

Hand dermatitis as an unsuspected presentation of textile dye contact sensitivity

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The aim of this study was to evaluate disperse dye sensitization in patients with hand dermatitis. From January 1996 to December 2000, we identified 130 patients with hand dermatitis reacting to one of the 7 dyes included in our standard series. In 82 subjects the dermatitis was localized to the hands alone, whereas 48 patients had lesions both on the hands and on other skin sites. Disperse Blue dyes, and Disperse Orange 3 were the most common sensitizers. Among the 13 subjects allergic to disperse dyes alone, we found 3 cases of occupational allergic contact dermatitis, 1 child with atopic dermatitis worsening after the use of synthetic fibre garments, 4 subjects affected by clothing dermatitis, and 5 individuals occupationally exposed to irritants with a dermatitis involving the hands alone. In the latter, the hands may represent a 'locus minoris resistentiae', and both induction and elicitation of contact sensitization could be caused by impaired barrier function at a skin site repeatedly exposed to sensitizing garments.

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Textile dye contact dermatitis is well recognized, although data about its prevalence are lacking in many countries because of infrequent inclusion of textile dyes in the standard patch test series (1–4). Dyes known to sensitize are disperse ones, with an azo or anthraquinone structure, in most cases, whereas reports on textile dermatitis due to non-disperse dyes are scarce and mainly concern occupationally exposed subjects (1–8). Disperse dyes are suitable for colouring mixed and synthetic fibres and are only partially soluble in water. They loosely hold on the fibre surface and are easily released from fabrics, mainly in areas with increased friction and sweating. In fact, the distribution of textile dermatitis usually corresponds to sites on which garments fit snugly, i.e. neck, axillary folds, groin, buttocks, popliteal fossae, inner and anterior thighs (1, 9). However, involvement of skin sites not directly exposed to sensitizing dyes, such as the hands and the face, is frequently also described in non-occupational cases (3). In these, assessment of the relevance of sensitization to disperse dyes may be difficult, especially in subjects with widespread dermatitis or when cosensitizations to other substances of the patch test series are observed.

In Modena, textile dyes have been included in

the standard patch test series since December 1988. Since then, about 15,000 subjects have been patch tested with disperse dyes (3, 10, 11). The aim of this study was to describe 130 patients with hand dermatitis selected among 437 patients allergic to disperse dyes, identified by testing 6478 consecutive individuals with suspected allergic contact dermatitis during the period 1996–2000.

Patients and methods

130 disperse-dye positive subjects with hand dermatitis, seen at the Department of Dermatology of Modena from January 1996 to December 2000 and identified by routinely patch testing 6478 consecutive patients with suspected allergic contact dermatitis, are described. Our standard series includes 7 azo dyes: Disperse Blue 124 (DB124), Disperse Blue 106 (DB106), Disperse Red 1 (DR1), Disperse Yellow 3 (DY3), Disperse Orange 3 (DO3), para-aminoazobenzene (PAAB), and para-dimethylaminoazobenzene (PDAAB). The test dye substances, provided by FIRMA (Firenze, Italy), were applied to the healthy skin of the back with Finn Chambers on Scanpor tape (Epitest, Tuusula, Finland) for 3 days. Patch test responses were

Table 1. Number (%) of positive responses to azo dyes in 130 disperse dye-sensitive subjects with hand dermatitis and in a control population comprising 307 disperse dye-sensitive patients without hand involvement

Allergen	Study population	Control population
DB106*	63 (50%)	133 (49%)
DB124	63 (49%)	130 (42%)
DO3	54 (42%)	109 (36%)
DR1	36 (29%)	66 (22%)
DY3	34 (26%)	61 (20%)
PAAB*	25 (20%)	74 (27%)
PDAAB	18 (14%)	42 (14%)

*Not tested in children <10 years.

evaluated according to ICDRG guidelines, 30 min–3 h after patch test removal.

Data were collected for each patient with hand dermatitis reacting to at least 1 dye, including involvement of other skin sites, other test results and their relevance. The data were compared to those of a control population including 307 disperse dye-sensitive subjects without hand dermatitis.

Statistics

The chi-square test was used to evaluate possible differences between subgroups of our study population or between our study population and con-

trols. A p -value <0.05 was considered statistically significant.

Results

Out of 130 disperse dye-sensitive patients with hand dermatitis, 78 were women and 52 men; their ages ranged from 3 to 77 years (mean age $\pm$ SD = 40.7 ± 16.5 years). A history of atopic dermatitis was present in 12 subjects (9.2%); an occupational exposure was found in 7 individuals (5.4%). 82 patients showed eczematous lesions limited to the hands alone (subgroup 1), whereas in 48 subjects the dermatitis involved the hands and other skin sites (subgroup 2). The former group included 15 hairdressers, all of whom were sensitized to paraphenylenediamine (PPD), whereas no hairdressers were found among the latter. Among the 307 disperse dye-sensitive patients without hand involvement, the male/female ratio (0.56), the mean age $\pm$ SD (40.5 ± 21.3), and the frequency of occupational exposure (4.5%) were similar to the figures we observed in our study population comprising 130 disperse dye-sensitive subjects with hand dermatitis.

DB106 gave the highest number of positive responses, followed by DB124, DO3, DR1, DY3, PAAB, and PDAAB (Table 1). No significant dif-

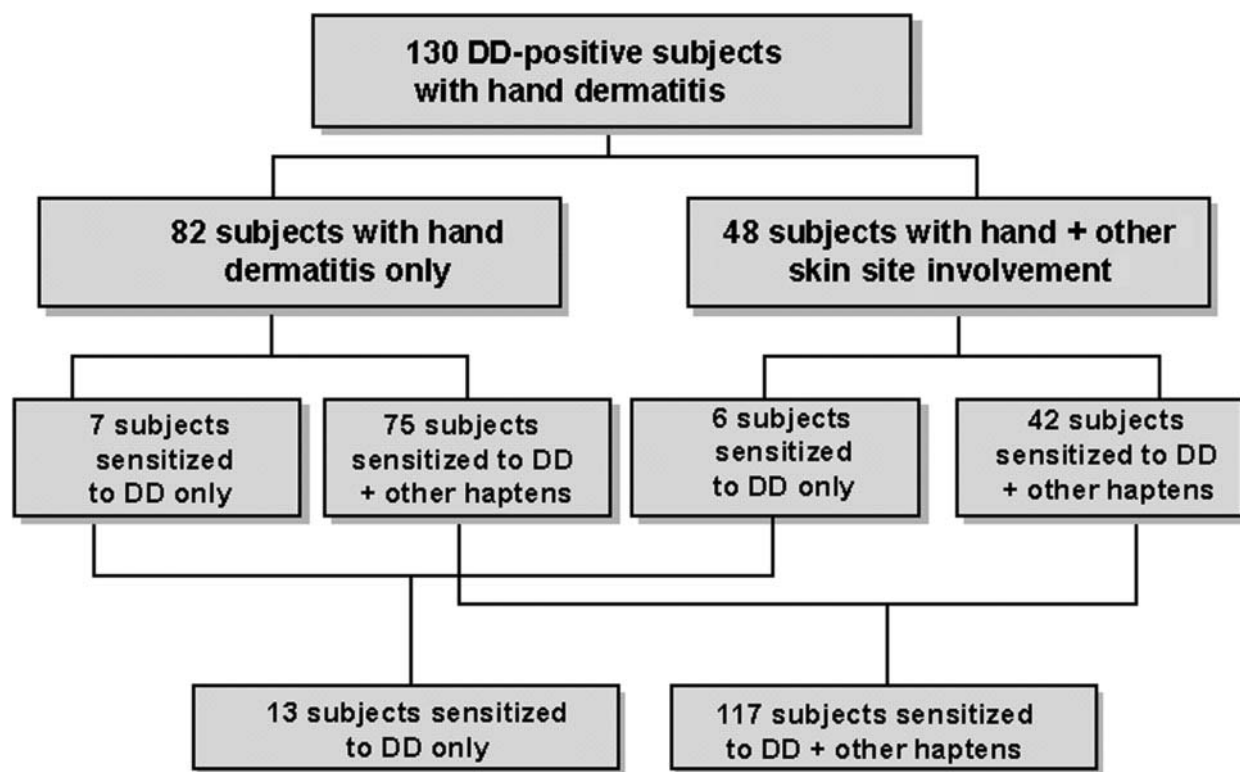


Fig. 1. Concomitant sensitizations in 130 disperse dyes (DD)- positive subjects with hand dermatitis.

Table 2. Number (%) of positive reactions to other patch test allergens in 130 disperse dye-sensitive subjects with hand dermatitis and in a control population comprising 307 disperse dye-sensitive patients without hand involvement

Allergen	Study population	Control population
Nickel sulphate	42 (32%)	95 (31%)
PPD	38 (29%)	61 (20%)
Fragrance mix	36 (28%)	66 (21%)
Diaminodiphenylmethane	19 (15%)	40 (13%)
Oleamidopropylidiphenylamine	18 (14%)	33 (11%)
Methyldibromoglutaronitrile (MDGN)	16 (12%)	22 (7%)
Lanolin alcohol	14 (11%)	33 (11%)
Neomycin	14 (11%)	40 (13%)
Potassium dichromate	14 (11%)	31 (10%)
Methyl (chloro)isothiazolinone (MI/MCI)	13 (10%)	29 (9%)
Phenylisopropyl-PPD	12 (9%)	18 (6%)
Span 20.5	8 (6%)	13 (4%)
Gold	8 (6%)	22 (7%)
Thiuram mix	8 (6%)	14 (5%)
Dimethylaminopropylamine	8 (6%)	17 (6%)
Propolis	8 (6%)	23 (7%)
Formaldehyde*	7 (5%)	5 (2%)

*Significant difference between the study population and the control population.

Table 3. Description of 13 patients with hand dermatitis and sensitization to disperse dyes only

Age/Sex	Job	AD	Site	Test results
(1) 33/F	textile worker	no	hands, axillae, abdomen, face	DB124 + + +, DB106 + + +, DY3 + + +
(2) 77/F	retired (dressmaker)	no	hands, upper limbs, axillae	DB124 + + +, DB106 + + +, DR1 +, DO3 + + +, PAAB + + +, PDAAB + + +
(3) 68/F	retired (textile worker)	no	hands, forearms	DB124 + +, DB106 + +
(4) 11/M	student	yes	hands, face, skin folds	DB124 + + +
(5) 26/F	student	no	hands, neck, upper limbs	DB124 + +, DB106 + +
(6) 17/M	student	no	hands, forearms	DO3 + +, PAAB + +
(7) 28/M	storeman	no	hands, trunk, thighs	DB106 + + +, DO3 + + +
(8) 36/F	metal-worker	no	hands, feet, axillae	DB124 + +, DB106 + +
(9) 21/M	barman	no	hands	DB124 + + +
(10) 31/M	worker	no	hands	DB124 + +
(11) 38/F	metal-worker	no	hands	DB124 + + +, DB106 + + +
(12) 55/M	metal-worker	no	hands	DB124 + +, DB106 + +
(13) 68/M	metal-worker	no	hands	DB124 + +, DB106 +

ferences in the proportions of individuals reacting to the different dyes have been found either between subgroups 1 and 2, or between the 130 hand dermatitis subjects and the 307 disperse dye-positive ones without hand involvement. Combined sensitizations to different dyes were present in 98 cases (75.4%); in 63 patients (76.8%) of the group with dermatitis localized to the hands alone and in 35 (73%) subjects of the other group; 13 (10%) individuals were allergic to azo-dyes alone and 3 (2.3%) were mono-sensitized (all cases to DB124). Concomitant sensitizations to other patch test allergens (Fig. 1) were observed in 90% of our study population. Table 2 shows the positive responses per substance in dye-positive patients with and without hand dermatitis. Nickel sulphate, PPD, fragrance mix, diaminodiphenylmethane, and oleamidopropylidiphenylamine were the most common sensitizers; reactions to formaldehyde were more frequent ($p < 0.05$) in our study population. Moreover, in patients with a dermatitis involving other skin sites besides the hands (subgroup 2) the frequency of sensitization to formaldehyde, thiuram mix, and phenylisopropyl-PPD was significantly higher than in subgroup 1.

Among those subjects with hand dermatitis reacting to disperse dyes alone (13 cases), sensitization to DB124 (11 cases) and DB106 (9 cases) prevailed (Table 3). In these subjects the number of positive responses to DO3, DR1, DY3, PAAB and PDAAB was lower than in the whole group of 130 patients with hand dermatitis, whereas the frequency of positivity to DB124 ($p < 0.05$) and DB106 was higher. This subgroup comprised the following:

- 3 subjects occupationally exposed to textile dyes, reporting dermatitis of the hands, forearms and face when working with fabrics, who also showed a dermatitis of the axillae after wearing synthetic shirts in the warm season;
- 1 child affected by atopic eczema worsening after the use of garments in synthetic or mixed fibres;
- 4 individuals with a clinical picture of clothing dermatitis and patch test responses of clinical relevance;
- 5 subjects occupationally exposed to irritant substances without involvement of other skin sites except the hands.

Discussion

Epidemiological studies on textile dye dermatitis, mainly performed on European patients, report that typical localizations include the neck, the major skin folds, and the inner and anterior thighs (1, 3, 9–14). This distribution corresponds to areas that come into direct contact with clothing; in fact, the dermatitis is often worse at skin sites with increased friction and sweating. Hand dermatitis mainly affects occupationally exposed subjects, but involvement of the hands, often associated with that of other skin sites, is not confined to workers in the textile industry. In a German study conducted on about 1800 patients patch tested with DB106 and DB124, hand dermatitis was observed in 25% of 86 disperse dye-positive patients (12). In a study performed on 100 patients sensitized to disperse dyes, 36 of whom were working with fabrics, we reported that the hands were affected in 41.7% of occupational cases and in 26.6% of non-occupational ones (3). Among 236 patients reacting to at least 1 of 6 different azo dyes (DB124, DR1, DY3, DO3, PAAB, and PDAAB) from 1990 to 1995, the hands were most frequently involved (35%) (10). Our data on textile dye allergy referring to the period 1996–2000 confirm the frequency of hand dermatitis in subjects positive to disperse dyes (11).

DB106 and DB124 were the most common sensitizers among textile dyes, involving about 50% of our study population. Only in hand dermatitis patients without involvement of other skin sites did we find the same number of reactions to DB124, DB106 and to D03. In the population of hand dermatitis patients sensitized to disperse dyes alone the sensitization rate to DB dyes was even higher, reaching 85%. Allergy to these dyes, mainly linked to black 'velvet' clothes, was more frequently reported in southern Europe than in central or

northern countries but, recently, awareness concerning Disperse Blue dyes has so increased that they were even elected 'contact allergens for the year 2000' (1–4, 9–16).

Contemporary positive patch test reactions to different disperse dyes are frequently observed in clinical practice (10, 17). Whereas DB124 and DB106 share similar chemical groups, DO3, PAAB, and PDAAB belong to a different chemical class (17). In fact, exposure to different dyes occurs simultaneously because these are mixed in order to obtain particular colours and shades. Thus, contemporary exposure resulting in concomitant allergy could explain why 15.4% of our patients showed contemporary sensitization to DO3 and DB dyes.

No relevant differences were found between hand dermatitis subjects reacting to disperse dyes and the controls sensitized to disperse dyes but affected by a dermatitis sparing the hands.

In the present patient population, 90% showed positive patch tests to other haptens of the standard series. Concomitant sensitization to nickel sulphate, PPD, fragrance mix, diaminodiphenylmethane and oleamidopropylidiphenylamine prevailed. Some allergens, i.e. formaldehyde, thiuram mix, and phenylisopropyl-PPD were significantly over-represented in subgroup 2 compared to subgroup 1. However, we could not find the reason for this increased prevalence.

Involvement of the hands in disperse dye-positive patients may be induced by concomitant non-dye sensitizers. Therefore, it is extremely important to identify subjects sensitized to disperse dyes alone and to try to correlate sensitization and exposure to disperse dyes to hand involvement.

Investigating the issue of relevance in 13 hand dermatitis patients with positive patch test responses to disperse dyes alone, we found 3 cases of occupational allergic contact dermatitis to textile dyes (patients Nos. 1–3), 1 atopic dermatitis child with a clinical history of worsening of the dermatitis after wearing synthetic fibre garments (patient No. 4), and 4 subjects with a clinical picture of clothing dermatitis (patients Nos. 5–8). 5 individuals (patients Nos. 9–13) were occupationally exposed to irritants, and showed a dermatitis involving the hands alone. In these latter cases the hands may represent a 'locus minoris resistentiae', and both induction and elicitation of contact sensitization could be caused by decreased barrier function at a skin site where exposure to sensitizing garments repeatedly occurs. Therefore, in subjects with irritant contact dermatitis of the hands, textile dye dermatitis may spare typical sites and involve only the hands.

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