

Patch testing and aeroallergen intradermal testing in facial dermatitis

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The rôle of contact allergens and aeroallergens in facial dermatitis (FD) was studied. 114 cases of FD were divided into 3 groups. Group 1 comprised 47 cases of facial cosmetic dermatitis (FCD), in which all patients had a history of dermatitis related to cosmetics clinically; group 2 comprised 15 cases of seasonal facial dermatitis (SFD); Group 3 comprised 52 cases of other FD (OFD) that could not be categorized as FCD or SFD. Reactions to contact allergens and aeroallergens were detected using patch testing and intradermal testing, respectively, with non-facial eczematous skin disease patients serving as controls. The positivity rate for each allergen between different groups was compared by the χ^2 -test. The results show that the positivity rate for fragrance mix in FCD is much higher than in non-FCD (27.7% versus 6.7% in SFD, 7.6% in OFD and 6% in eczema patients, $p < 0.05$). No significant difference was detected for other common allergens, such as PPD, rubber mix, nickel sulfate, and colophonium ($p > 0.05$ for all). These results suggest that fragrance mix contains the main contact allergens in FCD. Patch testing with patients' own products also yields high numbers of relevant results in FCD and OFD. No relevant patch test results were found in SFD, indicating that contact allergy may not be relevant to SFD. No significant difference was observed between intradermal skin reactions to aeroallergens, including pollens and moulds, in SFD, OFD, FCD and controls. These results suggest that Type I reactions to aeroallergens may not be relevant in FD. The rôle of aeroallergens in FD needs to be studied further.

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Facial dermatitis (FD) is very common in dermatology clinics and very distressing to patients. For most people, a mild erythema on the face may be a greater burden than a more severe one on another part of the body. In China, more and more people with FD are looking for help in dermatology clinics each year. However, the cause of FD is often difficult to determine and recurrence is common. Cosmetics, aeroallergens, metals in eyeglasses or jewellery, and physical factors such as wind or changes in temperature and humidity in the environment may all contribute to the development of FD.

Clinically, it may be helpful to divide FD into: facial cosmetic dermatitis (FCD), in which lesions relate to the use of cosmetics; seasonal facial dermatitis (SFD), in which dermatitis appears seasonally; and other FD that cannot be categorized as either FCD or SFD. Patch testing has proved a useful tool for the identification of contact aller-

gens in contact dermatitis. FCD can be identified by patch testing patients with standard cosmetics series or the common cosmetic contact allergens in the standard series and the cosmetics that patients have used. Allergy to metal in glasses or jewellery can also be elucidated by patch testing patients with the standard series (1).

Using prick testing, Waersted & Hjorth (2) reported that Type I skin reactions to *Pityrosporum ovale* may play a rôle in the eczematous skin lesions of atopic dermatitis on the face, neck and scalp. Using ELISA or RAST, other researchers have also demonstrated that serum specific-IgE to *Pityrosporum ovale* correlated with eczematous skin lesions on the extremities of atopic dermatitis patients, including the face (3, 4). Since aeroallergens are universally distributed and most pollens and moulds are seasonal, it is worthwhile to study the relationship of Type I reactions to aeroallergens, such as pollens and moulds, in FD, especially

in SFD. It has been found that an aeroallergen such as pollen may play a part in the development of seasonal facial dermatitis (5).

The purpose of this study was to investigate the relevance of patch testing and aeroallergen intradermal testing in FD, in order to analyze the rôle of allergic contact and Type I reactions to aeroallergens in FD. 114 cases of FD were studied. Sensitivity to contact allergens was identified by patch testing and Type I reactions to aeroallergens, including pollens and moulds in FD were investigated by intradermal testing.

Patients, Materials and Methods

Diagnostic criteria

Facial dermatitis. FD was defined as dermatitis confined to the face, other skin diseases involving the face, such as atopic dermatitis, seborrhoeic dermatitis, acne, rosacea, herpes simplex, systemic lupus erythematosus and photosensitivity, being excluded by history and clinical examination.

Facial cosmetic dermatitis. To diagnose FCD, (i) the criteria of FD had to be met; (ii) cosmetics had to have been used several days to years before FD appeared; (iii) if possible, a use test was used to exclude non-FCD; (iv) the dermatitis was not seasonal.

Seasonal facial dermatitis (SFD). SFD was defined as the FD appearing seasonally for more than 2 years. FCD was excluded either by a history of no cosmetics having been used or by a use-test in which the dermatitis did not recur with the reuse of suspected cosmetics.

Study populations

114 cases of FD, where the dermatitis had persisted for more than 1 month, were studied. All patients were from the dermatology clinics in our hospital between November 1993 and October 1995, and October 1998 and October 1999. There were 7 males and 107 females. The patients were selected according to the diagnostic criteria above and their willingness to be patch tested, i.e., patients without patch testing were excluded. Since atopy may affect the test results, atopic subjects were excluded from this study. The patients were divided into 3 groups.

Group 1 comprised 47 cases of FCD, 1 male and 46 females, with an average age of 36.7 ± 14.9 years (mean $\pm$ SD). Group 2 comprised 15 cases of SFD, all females, with an average age of 33.4 ± 6.7 years (mean $\pm$ SD). Group 3 comprised 52 cases of FD that could not be categorized as either FCD or SFD. The patients in this group were recorded as other facial dermatitis (OFD). There were 6 males

and 46 females, with an average age of 38.2 ± 15.3 years (mean $\pm$ SD).

Patch testing

Patch testing was performed with the standard series of Beijing Medical University, Beijing, China. Allergens were applied to the upper back, using Finn Chambers and the results were recorded at 2 and 3 days according to ICDRG recommendations (1). If the patient could supply the suspected allergens, patch testing with the patients' own products was performed, using published methods (6).

Intradermal testing

Intradermal testing was performed in 13 SFD patients, with either negative patch test results or non-relevant patch test findings, and 28 OFD patients with negative results on patch testing. Aeroallergens for intradermal testing were bought from Beijing Union Medical University, Beijing, China, 20 groups of common aeroallergens, such as dust, dust mite, pollens, moulds, insects, silk, feathers and animal hair, being included. Injections were performed on the outer upper arms and reactions were observed 20 min later. A papule or wheal of 0.5 cm or more in diameter was considered positive. This procedure is a standardized method for the detection of hypersensitivity to aeroallergens in China.

Controls

50 patients with non-facial eczematous skin diseases, patch tested with the standard series in the same period, served as a control for standard series patch testing. There were 22 males and 28 females, with an average age of 49.0 ± 16.0 (mean $\pm$ SD). Aeroallergen hypersensitivity was tested in 45 patients with non-facial eczematous skin diseases, who served as a control for intradermal testing of FD. There were 22 males and 23 females, with an average age of 48.5 ± 16.4 (mean $\pm$ SD). All patients in both control groups were non-atopic.

Statistical analysis

$2 \times K$ χ^2 -test was used to compare the positivity rate to each allergen in the different groups (7).

Results

Patch test results are summarized in Table 1. The positivity rate for fragrance mix in FCD was much higher than in SFD, OFD and non-facial eczematous skin diseases.

Table 1. Positivity rate of patch tests to allergens in the standard series

Allergen	FCD (n=47)	SFD (n=15)	OFD (n=52)	Eczema (n=50)	p value
fragrance mix	13 (27.7%)	1 (6.7%)	4 (7.6%)	3 (6%)	<0.05
PPD	11 (23.4%)	1 (6.7%)	8 (15.4%)	9 (18%)	
rubber mix	7 (14.9%)	0	7 (13.5%)	8 (16%)	<0.05
nickel	6 (12.8%)	6 (40%)	10 (19.2%)	2 (4%)	
ammoniated mercury	4 (8.5%)	2 (13.3%)	5 (9.6%)	6 (12%)	
colophonium	2 (4.3%)	0	0	0	
dichromate	1 (2.1%)	1 (6.7%)	3 (5.8%)	2 (4%)	
benzocaine	1 (2.1%)	0	0	0	

FCD=facial cosmetic dermatitis. SFD=seasonal facial dermatitis. OFD=other facial dermatitis.

Table 2. The clinical diagnosis and the results of patch testing in 7 male patients

No.	Age (years)	Occupation	Diagnosis	Positive patch test
1	36	office worker	FCD	fragrance ++ *, facial cream as is ++*
2	29	office worker	OFD	PPD++, dichromate +
3	46	teacher	OFD	rubber mix +
4	29	lab worker	OFD	rubber mix +
5	25	computer worker	OFD	nickel ++
6	36	office worker	OFD	fragrance mix ++ *
7	50	researcher	OFD	epoxy resin ++*

* Relevant patch test results, see text. FCD=facial cosmetic dermatitis. OFD=other facial dermatitis.

13 out of 47 FCD patients were patch tested with their own suspected cosmetics. 6 of these (46.2%) showed positive results. Among these 13 patients, only 1 male patient showed a relevant positive result to a component of the standard series (Table 2), while the patch test standard series was negative in the other 12 patients.

In the 52 cases of OFD, contact allergy was identified in 12 (12/52=23%) and 6 of these were due to topical drugs. The offending drugs were wuji paste (a Chinese traditional medicine), benzoyl peroxide, a Chinese medical solution for acne, rifampicin eye-drops, herb powder and topical corticosteroid. Patch tests were all positive in these patients on testing with the suspected materials as is. Patch tests with the standard series of Beijing Medical University were negative. In another 6 patients, metal allergy from eyeglasses or jewellery was found in 4 and a positive patch test to nickel

was found. Interestingly, a male patient's FD appeared after visiting a flower show, and the fragrance mix patch test was positive (Table 2, case no. 6). 1 male patient with a recurrence of OFD worked in a laboratory, where epoxy resin was often used. Patch testing with the standard series revealed a positive result to epoxy resin (Table 2, case no. 7).

The clinical diagnosis and the results of patch testing in 7 male patients are shown in Table 2. Table 3 shows the results of intradermal testing with aeroallergens.

Discussion

The common contact allergens in FCD in our study were fragrance mix (27.7%) and PPD (23.4%) (Table 1). The positivity rate to fragrance mix in FCD is much higher than in SFD, OFD and non-facial eczematous skin diseases (Table 1). The frequency of reactions to fragrance mix in the standard series in the SFD, OFD and non-facial eczematous skin diseases patients is similar to that at St John's Hospital for Diseases of the Skin, while a much higher rate was found in FCD patients (8). These results suggest that fragrance is the main contact allergen in FCD patients in China.

Fragrance mix, balsam of Peru (Myroxylon Per-eirae), colophonium, PPD, wool wax alcohols, formaldehyde, and parabens are the common ingredients that cause FCD (8). All these allergens

Table 3. The positive number (rate) of intradermal tests to aeroallergens

Allergen	SFD (n=13)	OFD (n=28)	Eczema (n=45)
dust	2 (23.1%)	5 (17.9%)	7 (15.6%)
dust mite	2 (15.4%)	4 (14.3%)	6 (13.3%)
animal hair	1 (7.1%)	0	2 (4.4%)
insects	1 (7.1%)	1 (3.6%)	6 (13.3%)
moulds	4 (30.8%)	6 (14.3%)	5 (11.1%)
pollens	3 (23%)	3 (10.7%)	4 (8.9%)
silk	1 (7.7%)	5 (17.9%)	0

* $p > 0.05$ for all.

SFD=seasonal facial dermatitis. OFD=other facial dermatitis.

are included in the standard series of Beijing Medical University, except balsam of Peru and wool wax alcohols. However, no positive patch test was found to formaldehyde and parabens. The reason for this needs to be investigated further. The positivity rate to colophony in our group is similar to that at St John's (8).

In this study, FD was divided into FCD, SFD and OFD according to clinical findings. FCD was diagnosed when the FD appeared after several days to years of cosmetic use and other FD was excluded. Therefore, in this study, some non-FCD may be included in the FCD group. If we had performed a ROAT in all suspected FCD patients to exclude all non-FCD, the results of patch testing would have been greater. However, since most patients had been using more than one kind of cosmetic, it was difficult to test all such products, most FCD patients preferring to change to a new brand of cosmetic rather than persisting with the suspected one.

It appears that the positivity rate to PPD in our study is higher than the frequency of reactions to PPD at St John's Hospital for Diseases of the Skin (8). This may be due to the wider use of this chemical in China. Since black is the normal hair color of Chinese, and black hair is regarded as a sign of youth, more and more Chinese dye their hair if gray hairs appear. However, the risk from PPD has not been fully appreciated by clients, hairdressers and beauticians. In this study, 7 cases of hair dye dermatitis were included and a patch test to PPD was positive in all 7 of these patients. These results suggest that the PPD patch test is a sensitive test for hair dye dermatitis. No hair dye history could be found in the other 4 patients with positive PPD patch tests, suggesting that other sources of PPD sensitization may exist.

Patch testing with the patients' own cosmetic products showed a high positivity rate (46.2%) in this study, most such patients (12 out of 13) not showing positive patch test reactions to the standard series. These results support the notion that it is necessary to patch test with patients' own cosmetic products.

Although positive patch tests were shown to some standard contact allergens, relevant patch test results were found only in 6 patients (6/52 = 11.5%). In 12 patients with relevant patch tests, 6 were also positive to their own products. These results also indicated that careful history taking to find the suspected contact allergens and patch test with them is necessary in OFD.

Male FD is not commonly diagnosed in China. Seborrheic dermatitis is the main diagnosis of most of the dermatitis on the male face of unknown cause. In this study, 7 cases of male FD

were patch tested. Relevant patch test results were found in 3 cases, suggesting it is useful to patch test in male FD.

No relevant patch test results were revealed in SFD, indicating that contact allergy may be not relevant in SFD. However, a high positivity rate to nickel was found. The relationship between SFD and nickel sensitization is still not clear.

Liu's study of 55 cases of SFD suggests that seasonal pollen may be the causative agent in SFD (5). In our study, no significant difference was found between the positivity rates to aeroallergen intradermal testing in SFD, FCD, OFD and the patients with non-facial eczematous skin diseases, although the positivity rates to moulds and pollens in SFD were almost 2× that of other groups (Table 3). Increasing the number of SFD subjects might be helpful in elucidating the rôle of aeroallergen Type I reactions in SFD. On the other hand, since the intradermal test in this study detects only Type I skin reactions whether delayed-type reactions to aeroallergens in FD, especially SFD, are relevant, is not clear. Patch testing patients with aeroallergens may be helpful for clarification this question. Our results do not support the theory that Type I skin reactions to aeroallergens, including pollens and moulds, play a rôle in the eczematous skin lesions of FD.

In summary, fragrance mix is the main contact allergen in FCD in China. Patch testing with both standard series and patients' own products is necessary for the investigation of FCD and OFD. Patch testing with standard series is not helpful in SFD. Type I reactions to aeroallergens in FD may not be relevant to the persistence of eczematous lesions of FD and the relevance of aeroallergens in FD needs further study.

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