

Patch testing in children with hand eczema. A 5-year multicentre study in Spain

Fernando Toledo¹, Begoña García-Bravo², Virginia Fernández-Redondo³, Jesús De la Cuadra⁴, Ana María Giménez-Arnau⁵, Leopoldo Borrego⁶, José Manuel Carrascosa⁷, José Carlos Armario-Hita⁸, Paloma Sánchez-Pedreño⁹, Marcos Hervella¹⁰, Ricardo González¹¹ and Juan Francisco Silvestre¹

¹Department of Dermatology, Hospital General Universitario de Alicante, Alicante 03010, Spain, ²Department of Dermatology, Hospital Universitario Virgen de la Macarena, Sevilla 41004, Spain, ³Department of Dermatology, Complejo Hospitalario Universitario de Santiago, Santiago de Compostela 15706, Spain, ⁴Department of Dermatology, Hospital General Universitario de Valencia, Valencia 46014, Spain, ⁵Department of Dermatology, Hospital del Mar, Barcelona 08003, Spain, ⁶Department of Dermatology, Hospital Universitario Insular, Palmas de Gran Canaria 35016, Spain, ⁷Department of Dermatology, Hospital Universitario Germans Trias i Pujol, Badalona 08916, Spain, ⁸Department of Dermatology, Hospital Universitario de Puerto Real, Cádiz 11207, Spain, ⁹Department of Dermatology, Hospital Universitario Virgen de la Arrixaca, Murcia 30120, Spain, ¹⁰Department of Dermatology, Hospital de Estella, Navarra 31200, Spain, and ¹¹Department of Dermatology, Hospital Santiago Apóstol, Vitoria 01004, Spain

doi:10.1111/j.1600-0536.2011.01943.x

Summary

Background. Hand eczema is common in children, but affected children are seldom patch tested. Relatively few studies have assessed patch testing in the paediatric population, and none has specifically evaluated its use in hand eczema in children.

Objectives. The aim of this study was to determine the prevalence of contact allergy in children with hand eczema, and to identify the most frequent allergens and their relevance.

Material and methods. We performed a 5-year retrospective study of children (aged 0–15 years) with hand eczema tested with the Spanish baseline series at the Dermatology Departments of 11 Spanish hospitals.

Results. During the study period, 11 729 patients were patch tested, of whom 480 were children. Hand eczema was present in 111 (23.1%) of the children and in 3437 (30.5%) of the adults. Of the children with hand eczema, 46.8% had at least one positive reaction in the patch tests. Current relevance was found for 78% of the allergens detected. The most common allergens were nickel sulfate, methylchloroisothiazolinone/methylisothiazolinone, and fragrance mix I. Allergic contact dermatitis was the most frequent diagnosis (36%), followed by atopic dermatitis.

Conclusions. Allergic contact dermatitis was the most usual diagnosis in our series of children with hand eczema. We recommend patch testing of all children with chronic hand eczema, as is already performed in adults.

Key words: allergic contact dermatitis; children; hand eczema; patch test.

Correspondence: Fernando Toledo, Department of Dermatology, Hospital General Universitario, Pintor Baeza 12, 03010 Alicante, Spain. Tel: +34 965 937 873; Fax: +34 965 937 853. E-mail: fernandotoledoalberola@hotmail.com

Conflicts of interest: The authors have declared no conflicts.

Accepted for publication 29 April 2011

Hand eczema is a common dermatosis and one of the most common reasons for attending cutaneous allergy departments. The prevalence in the general population varies from 2% to 8.9% (1–3), and between 20% and 30% of all cases of dermatitis are located on the hands (4, 5). The aetiology of hand eczema is multifactorial, and includes exposure to external agents, both irritants and allergens, and endogenous factors, such as atopy and other

conditions that alter the skin barrier function (6). Contact dermatitis, whether irritant or allergic, is the most usual diagnosis in hand eczema (7). Patch testing of all cases of chronic hand eczema is highly recommended. The frequency of positive patch test reactions in patients with hand eczema varies between 21% and 59% (8–12).

Allergic contact dermatitis in children has usually been considered to be uncommon, and the appearance of eczema has normally been attributed to endogenous factors (atopic dermatitis), or to irritant factors such as cleansing agents (9, 13–15). Until a few years ago, the low incidence of allergic contact dermatitis was thought to be attributable to reduced exposure to allergens (15) and to an immature immune system during childhood, making children less susceptible to sensitization by these allergens (14). However, numerous reports have appeared from different European countries over the last 10 years confirming that allergic contact dermatitis in children is relatively frequent. Different authors have reported frequencies of positive patch test reactions in children ranging from 14.5% to 71%, with a clinical relevance of 20–92% (16–25).

Despite these findings, few studies have specifically assessed the utility of patch testing in children with chronic hand eczema. Our group has recently reported a study in children with hand eczema who were studied by patch testing (26). However, one of the limitations of this study concerned the small sample size. Accordingly, the main aims of the present study were to:

- (1) Determine the prevalence of contact allergy in children with hand eczema patch tested with the Spanish baseline series;
- (2) Identify the most frequent allergens and their relevance in this group.

The secondary aim of the study was to define the clinical and epidemiological characteristics of the children with hand eczema.

Materials and Methods

Study design

We performed a retrospective and descriptive multicentre study at the cutaneous allergy departments of 11 Spanish hospitals (Hospital General Universitario de Alicante, Alicante; Hospital Universitario Virgen de la Macarena, Sevilla; Hospital Gil y Casares, Santiago de Compostela; Hospital General Universitario de Valencia, Valencia; Hospital del Mar, Barcelona; Hospital Universitario Insular, Palmas de Gran Canaria; Hospital Universitario Germans Trias i Pujol, Badalona; Hospital Universitario

de Puerto Real, Cádiz; Hospital Universitario Virgen de la Arrixaca, Murcia; Hospital de Estella, Navarra; and Hospital Santiago Apóstol, Vitoria). The study period was from January 2005 to December 2009.

Study population

We reviewed all paediatric patients (<16 years of age) with hand eczema tested with the Spanish Contact Dermatitis and Skin Allergy Research Group (GEIDAC) baseline series during the study period, as well as a subgroup of patients who had a positive result.

Hand eczema was defined as the appearance of eczema on the palm or back of the hand, on the lateral surface of the fingers, on the fingertips, diffusely, on the palms and soles, or on the hand and other sites, that had appeared on at least one occasion and persisted for over 2 weeks. Diffuse involvement of the hand was considered to be present when two different parts of the hand were affected.

The information was obtained from the computerized databases of the cutaneous allergy departments, where data were recorded about the patient, series tested, and patch test results and their relevance. The clinical data recorded for each patient were age, sex, history of atopic dermatitis, site of lesions, series tested, positive allergens and number of positive reactions and their relevance, source of sensitization, and final diagnosis.

Atopic dermatitis was defined according to the criteria of Hanifin and Rajka (27). Thus, we differentiated between patients with a personal history of atopic dermatitis and patients with no personal history of atopic dermatitis.

In the children with hand eczema studied by patch test, we distinguished three age groups: children aged 0–5 years, children aged 6–10 years, and children aged 11–15 years.

The final diagnosis was considered to be that recorded by the dermatologist after performance of the patch tests and application of the usual clinical criteria.

Patch tests

The allergens used in the GEIDAC baseline series were supplied by Chemotechnique® Diagnostics AB (Vellinge, Sweden), Matí-Tor® (Barcelona, Spain), and Trolab® (Reinbek, Germany). The patches were prepared with Finn Chambers® (Epitest, Oy, Tuusula, Finland), fixed with Scanpor® tape (Norgesplaster A/S, Kristiansand, Norway), and removed after 2 days of contact with the skin. Readings were made at 2 and 4 days according to the evaluation criteria (+, ++, and +++) recommended by the International Contact Dermatitis Research Group. The relevance was considered to be current if the

symptoms could be attributed totally or partially to the allergen identified, past if positivity explained only previous dermatitis, and unknown if the symptoms could not be attributed to the allergen found.

Statistical analyses

Data management and descriptive statistical analyses were performed with SPSS® version 15.0 (SPSS, Chicago, IL, USA). Comparison between qualitative variables was performed with 2×2 contingency tables for simple data (female and male, or positive and negative patch test reactions), and the hypothesis was tested with the χ^2 -test, or Fisher's exact test when the conditions necessitated this. $P < 0.05$ was considered to be statistically significant. Comparison of continuous quantitative variables (e.g. age) was performed with non-parametric tests (Mann–Whitney U -test or Kruskal–Wallis test).

Results

From January 2005 to December 2009, we performed patch tests with at least the GEIDAC baseline series in a total of 11 729 patients, of whom 11 249 (95.9%) were adults and 480 (4.1%) children. Of these, 3437 adults (30.5%) and 111 children (23.1%) had eczema on the hand. Hand eczema in children younger than 16 years of age accounted for 2.8% (111 of 3548) of all cases of hand eczema studied.

Frequencies in children with hand eczema

A total of 111 children with hand eczema (41 boys; 70 girls) were patch tested with the GEIDAC baseline series. Their age ranged from 2 to 15 years (mean 12 ± 3.5 years). By age group, hand eczema was more frequent in older children and adolescents (11–15 years; 64.9%) than in children aged 6–10 years (23.4%) and the younger children (<6 years; 11.7%) (Table 1).

Signs and/or symptoms of atopic dermatitis were identified in 54.2% of the children with hand eczema

Table 1. Distribution according to age of the children with hand eczema studied by patch testing

Age group (years)	Patch tests		Total n (%)
	Positive n (%)	Negative n (%)	
0–5	7 (13.5)	6 (10.2)	13 (11.7)
6–10	11 (21.1)	15 (25.4)	26 (23.4)
11–15	34 (65.4)	38 (64.4)	72 (64.9)
Total	52 (46.8)	59 (53.2)	111

Table 2. History of atopic dermatitis in children with hand eczema

	Patch tests		Total n (%)
	Positive n (%)	Negative n (%)	
History of atopic dermatitis	27 (55.1)	31 (53.4)	58 (54.2)
No history of atopic dermatitis	22 (44.9)	27 (46.6)	49 (45.8)
Total	49 (45.8)	58 (54.2)	107 (100)

No atopic history was available for 4 children with hand eczema.

Table 3. Anatomical site in the children with hand eczema according to the patch test results

Site	Patch tests		Total n (%)
	Positive n (%)	Negative n (%)	
Diffuse hand	10 (19.2)	9 (15.2)	19 (17.1)
Palms	16 (30.7)	13 (22)	29 (26.1)
Dorsum	2 (3.8)	5 (8.5)	7 (6.3)
Tips	5 (9.6)	9 (15.2)	14 (12.6)
Lateral	9 (17.3)	6 (10.2)	15 (13.5)
Palms and soles	1 (1.9)	6 (10.2)	7 (6.3)
Hand and other site(s)	9 (17.3)	11 (18.6)	20 (18)
Total	52 (46.8)	59 (53.2)	111 (100)

(58/107). No atopic dermatitis history was available for 4 of the 111 children (Table 2).

The most frequent location of involvement was the palms, in 29 (26.1%) of the 111 patients, followed by the hands and another site (20), diffuse involvement of the hands (19), lateral surface of the fingers (15), fingertips (14), back of the hands (7), and palms and soles (7). Table 3 shows the site of the hand eczema according to sex and the patch test result.

Analysis of the distribution of the eczema according to age group showed that the most frequent locations were the palms in the 0–5-year group (46.1%), the palms and fingertips in the 6–10-year group (34.6% for each), and diffuse involvement of the hands in the 11–16-year group (22.2%).

Table 4. Most common causes of hand eczema in the children studied

	Patch tests		Total n (%)
	Positive n (%)	Negative n (%)	
Allergic contact dermatitis	40 (76.9)	0 (0)	40 (36)
Irritant contact dermatitis	3 (5.8)	13 (22)	17 (15.3)
Atopic dermatitis	5 (9.6)	27 (45.8)	32 (28.8)
Vesicular (dyshidrotic) eczema	4 (7.7)	14 (23.7)	18 (16.2)
Psoriasis	0 (0)	4 (6.8)	4 (3.6)
Total	52 (46.8)	59 (53.2)	111 (100)

Table 5. Site of the hand eczema and final diagnosis in the children with hand eczema

Site	Final diagnosis					
	Number n (%)	Allergic contact dermatitis n (%)	Atopic dermatitis n (%)	Irritant contact dermatitis n (%)	Vesicular (dyshidrotic) eczema n (%)	Psoriasis n (%)
Diffuse hand	19 (26.4)	9 (22.5)	5 (15.6)	2 (11.7)	3 (16.7)	0
Palms	29 (40.3)	10 (25)	7 (21.9)	5 (29.4)	5 (27.7)	2 (50)
Dorsum	7 (9.7)	2 (5)	2 (6.2)	3 (17.6)	0	0
Tips	14 (19.4)	3 (7.5)	6 (18.8)	4 (23.4)	1 (5.5)	0
Lateral	15 (20.9)	7 (17.5)	1 (3.1)	1 (5.9)	4 (22.2)	2 (50)
Palms and soles	7 (9.7)	1 (2.5)	3 (9.4)	1 (5.9)	2 (11.1)	0
Hand and other site(s)	20 (2.8)	8 (20)	8 (25)	1 (5.9)	3 (16.7)	0
Total	111 (100)	40 (36)	32 (28.8)	17 (15.3)	18 (16.2)	4 (3.6)

Patch tests in the children with hand eczema

Of the 111 children with hand eczema, 52 (46.8%) had at least one positive patch test reaction. Tables 1 and 2 show the distribution of the positive patch test reactions by sex, age group, and history of atopic dermatitis. The total number of positive reactions was 76. The mean number of positive allergens per patient with a positive patch test reaction was 1.46.

Of the 52 children with a positive reaction, 28 (53.8%) reacted to only one allergen, 16 (31%) to two allergens, 5 (9.6%) to three allergens, and 3 (5.8%) to four allergens.

We found no significant differences between the likelihood of having a positive patch test reaction and a history of atopic dermatitis (Table 2).

The allergens most commonly found were nickel sulfate (16), methylchloroisothiazolinone/methylisothiazolinone (13), fragrance mix I (11), *Myroxylon pereirae* (6), cobalt chloride (6), thiomersal (4), potassium dichromate (3), and mercury (3).

The most usual final diagnosis was allergic contact dermatitis, in 40 children (36%), followed by atopic

dermatitis (32; 28.8%), vesicular (dyshidrotic) eczema (18; 16.2%), irritant contact dermatitis (17; 15.3%), and psoriasis (4; 3.6%) (Tables 4 and 5).

The most frequent sources of exposure related to the allergens found in children with hand eczema were cosmetics (19), metals (9), clothes (3), medicaments (3), cleaning products (3), occupation (1), plants (1), and tattoos (1).

Relevance of the positive reactions in children with hand eczema

Of the 76 positive reaction, relevance was considered to be current in 59 (77.6%), past in 3 (3.9%), and unknown in 14 (18.4%). Table 6 shows the allergens obtained according to age, sex, and relevance. The relevance for fragrance mix I and *M. pereirae* was current in 100% of the cases.

Discussion

Hand eczema in children is common, with a prevalence of 12.6–27% (16, 28, 29), which is in agreement with

Table 6. The 10 most frequent allergens obtained with the baseline GEIDAC series in the 111 children with hand eczema according to sex, age group, and relevance

Allergens	No. of positive reactions	Girls	Boys	0–5 years	6–10 years	11–15 years	Current relevance	Past relevance	Unknown relevance
Nickel sulfate	16	13	3	2	3	11	9	4	3
MCI/MI	13	10	3	1	3	9	12	0	1
Fragrance mix I	11	5	6	2	2	7	11	0	0
<i>Myroxylon pereirae</i>	6	1	5	2	2	2	6	0	0
Cobalt chloride	6	4	2	1	1	4	2	1	3
Thiomersal	4	2	2	0	1	3	0	0	4
Potassium dichromate	3	2	1	1	2	0	3	0	0
Mercury	3	2	1	1	0	2	1	0	2
<i>p</i> -Phenylenediamine	2	2	0	0	0	2	2	0	0
Thiuram mix	2	1	1	0	0	2	2	0	0
Totals	76	46	30	12	19	45	59	3	14

MCI/MI, methylchloroisothiazolinone/methylisothiazolinone.

the 23.1% found in this series. However, unlike in adults, it is not often studied with patch tests, probably because it is initially assumed to be a manifestation of atopic dermatitis.

The aetiology of hand eczema is multifactorial, and includes both exogenous factors (exposure to irritant agents or allergens) and endogenous factors (atopy and other alterations in skin barrier function (6)). Irritant contact dermatitis represents the most common diagnosis among adults with hand eczema (30–32). However, in our population of children with hand eczema, the most frequent final diagnosis was allergic contact dermatitis, followed by atopic dermatitis and vesicular (dyshidrotic) hand eczema. Irritant contact dermatitis was in fourth place, with a frequency that was half that of allergic contact dermatitis. These findings are similar to those of an earlier study carried out in Spain (26). This suggests that the children with hand eczema who we are patch testing are too narrowly selected, which explains the inverted relationship between irritant and allergic contact dermatitis. This supports the importance of patch testing all children with hand eczema, just as in adults.

Most studies of the distribution by sex of adult patients with hand eczema indicate a slight predominance in women. This has been explained by differences in household and occupational exposure, as well as by the higher rates of atopic dermatitis in women (33–35). However we found little difference between boys and girls with hand eczema. This may be because they are not working. Concerning the distribution by age group, we noted that the prevalence of hand eczema increased with age. This might be related to the greater environmental exposure to irritants and manual activities with increasing age. Despite the practical difficulties of patch testing children under 5 years of age, a high percentage of positive reactions was found in this age group, so we do not think that this should be considered as a limitation to patch testing small children.

Atopic dermatitis, either prior or concomitant, has been described as a predisposing factor for the development of hand eczema in children (9, 11, 32, 36, 37). Mortz et al. (38) found that 24.5% of the children with atopic dermatitis reported having had an episode of hand eczema during their lifetime, whereas this was only so in 5.1% of the non-atopic children. A Norwegian study found that approximately 90% of the children with hand eczema had a personal history of atopic dermatitis (39). The figures in our study were not so high, although 54.2% of our patients had a personal history of atopic dermatitis. Toledo et al. (26) found a prevalence of atopic dermatitis in children with hand eczema that was six to seven times greater than that seen in adults with hand eczema.

This difference was significant, and atopic dermatitis is therefore a predisposing factor for hand eczema at any age, and particularly in children.

All authors agree with the recommendation to perform patch tests in all adult patients with chronic hand eczema. The test is extremely useful for the diagnosis of patients with allergic contact dermatitis. Between 21% and 59% of adults with hand eczema have at least one positive allergen in patch tests (8–11), although fewer than one-third of the positive reactions show current relevance (32). Nevertheless, despite its frequency, we have found no studies of the usefulness of patch tests in children with hand eczema. Beattie, in a series of 114 children, found that 12 of the 17 (71%) children with hand eczema had a positive patch test reaction (16). In our study, we saw that 46.8% of the children with hand eczema had at least one positive reaction in the patch tests performed. In addition, we detected no significant differences in the frequency of positive patch test reactions according to sex, age group, or site of involvement.

The evaluation of the relevance of the patch tests is fundamental if we wish to establish their usefulness (5). This information is lacking in many studies on allergic contact dermatitis in children. When it is included, however, the percentages are relatively high, and the clinical relevance (present or past) varies from 40% to 87% (17, 23, 38), although Pambor et al. (40) found clinical relevance in only 3.6% of the children tested. In our study, the current relevance of the positive reactions found in the children with hand eczema was 78%. Accordingly, we think that patch tests should be indicated in any child with chronic hand eczema, irrespective of age.

Controversy exists concerning whether patients with atopic dermatitis have a higher or lower frequency of allergic contact dermatitis (5). It is very probable that there are no differences from patients without atopic dermatitis, as their lower immunological predisposition is compensated for by an impaired skin barrier and greater exposure to sensitizing substances. In our study, we detected similar frequencies of positive patch test reactions in the children with atopic dermatitis and in those with no history of atopic dermatitis. This is in agreement with most previous studies (5, 39, 41), and shows that allergic contact dermatitis is not infrequent in children with hand eczema and a history of atopic dermatitis; therefore, if allergic contact dermatitis is suspected in them, patch testing should be performed.

The allergens most frequently found in earlier studies in children were metals, such as chromium (in footwear) and nickel, sometimes associated with cobalt and palladium, rubber chemical accelerators, and fragrances (22, 23, 25, 28, 30, 42–46). No studies have yet described the most

usual allergens in children with hand eczema. Nickel sulfate was still the most common allergen, and we found that, despite measures adopted 10 years ago (47) to reduce the amount of nickel in costume jewellery, no differences were found in its prevalence between children younger or older than 10 years of age. Of note in our study was the high number of patients with allergy to methylchloroisothiazolinone/methylisothiazolinone, fragrance mix I, and *M. pereirae*, as well their high present relevance. Kohl et al. (48) studied the impact of allergy to cosmetics in children under 16 years of age, and found that 48.6% of the children patch tested showed allergic contact dermatitis caused by cosmetics. Studies in Portugal (49) and Denmark (25, 50) have noted that approximately 1.8% of children have a positive reaction when patch tested with fragrance mix I, and that fragrances represent one of the main causes of allergic contact dermatitis in children with eczema. Because children under 16 years of age have been shown to be sensitized to nickel, preservatives, and fragrances in particular, more stringent limitations on nickel release in jewellery and toys, as well as the use of fragrance-free toiletry products, would help to reduce the risk of sensitization to these allergens.

Conclusions

Hand eczema in children is frequent, but it is not often studied with patch testing. In our study, we found that almost half of the children with hand eczema were positive for at least one allergen in the baseline patch test series, and most reactions were considered to be relevant. This study showed that 36% of the children with hand eczema had allergic contact dermatitis. Fragrances and preservatives found in toiletry products, as well as nickel, were the most important allergens in children with hand eczema. The results of this study support the recommendation of patch testing any children with chronic hand eczema, independently of age, sex, personal history of atopic dermatitis, or distribution of the eczema.

Acknowledgement

I would like to thank the Spanish Contact Dermatitis and Skin Allergy Research Group for its contribution to this manuscript and specially to Dr. Juan Francisco Silvestre for teaching me everything I know about contact dermatitis.

References

- Kavli G, Förde O H. Hand dermatoses in Trömsö. *Contact Dermatitis* 1984; **10**: 174–177.
- Coenraads P J, Nater J P, Van Der Lende R. Prevalence of eczema and other dermatoses of the hands and arms in the Netherlands. Association with age and occupation. *Clin Exp Dermatol* 1983; **8**: 495–503.
- Goh C L, Soh S D. Occupational dermatoses in Singapore. *Contact Dermatitis* 1984; **11**: 288–293.
- Elston D M, Ahmed D D, Watsky K L, Schwarzenberger K. Hand dermatitis. *J Am Acad Dermatol* 2002; **47**: 291–299.
- García-Bravo B, Rodríguez E. Dermatitis de contacto en la infancia. *Piel* 2000; **15**: 316–323.
- Bryld L E, Hindsberger C, Kyvik K O, Agner T, Menné T. Risk factors influencing the development of hand eczema in a population-based twin sample. *Br J Dermatol* 2003; **149**: 1214–1220.
- Warshaw E, Lee G, Storrs F J. Hand dermatitis: a review of clinical features, therapeutic options, and long-term outcomes. *Am J Contact Dermatitis* 2003; **14**: 119–137.
- Carrascosa J M, Benvenuti F, Rodríguez C, Ferrándiz C. Perfil de los pacientes con dermatosis en las manos remitidos a la Unidad de Contacto de un hospital terciario e impacto de las pruebas epicutáneas en el diagnóstico. *Actas Dermosifiliogr* 2009; **100**: 493–498.
- Lerbaek A, Kyvik K O, Ravn H, Menné T, Agner T. Incidence of hand eczema in a population-based twin cohort: genetic and environmental risk factors. *Br J Dermatol* 2007; **157**: 552–557.
- Nielsen N H, Linneberg A, Menné T et al. The association between contact allergy and hand eczema in 2 cross-sectional survey 8 years apart. *Contact Dermatitis* 2002; **47**: 71–77.
- Hald M, Agner T, Blands J, Ravn H, Johansen J D. Allergens associated with severe symptoms of hand eczema and a poor prognosis. *Contact Dermatitis* 2009; **61**: 101–108.
- Warshaw E M, Ahmed R L, Belsito D V et al. Contact dermatitis of the hands: cross-sectional analyses of North American Contact Dermatitis Group Data, 1994–2004. *J Am Acad Dermatol* 2007; **57**: 301–314.
- Epstein E. Contact dermatitis in children. *Pediatr Clin North Am* 1971; **18**: 839–852.
- Cronin E. *Contact Dermatitis*. New York, Churchill Livingstone Inc., 1980: pp. 20–21.
- Hjorth N. Contact dermatitis in children. *Acta Derm Venereol* 1981; **95**: 36–39.
- Beattie P E, Green C, Lowe G, Lewis-Jones M S. Which children should we patch test? *Clin Exp Dermatol* 2006; **32**: 6–11.
- Stables G I, Forsyth A, Lever R S. Patch testing in children. *Contact Dermatitis* 1996; **34**: 341–344.
- Manzini B M, Ferdani G, Simonetti V, Donini M, Seidenari S. Contact sensitization in children. *Pediatr Dermatol* 1998; **15**: 12–17.
- Shah M, Lewis F M, Gawkrödger D J. Patch testing in children and adolescents: five years experience and follow-up. *J Am Acad Dermatol* 1997; **37**: 964–968.
- Rudzi E, Rebandel P. Contact dermatitis in children. *Contact Dermatitis* 1996; **34**: 66–67.
- Roul S, Ducombs G, Taieb A. Usefulness of the European standard series for patch testing in children. *Contact Dermatitis* 1999; **40**: 232–235.

- 22 Romaguera C, Vilaplana J. Contact dermatitis in children: 6 years experience (1992–1997). *Contact Dermatitis* 1998; **39**: 277–280.
- 23 Sevilla A, Romaguera C, Vilaplana J, Botella R. Contact dermatitis in children. *Contact Dermatitis* 1994; **30**: 292–294.
- 24 Romaguera C, Alomar A, Camarasa J M et al. Contact dermatitis in children. *Contact Dermatitis* 1985; **12**: 283–284.
- 25 Mortz C G, Lauritsen J, Bindslev-Jensen C. Contact allergy and allergic contact dermatitis in adolescents: prevalence measures and associations. *Acta Derm Venereol* 2002; **82**: 352–358.
- 26 Toledo F, Silvestre J F, Cuesta L, Latorre N, Monteagudo A. Utilidad de las pruebas epicutáneas en el eczema de manos en niños: estudio comparativo con el eczema en la edad pediátrica y con el eczema de manos en adultos. *Actas Dermosifiliogr* 2011; **7**.
- 27 Hanifin J M, Rajka G. Diagnostic features of atopic dermatitis. *Acta Derm Venereol* 1980; **92** (Suppl.): 44–47.
- 28 Vozmediano J M, Armario J C. Allergic contact dermatitis in children. *J Eur Acad Dermatol Venereol* 2005; **19**: 42–46.
- 29 Yngveson M, Svensson A, Isacson A. Evaluation of a self-reported questionnaire on hand dermatosis in secondary school children. *Acta Derm Venereol* 1997; **77**: 455–457.
- 30 Veien N K, Hattel T, Laurberg G. Hand eczema: causes, course and prognosis I. *Contact Dermatitis* 2008; **58**: 330–334.
- 31 Lantinga H, Nater J P, Coenraads P J. Prevalence, incidence and course of eczema on the hands and forearms in a sample of the general population. *Contact Dermatitis* 1984; **10**: 135–139.
- 32 Agner T. Hand eczema. In: *Contact Dermatitis*, 4th edition, Frosch P J, Menne T, Lepoittevin J P (eds): Berlin, Springer, 2006: pp. 335–344.
- 33 Meding B. Differences between the sexes with regard to workrelated skin disease. *Contact Dermatitis* 2000; **43**: 65–71.
- 34 Schultz L F, Diepgen T, Svensson A. The occurrence of atopic dermatitis in north Europe: an international questionnaire study. *J Am Acad Dermatol* 1996; **34** (Pt 1): 760–764.
- 35 Williams H, Robertson C, Stewart A et al. Worldwide variations in the prevalence of symptoms of atopic eczema in the International Study of Asthma and Allergies in Childhood. *J Allergy Clin Immunol* 1999; **103** (Pt 1): 125–138.
- 36 Meding B, Meding B, Järholm B. Hand eczema in Swedish adults – changes in prevalence between 1983 and 1996. *J Invest Dermatol* 2002; **118**: 719–723.
- 37 Meding B, Swanbeck G. Predictive factors for hand eczema. *Contact Dermatitis* 1990; **23**: 154–161.
- 38 Mortz C G, Lauritsen J M, Bindslev-Jensen C, Andersen C E. Prevalence of atopic dermatitis, asthma, allergic rhinitis, and hand and contact dermatitis in adolescents. The Odense Adolescence Cohort Study on Atopic Diseases and Dermatitis. *Br J Dermatol* 2001; **144**: 523–532.
- 39 Dotterud I K, Falk E S. Contact allergy in relation to hand eczema and atopic diseases in north Norwegian schoolchildren. *Acta Paediatr* 1995; **84**: 402–406.
- 40 Pambor M, Krüger G, Winkler S. Results of patch testing in children. *Contact Dermatitis* 1992; **27**: 326–328.
- 41 Klas P A, Corey G, Storrs F J, Chan S C, Hanifin J N. Allergic and irritant patch test reactions and atopic disease. *Contact Dermatitis* 1996; **34**: 121–124.
- 42 Romaguera C, García-Bravo B. Dermatitis de contacto en niños. In: *Dermatitis de contacto*, Giménez Camarasa J M (ed.): Madrid, Aula Médica, 1999: pp. 117–128.
- 43 Goossens A, Morren M. Contact allergy in children. In: *Contact Dermatitis*, 4th edition, Frosch P J, Menne T, Lepoittevin J P (eds): Berlin, Springer, 2006: pp. 811–830.
- 44 Veien N K, Hattel T, Justesen O, Norholm A. Contact dermatitis in children. *Contact Dermatitis* 1982; **8**: 373–375.
- 45 Gonçalo S, Gonçalo M, Azenha A et al. Allergic contact dermatitis in children. *Contact Dermatitis* 1992; **26**: 112–115.
- 46 Rudzki E, Rebandel P. Contact dermatitis in children. *Contact Dermatitis* 1996; **34**: 66–67.
- 47 Lidén C. Legislative and preventive measures related to contact dermatitis. *Contact Dermatitis* 2001; **44**: 65–69.
- 48 Kohl L, Blondeel A, Song M. Allergic contact dermatitis from cosmetics. Retrospective analysis of 819 patch-tested patients. *Dermatology* 2002; **204**: 334–337.
- 49 Barros M A, Baptista A, Correia T M, Azevedo F. Patch testing in children: a study of 562 school children. *Contact Dermatitis* 1991; **18**: 156–159.
- 50 Mortz C G, Bindslev-Jensen C, Lauritsen J, Andersen K E. Allergic contact sensitization in 8th grade school children in Odense, Denmark. Abstract Presented at the Jadassohn Centenary Congress, London, 9–12 October 1996.