

Allergic contact dermatitis in children: trends in allergens, 10 years on. A retrospective study of 500 children tested between 2005 and 2014 in one UK centre

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Summary

Background. Contact allergy in children is becoming increasingly recognized as a cause of eczema. The causal agents may change with time, but there are few comparative data for this age group.

Objectives. To compare data from the past 10 years with a similar study from the previous decade.

Methods. Between 2005 and 2014, 500 consecutive children who had been patch tested at Leeds Teaching Hospitals were identified, and the results were reviewed.

Results. Twenty-seven per cent (134 cases) of children had one or more positive patch test findings. The mean $\pm$ standard deviation age of patients with a positive test reaction was 11.9 ± 4.1 years, which was significantly higher than that of patients with a negative result (10.9 ± 4.0 years) ($p = 0.01$; Mann–Whitney U -test). No significant relationship between sex and a positive patch test result was found ($p = 0.484$, chi-squared). Allergy to nickel was the most frequent finding, although this accounted for 18%, rather than 33% (1995–2004), of all positive reactions. The next most common allergens included fragrance mix 1 (17%), p -phenylenediamine (16%), and methylchloroisothiazolinone/methylisothiazolinone (6%).

Conclusions. Although the overall incidence of contact allergy in our paediatric population is static, there has been a significant change in the allergens detected, probably as a result of changes in European legislation and cosmetic product use in children.

Key words: cosmetics; cutaneous allergy; methylisothiazolinone; paediatric; patch testing; p -phenylenediamine.

The frequency of contact allergy is known to increase with age during childhood. Patch testing is the gold standard for confirming contact allergy, which is a delayed T cell hypersensitivity reaction (1). Estimated rates of sensitization range from 26.6% to 95.6% in selected groups of children referred for patch testing, with the associated

relevance being between 51.7% and 100% (1). Over the past 30 years, there appears to have been an increase in the frequency of contact allergy within the paediatric population. This has been attributed to increased exposure to allergens at a younger age, new trends in body piercing, the use of cosmetic products, and participation in sports and hobbies, in addition to improved recognition of contact allergy and increased patch testing of children (2). Contact allergy acquired in childhood has important consequences for the individual, as it may affect quality of life by interfering with sports activities and schooling (3). It may also have important consequences for choice of future occupation.

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Patch testing in children is technically more difficult than in adults, owing to smaller body surface area and general compliance with testing, and, consequently, may not be considered as a suitable investigation to undertake.

In the past few years, a number of studies on the rates of contact allergy in children have been published. A 2013 study investigating 2594 Danish children referred for patch testing found that 25.1% had one or more positive patch test reactions. The most common sensitizers were metals, fragrances, and hair dyes (4). A further UK study from 2015 investigated 137 children patch tested between 2009 and 2011, and found the two most common sensitizers to be nickel and potassium dichromate (5), whereas a 2010 study from Greece investigating 255 children patch tested between 1994 and 2007 found the two most common allergens to be nickel and thiomersal (6). A recently published review of the European Surveillance System on Contact Allergies Network 2002–2010, which examined 6080 patients, found the 10 most frequent haptens to be: nickel sulfate, cobalt chloride, potassium dichromate, neomycin sulfate, *Myroxylon pereirae* resin (balsam of Peru), *p*-phenylenediamine (PPD), methylchloroisothiazolinone (MCI)/methylisothiazolinone (MI) 3:1, fragrance mix, lanolin alcohols, and colophonium. No differences were found in the prevalence of a positive reaction to at least one hapten between boys and girls or between children with atopic dermatitis and children without (7).

Having published data 10 years ago on the rates of contact allergy in the Leeds, UK paediatric patch tested population (8), we undertook a further retrospective study to document the changes that have occurred over the last 10 years at our centre and to perform a comparison with data from other centres.

Patients and Methods

All children referred, defined as being aged ≤ 16 years, were patch tested with the British Society for Cutaneous Allergy (BSCA) baseline series (9), with additional series and own products being added where indicated from the history. Allergens obtained from Trolab® (SmartPractice Europe, Reinbek, Germany) or Chemotechnique Diagnostics (Vellinge, Sweden) were applied to healthy skin on the patients' backs under polyethylene plastic chambers (IQ Ultra™; Chemotechnique Diagnostics), and left for 48 hr. Readings were performed at 2 and 4 days. Reactions were scored according to ICDRG criteria (10). Photopatch testing was performed as indicated from the history (11). All patient details and patch test results were routinely prospectively recorded on a departmental patch test database.

A total of 500 consecutive children who underwent patch testing in the Contact Dermatitis Investigation Unit at Leeds Teaching Hospitals NHS Trust between 2005 and 2014 were identified. The patch test results and diagnoses were reviewed for each individual.

Prick tests were undertaken when clinically indicated from the history.

Comparison with a similar previous study from 1995 to 2004 (8) was performed.

The χ^2 test was used for the analysis of sensitization to allergens and site of primary dermatosis. The Mann–Whitney *U*-test was used to elucidate the relationship between age and a positive patch test result. Analysis was carried out with IBM SPSS™ STATISTICS 20.0.

Results

We collected data from 500 consecutive paediatric patients patch tested at the Contact Dermatitis Investigation Unit at Leeds Teaching Hospitals NHS Trust between 2005 and 2014. Of these, 134 (27%) had one or more positive patch test reactions. Probable or definite current relevance was considered to be present in 112 of the 134 cases (84%).

The mean $\pm$ standard deviation (SD) age of patients with a positive reaction was 11.9 ± 4.1 years (median 13.2 years; range 0.8–17 years). This was significantly higher than that of patients who had a negative result (mean $\pm$ SD 10.9 ± 4.0 years; median 11.2 years; range 1.0–17 years) ($p = 0.01$; Mann–Whitney *U*-test; Table 1). Using the χ^2 test, we did not find a significant relationship between sex and a positive patch test result ($p = 0.484$).

Site of dermatosis was recorded in all cases. In 151 cases, two primary sites were stated (e.g. hand and face). Positive reactions by site are shown in Table 2.

Of the 134 children who had positive reactions, 84% were considered to have at least one reaction that was of probable or definite current clinical relevance; in the remaining 22 children (16%), the only reactions detected were of past or no relevance. Overall, nickel sulfate most frequently gave positive results, accounting for 24 reactions (18%), although it was found to be relevant in only 7 cases. Frequently detected allergens are shown in Table 3.

Table 4 shows the changes in incidence rates of reactions to frequent contact allergens found in the baseline series and selected common allergens as compared with our previous study in 2004.

In the current study, the youngest child to have a contact allergy was aged 10 months, and was allergic to potassium dichromate. This was of relevance, as chrome-tanned leather used in the child's orthopaedic leg brace that had induced dermatitis.

Table 1. Results of patch testing in the 500 children

	Positive patch test result (n = 134)		Negative patch test result (n = 366)	
Sex, n (%)	Male, 51 (38)	Female, 83 (62)	Male, 152 (41)	Female 214 (59)
Age range (months)	31–201	10–204	12–204	16–204
By age group, n (%)				
0 to < 2 years	0	1 (1)	3 (1)	2 (1)
2 to < 5 years	7 (5)	4 (3)	12 (3)	17 (5)
5 to < 10 years	17 (13)	11 (8)	54 (15)	58 (16)
10 to < 15 years	19 (14)	39 (29)	56 (15)	95 (26)
≥15 years	8 (6)	28 (21)	27 (7)	42 (11)

Table 2. Site of dermatoses and patch test result

Site of dermatosis	Total, n	Positive patch test result, n (%)	Negative patch test result, n	χ^2 test
Face	207	57 (28)	150	0.754
Generalized	131	23 (18)	108	0.005
Flexures	48	14 (29)	34	0.697
Trunk	36	11 (31)	25	0.597
Hand				
Entire	34	8 (24)	26	0.656
Finger	20	4 (20)	16	0.491
Dorsa	15	4 (27)	11	0.991
Palm	9	3 (33)	6	0.655
Arm	33	9 (27)	24	0.949
Leg	33	7 (21)	26	0.453
Neck	16	4 (25)	12	0.869
Foot				
Entire	14	7 (50)	7	0.047
Dorsa	14	3 (21)	11	0.645
Sole	12	3 (25)	9	0.887
Head	14	13 (93)	1	< 0.01
Perineal	9	4 (44)	5	0.228
Ear	6	2 (33)	4	0.716

Bold type signifies where the results are significant (i.e. result less than 0.05).

Among the 388 children with a personal history of atopy, a positive reaction was found in 99 (26%). Specifically, among the 335 children with a diagnosis of atopic dermatitis, a positive reaction was found in 760 (23%). The rates of positive reactions in patients without atopy or atopic dermatitis were 31% and 35%, respectively. Using the χ^2 test, we found no statistical differences in the likelihood of a positive reaction ($p = 0.227$) between the two groups.

All patients were patch tested with the baseline series. Further testing was based on clinical history. Of the 134 children who had one or more positive reactions, 110 had a reaction to an allergen in the baseline series; that is, in 24 cases, no allergen would have been identified if additional series had not been used. The additional series used and results are summarized in Table S1.

Prick tests gave positive results in 47 of the 128 cases tested, with the most frequently detected allergens being as follows: house dust mite, 17; cat, 12; dog, 11; timothy grass, 9; peanut, 5; natural rubber latex proteins, 4; milk, 4; tree pollen, 3; almond, 2; banana, 2; egg, 2; pepper, 2; rabbit, 2; and wheat, 2.

Discussion

This study supports previous findings (8) that the frequency of contact allergy increases with age during childhood. However, unlike in our 2004 study, we did not find that girls were significantly more likely to have a positive patch test result. The majority of studies report a female predominance in contact allergy and allergic contact dermatitis (ACD). It has previously been suggested that hormonal factors may play a role in this (12). However, nickel allergy is well recognized as being more common among girls (13). This is thought to be attributable to girls being more likely to have their ears pierced and wear jewellery at an earlier age (14, 15). In our study, we have seen a large reduction in the frequency of nickel allergy. As more of those affected by nickel allergy are female, this observed reduction in the frequency of nickel allergy may explain why the sex balance has evened out.

The relationship between atopy and contact allergy is poorly understood. We found no significant differences between the test results of those with atopy and those without. We would therefore conclude that all patients, regardless of a history of atopy, should be considered for patch testing when indicated.

The objective of our previous study was to assess whether the presenting pattern of dermatitis could predict the outcome of the patch test alone. At that time, no correlation could be found between the presenting pattern of dermatosis and a positive patch test result (8). Although this study has found that eczema occurring on the head, generalized to the body and affecting the entire foot are associated with positive results, the numbers are small. We believe that there is a need to undertake patch

Table 3. Most commonly detected allergens in 2005–2014

Rank	Allergen	Total	Relevant
1	Nickel sulfate 5% pet.	24	7
2	Fragrance mix I 8% pet.	23	22
3	<i>p</i> -Phenylenediamine 1% pet.	21	21
4	Limonene hydroperoxides 0.3% pet.	17	16
5	Cobalt chloride 1% pet.	12	6
6*	4-Aminophenol 1% pet.	11	11
7	Linalool hydroperoxides 1% pet.	11	9
8*	Amino azobenzene 0.25% pet.	10	5
9*	Disperse Orange 3 1% pet.	10	5
10	Toluene-2,5-diamine sulfate 1% pet.	10	10
11	Methylchloroisothiazolinone/methylisothiazolinone 0.01% aq. (0.02% aq. from 2008)	8	8
12*	Disperse Yellow 3 1% pet.	7	2
13	Propolis 10% pet.	7	6
14*	Thiomersal 0.1% pet.	7	2
15	3-Aminophenol 1% pet.	7	7
16	Methylisothiazolinone 0.2% aq.	7	7
17	2-Bromo-2-nitropropane-1,3-diol 0.5% pet.	7	7
18*	<i>o</i> -Nitro- <i>p</i> -phenylenediamine 1% pet.	6	6
19	Thiuram mix 1% pet.	6	2
20	Fragrance mix II 14% pet.	5	4
21	<i>Myroxylon perei</i> ae 25% pet.	5	5
22	Epoxy resin 1% pet.	4	1
23	Lanolin alcohols 30% pet.	4	3

*Allergen not in baseline series.

testing in any child with a persistent eczema, regardless of anatomical site.

The most common allergens found in this study were similar to those found in other studies, namely nickel sulfate and fragrance. However, nickel sulfate now accounts for 18%, rather than 33%, of all positive reactions. This is a significant decrease, and it may be a result of the EU Nickel Directive (16), which was implemented in 1994.

The incidence of allergy to fragrance mix I (FMI) was relatively unchanged, being 17% from 18%. Interestingly, fragrance allergy was detected more frequently in boys than in girls, and, given that young age groups are affected, it may well be that these children are being exposed to fragrance through children's personal care products, such as moisturizers, sunscreens, and bubble baths, which are used equally between the sexes. This lack of female predominance in those with a fragrance allergy among the paediatric population is supported by the existing literature (7). Testing with fragrance mix II (FMII) was also performed, but, of the 5 cases detected, 4 had an allergy to FMI as well. Overall, the rate of allergy to one or all of the four fragrance markers – FMI, FMII, hydroxyisohexyl 3-cyclohexene carboxaldehyde, and *M. perei*ae – was 5.2% of the 500 children tested. This is in keeping with a large Danish study, in which 4.7% of the

children were found to be sensitized to at least one of the markers (7). Whereas some studies have corroborated this assertion that the rate of fragrance allergy has not changed (5), other studies have found a decrease in the incidence of fragrance allergy in children (6).

Our data also show high levels of propolis allergy. As this was not routinely tested for in the previous study, we are unable to say whether numbers have increased. Patients with a propolis allergy may also react to fragrance mixes, owing to a cross-reaction. Propolis is regarded by some as having antibacterial and anti-inflammatory properties, and is therefore now contained in an increasing number of more 'natural' over-the-counter products. Because of the observed increase in the frequency of ACD caused by propolis, this allergen became part of the baseline series in Germany and Austria in 2004, and part of the BSCA baseline series in 2007.

Furthermore, patients with a fragrance allergy may be missed if only the above tests are performed. Other new and emerging allergens to consider include limonene and linalool hydroperoxides and essential oils. These were not tested as part of the baseline series during the time of the previous study. Now that patients are being tested with these, more cases of fragrance allergy are being identified.

Table 4. Contact allergic reactions in children in 2005–2014 by age group with comparative results for 1995–2004

Allergen	1995–2004			2005–2014							M:F ratio
	Total	Relevant	Significant change (<i>p</i>)	Total	Relevant	< 2 years	2–5 years	5–10 years	10–15 years	≥ 15 years	
Nickel sulfate 5% pet.	44	3	▼ (0.0119)	24	7	–	2	6	6	10	9:15
Cobalt chloride 1% pet.	15	4	–	12	6	–	3	3	4	2	1:11
Potassium dichromate 0.5% pet.	4	2	–	3	1	1	0	0	0	2	1:2
Fragrance mix II 14% pet.	Not tested		–	5	4	–	–	–	4	1	2:3
Fragrance mix I 8% pet.	24	21	–	23	22	–	1	6	9	7	13:10
<i>Myroxylon pereirae</i> 25% pet.	11	9	–	5	5	–	–	2	2	1	3:2
Colophonium 20% pet.	9	7	▼ (0.0338)	2	0	–	–	–	2	0	1:1
Propolis 10% pet.	Not tested		–	7	6	–	2	2	3	0	1:6
<i>p</i> -Phenylenediamine 1% pet.	11	10	–	21	21	–	–	1	9	11	3:18
Toluene-2,5-diamine sulfate 1% pet.	4	4	–	10	10	–	–	–	3	7	0:10
2-Bromo-2-nitropropane-1,3-diol 0.5% pet.	<2	<2	▲ (0.0332)	7	7	–	1	0	4	2	3:4
Formaldehyde 2% aq.	3	3	–	1	1	–	–	–	1	0	0:1
Imidazolidinyl urea 2% pet.	2	2	–	1	1	–	1	0	0	0	1:0
MCI/MI 0.02% aq.	<2	<2	▲ (0.0191)	8	8	–	1	2	3	2	2:6
MI 0.2% aq.	Tested since 2011			7	7	–	4	1	2	0	2:5
Quaternium-15 1% pet.	2	2	–	0	0	–	–	–	–	–	–
Mercapto mix 2% pet.	11	9	▼ (0.0119)	2	1	–	–	1	1	0	0:2
Mercaptobenzothiazole 2% pet.	3	3	–	1	1	–	–	1	0	0	0:1
Carba mix 3% pet.	2	2	–	2	1	–	–	1	0	1	1:1
Thiuram mix 1% pet.	3	3	–	6	2	–	–	1	1	4	2:4
Epoxy resin 1% pet.	<2	<2	–	4	1	–	–	1	2	1	2:2
Neomycin 20% pet.	4	4	▼ (0.0451)	0	0	–	–	–	–	–	–
Nystatin 2% pet.	2	2	–	0	0	–	–	–	–	–	–
Sodium fusidate 2% pet.	3	3	–	0	0	–	–	–	–	–	–
Thiomersal 0.1% pet.	5	0	–	7	2	–	–	2	4	1	1:6
Tixocortol pivalate 1% pet.	2	2	–	1	0	–	–	–	–	1	0:1
Lanolin alcohols 30% pet.	8	8	–	4	3	–	4	0	0	0	4:0

F, female; M, male; MCI, methylchloroisothiazolinone; MI, methylisothiazolinone.

Since 2004, MCI/MI has emerged as a significant allergen, and its use in baby wipes may account for why MCI/MI allergy is seen in young children. MI has only been tested since 2011, and, in just 4 years, 7 cases have been seen. Given this high annual incidence, although it is not reflected by Table 3, this allergen is likely to be among the top five most frequent allergens seen in children with eczema. This is supported by a number of other studies (17). It is important for patients to be tested with MI, as testing only with MCI/MI fails to detect sensitization to MI only (18), which has increased to epidemic proportions, owing to a large increase in exposures from cosmetic and other household products. A recent study examining contact sensitization in very young children aged <3 years found that MCI/MI accounted for 4.4% of all positive reactions (19). 2-Bromo-2-nitropropane-1,3-diol is another preservative, and our study has shown that the number of children who are allergic to this has significantly increased over the past 10 years; it now accounts for 5.2% of all positive

reactions. A 2011 study in Sheffield (UK) found that 12.5% of all positive reactions were to 2-bromo-2-nitropropane-1,3-diol (20).

Thiomersal is a preservative that is frequently contained within vaccinations, and is often not of current relevance to patients. Our data suggest that the incidence of sensitization to this may be increasing. This is supported by similar studies showing a rate of 1.7% in 1993 rising to 18% of the positive reactions in 2007 (6). Thiomersal has been ranked in the top four allergens among children in several studies (21, 22). In some studies, positive reaction rates of up to 15% have been reported (23). However, because of its limited relevance, it is now excluded from some baseline screening recommendations (24). Given that thiomersal is a well-recognized sensitizer within the paediatric population, we feel that our current reported incidence is more in keeping with the existing literature, and that perhaps our previous finding was lower than would be expected, rather than the current finding being high.

Since 2004, we have reported an increase in the number of children who are allergic to PPD, as it has almost doubled from 11% to 21%. However, this increase was not found to be significant ($p = 0.0724$). In this study, the youngest child with a PPD allergy was aged 5 years and 10 months. There was a statistically significant predominance of girls among those with positive reactions (86%), which reflects the hair dye and henna tattoo use in this group (χ^2 test, $p = 0.0121$). It is worth noting that a number of patients are sensitized to PPD through the use of black henna tattoos, but do not then present with ACD until they dye their hair for the first time. However, cases of connubial dermatitis caused by PPD in childhood have also been reported in the literature, with 2 cases of mothers regularly dyeing their hair being related to worsening of their children's dermatitis (17). Positive reactions to PPD may also be an expression of cross-reactivity with textile azo-dyes present in stockings and footwear (25, 26). Our incidence of allergy to PPD is similar to that published in the literature. In a large Danish study of 2594 children, 3.5% of those tested had an allergic reaction to PPD (4). This compares with 4.2% from our data. Table S1 shows that, in such cases where additional testing with further hairdressing-related allergens is performed, allergies to toluene-2,5-diamine sulfate, 4-aminophenol, 3-aminophenol and *o*-nitro-*p*-phenylenediamine may be detected, reflecting the increased use of semi-permanent and permanent hair dye products, particularly during the early teenage years. This is supported by the Odense Adolescence Cohort Study on Atopic Diseases and Dermatitis, which found, in its follow-up study, that 67.5% of its study population had used permanent hair dyes by the time they had reached 28–30 years of age, and that 18% had used a henna tattoo (27). Furthermore, 11 reactions were seen to amino azobenzene. In 9 cases this was probably a cross-reaction, because, in these patients, reactions to PPD were also seen; however, in 2 cases this was probably a result of a textile dye allergy.

As well as an increase in the number of cases of allergic responses to some allergens, some decreases, besides

nickel, were also seen, as shown in Table 4. Significant decreases in the rates of allergy to colophonium, mercapto mix and neomycin were found. The decrease in colophonium allergy may be attributable to a reduction in the use of Elastoplast®. However, such findings were not made in a similar study, in which numbers were static (5). Mecapto mix allergy may be less prevalent because of a reduction in the use of rubber-soled shoes, and, finally, a decrease in neomycin allergy may be attributable to less use of steroid antimicrobial combinations containing neomycin.

Table S1 shows that, when additional series are tested, perineal series allergens (textile dyes) and hairdressing allergens are often the most fruitful. We would have missed 24 cases of ACD if testing with the baseline series alone had been performed. A pick-up rate of 78% from the baseline series alone is in keeping with the existing literature, although this rate does vary from 37% to 73%, depending on the size of the series used (28). The photo patch test series [containing ultraviolet (UV) filters] detected 5 patients with allergic responses. Two of these had ACD, 1 was allergic to a known additive (decyl glucoside) in the UV filter methylene bis-benzotriazolyl tetramethylbutylphenol, and 2 had photo allergic contact dermatitis. This highlights the importance of irradiation of the patch test sites, something that is not always performed in some district hospitals (29).

In summary, although the incidence of contact allergy in the paediatric population is relatively static, there has been a significant change in the sensitizing substances. This is possibly the result of changing exposure as a consequence of legislation, and the use of personal care products such as hair dyes and cosmetics at a younger age.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table S1. Summary results of additional series tested and prick testing results.

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Table S1: Summary results of additional series tested and prick testing results

Series	Frequency used, n (%)	Number of positive cases identified (NB: One case may have >1 allergen)	Allergens Identified: Number of cases,
Medicament	214 (43%)	9 (4%)	Thiomersal 0.1% pet. 7, Triclosan 2% pet. 2, Phenylmercuric acetate 0.01% aq. 1
Facial	202 (40%)	8 (4%)	Abitol 10% pet 3, Ditertiary butyl hydroquinone 1% pet. 1, Sorbic acid 2% pet. 1, Dimethylaminopropylamine 1% pet. 1, Triethanolamine 2% pet. 1, Propylene glycol 20% aq. 1, Lauryl glucoside 3% pet. 1, Decylglucoside 10% aq. 1, Caprylyl/caprylglucoside 10% aq. 1, Cocoglucoside 10% aq. 1, Shellac 20% EtOH 1
Fragrance	125 (25%)	7 (6%)	Isoeugenol 1% pet. 1, hexyl cinnamal 10% pet. 1, Anise alcohol 10% pet. 1, Farnesol 5% pet. 1, Narcissus absolute 2% pet. 1, Cinnamal 1% pet. 1, Citral 2% pet. 1
Textile	114 (23%)	6 (5%)	Amino azobenzene 0.25% pet. 4, Disperse Orange 3 1% pet. 4, 4-aminophenol 1% pet. 3, Disperse Brown 11% pet. 1, Disperse Yellow 31% pet 1, Disperse Red 17 1% pet. 2, Disperse Orange 1 1% pet. 1, Melamine formaldehyde 7% pet. 1
Photopatch – UV filters	113 (23%) Irradiated with 5J UVA in 68 cases (14%)	4 (4%) - 2x ACD - 2x Photoallergic	ACD Octocrylene 10% pet. 2 Photoallergic Octyl dimethyl PABA 10% pet. 1, Isoamyl <i>p</i> -methoxycinnamate 10% pet. 1, Ethylhexyl methoxycinnamate 10% pet. 1, Butylmethoxy dibenzoylmethane 10% pet. 1
Bakery	47 (9%)	1 (2%)	Isoeugenol 1% pet 1
Rubber	39 (8%)		Butylatedhydroxyanisole (BHA) 2% pet. 1, 1,3-diphenylguanidine 1% pet. 2, Tetraethylthiuram disulphide 0.25% pet. 1, Tetramethylthiuram monosulphide 0.25% pet. 1
Shoe	35 (7%)	1 (3%)	Ester gum rosin 20% pet. 1
Caine	23 (5%)	2 (9%)	Benzocaine 5% pet. 2
Perineal	22 (4%)	7 (32%)	Amino azobenzene 0.25% pet. 7, Disperse Orange 3 1% pet. 7, Disperse Yellow 3 1% pet. 6, Disperse Blue 3 1% pet. 1, Disperse Red 1 1% pet. 2, Disperse Red 17 1% pet. 1
Steroid cream	20 (4%)	0	

Hair	15 (3%)	10 (67%)	toluene-2,5-diamine sulfate 1% pet. 10, 4-aminophenol 1% pet. 10, 3-aminophenol 1% pet. 7, <i>o</i> -nitro- <i>p</i> -phenylenediamine 1% pet. 6, Pyrogallol 1% pet. 2, Resorcinol 1% pet. 1, Ammonium persulfate 2.5%pet. 1
Plastic	13 (3%)	1 (8%)	<i>p</i> -tertiary butylcatechol 0.25% pet. 1, Benzoyl peroxide 1%pet. 1, BHA 2% pet. 1
Finger tip	11 (2%)	0	
Dental	10 (2%)	2 (20%)	Gold sodium thiosulfate 2% pet. 2, Methyl methacrylate 2%pet. 1, Ethyleneglycol dimethacrylate 2% pet. 1, 2-hydroxyethyl methacrylate 2% pet. 1
Acrylate: adhesive & nail	10 (2%)	1 (10%)	Tetraethyleneglycol dimethacrylate 2% pet. 1, Trimethylolpropane triacrylate 0.1% pet. 1, Triethyleneglycol diacrylate 0.1%pet. 1
Metals	10 (2%)	1 (10%)	Ammoniated mercury 1%pet. 1, Mercury 0.5% pet. 1, Mercuric oxide 1
Plant	7 (1%)	1 (14%)	Chamomile extract 1% pet. 1
Formaldehyde	6(1%)	0	
Ear	5(1%)	0	
Epoxy	5(1%)	2 (40%)	Epoxy resin, bisphenol F 0.25% pet. 1, Hexanediol diglycidylether 0.25%pet. 1
Isocyanates	2 (<1%)	0	
Eye	2 (<1%)	0	
Parabens	1 (<1%)	0	
Own samples	150 (30%)		3 patients where products positive - Soltan® and Simple® sunscreens - Piz Buin® 30 and Vichy® sunscreen - Huggies® Wipes