Although the frequency and relevance of positive photopatch test reactions to specific photoallergens can vary significantly depending on population, geographic location, personal preferences, and market trends, a North American consensus methodology will enable clinicians to perform photopatch testing in a reliable and reproducible manner. A taskforce group dedicated to establishing a consensus photopatch testing protocol including a standardized yet flexible photoallergen series may pave the way for more effective diagnosis, management, and prevention of PACD.

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