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Diagnosing chronic hand eczema by an algorithm: a tool for classification in clinical practice

S. Molin, T. L. Diepgen,* T. Ruzicka and J. C. Prinz

*Department of Dermatology and Allergology, Ludwig Maximilian University, Munich, Germany; and *Department of Social Medicine, Occupational and Environmental Dermatology, University of Heidelberg, Heidelberg, Germany*

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Summary

Background. Diagnostic classification of chronic hand eczema (CHE) represents a major clinical and taxonomic challenge because of its wide aetiological and clinical heterogeneity.

Aim. To develop an algorithm for the diagnosis and classification of CHE.

Methods. Well-defined aetiological, clinical and morphological criteria of CHE were arranged graphically in a diagnostic hierarchy, and validated in 137 German patients with hand eczema.

Results. The algorithm distinguished chronic hand eczema due to contact allergy, irritant damage or a combination of the two, each either with or without atopy, and also atopic hand eczema and idiopathic hand eczema lacking obvious causative factors. Foot involvement helped to distinguish idiopathic from irritant hand eczema. Each subtype could occur either with a hyperkeratotic–rhagadiform, dyshidrotic or mixed morphology, but certain hand eczema subtypes had clear morphological preferences.

Conclusions. By providing a more precise clinical definition this diagnostic algorithm could improve the classification and taxonomy of hand eczema subtypes, facilitating more rational treatment decisions and allowing better treatment outcome analysis.

Introduction

Chronic hand eczema (CHE) is defined as a persistent noninfectious skin inflammation of the hands. It is a common skin disease, with an estimated 1-year prevalence of up to 10% and average disease duration of > 10 years.[1,2] CHE presents a high socioeconomic burden, and often results in long-term sick leave or unemployment.

The clinical diagnosis of CHE refers to an aetiologically heterogeneous disease group, but its terminology lacked a generally accepted taxonomy. Diagnosis was based on aetiology when possible and morphology when necessary.[3–6] Recently, Diepgen *et al.*[7] proposed an aetiological classification that defined atopic hand eczema, allergic contact dermatitis (ACD) and irritant contact dermatitis (ICD), either alone or in combination, and CHE composed of atopic hand eczema and ICD. In cases where no causative or aetiological factors could be identified, CHE was classified according to morphology.[7]

The difficulty of discriminating aetiologically distinct subtypes of CHE has remained a constant clinical challenge.[7–12] A precise classification of CHE in the individual patient is essential for appropriate measures to be taken. To facilitate a more systematic approach to

Correspondence: Dr Sonja C. Molin, Department of Dermatology and Allergology, Ludwig Maximilian University, Frauenlobstrasse 9-11, D-80337 Munich, Germany
E-mail: sonja.molin@med.uni-muenchen.de

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the diagnosis of CHE subtypes, we integrated a number of aetiological, clinical and morphological criteria into a diagnostic hierarchy, and validated it in 137 patients with well-defined hand eczema.

Methods

The study was approved by the local ethics committee and carried out in accordance with the principles of the Declaration of Helsinki. All patients gave written informed consent for participation.

Classification of chronic hand eczema and development of the algorithm

The current criteria for classification of CHE comprise irritant skin damage, contact allergy or atopy. These three main decisive criteria were arranged in a graphic binary 'yes/no' answer algorithm (Fig. 1). Foot involvement was considered a distinguishing feature for idiopathic eczema if contact allergy and atopy were absent and irritant damage could not explain plantar eczema (Table 1). It was only used as a diagnostic criterion for idiopathic CHE if no other criteria could serve as causes for plantar involvement. Clinical morphology was used as a descriptive feature, with three classifications: (a) hyperkeratotic–rhagadiform; (b) dyshidrotic; or (c) a mixed pattern, comprising both.

Patients and investigations

In total, 137 patients with CHE (64 men, 73 women; mean ± SD age 47.8 ± 16.4 years, range 21–78) were recruited at the Department of Dermatology, LMU, Munich. Each patient underwent a clinical examination, and gave a detailed account of their disease history, course, seasonal and occupational variations or exposure, influence and amount of water or irritant contact, and presence of atopy or contact allergies of CHE.

Based on the classification above, the patients were investigated for five criteria (explained in detail below).

Clinical examination determined the distribution and morphology of CHE, foot involvement, presence of atopic eczema and signs of atopy according to the criteria defined by Hanifin and Rajka.[13]

All patients were screened for type I or IV allergies by prick testing with common allergens (e.g. cat, house dust mite, grass pollen), serum IgE levels, and patch

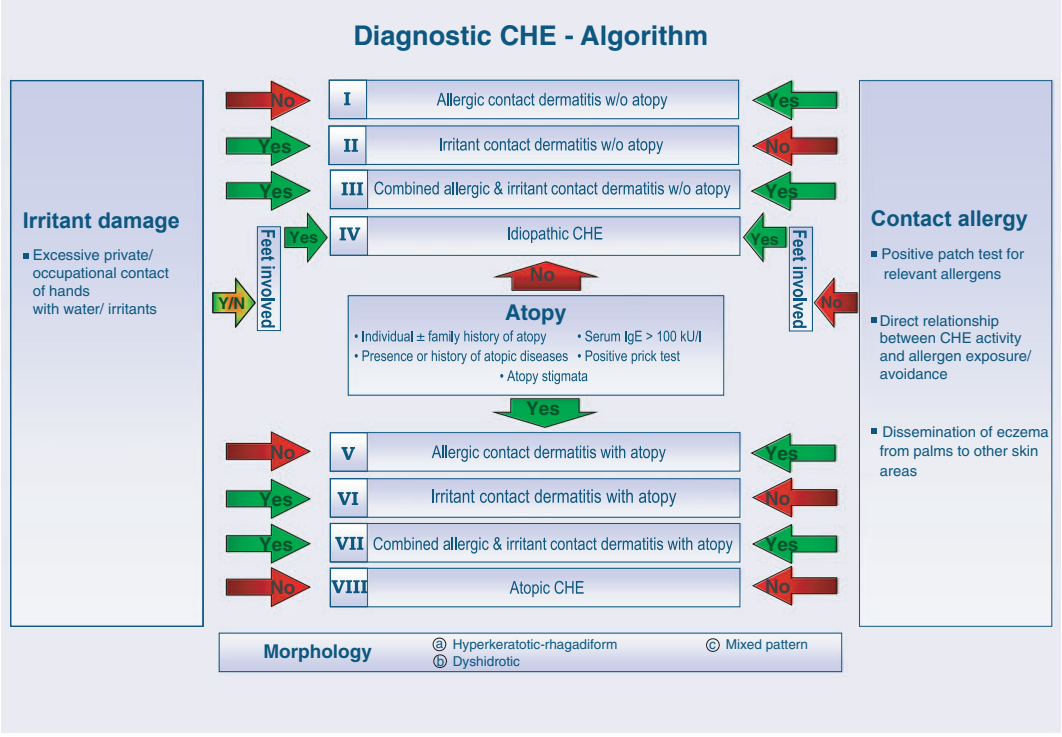

Figure 1 Diagnostic chronic hand eczema (CHE) algorithm. Four main features (irritant damage, contact allergy, atopy, foot involvement) constitute the basis for the therapeutic decision model. Using a binary (yes/no) approach, it defines eight different subtypes of CHE. Clinical morphology (a–c) distinguishes these subtypes further.

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Table 1 Definition of relevant criteria for classification of CHE subtypes and development of an algorithm.

Criterion	Description
Irritant damage	Excessive contact of hands with water or irritants, either private or occupational
Contact allergy	Positive patch test for relevant allergen and/or allergen avoidance successful in preventing flares and/or presence of eczema spreading
Atopy	Family history of atopy and/or history of atopy (allergic rhinitis or asthma) and/or serum IgE > 100 kU/L and/or positive prick test results presence of atopic diseases. Atopy stigmata
Foot involvement	Yes or No
Morphology	Hyperkeratotic–rhagadiform (a) or dyshidrotic (b) or mixed pattern (c)

testing with the present European standard series and additional series according to individual exposure, which were applied to the skin in Finn chambers.[14]

CHE without other obvious causes was diagnosed as atopic CHE if atopic stigmata, test results, or extrinsic or intrinsic atopic disease features were present. Common differential diagnoses for CHE were excluded by clinical and microbiological examination, history, and in inconclusive cases, histopathology.

The patients were rated based on the following five criteria.

Irritant skin damage. Irritant damage is often associated with CHE. Irritant contact dermatitis is reported to be much more common than allergic contact dermatitis (ACD).[7] Occupational and domestic exposure to wet work, and excessive contact with water and common irritants such as detergents, organic solvents or metal fluids, predispose to the development of ICD. Sweat can also serve as an irritant. Wet work is usually considered as frequent skin exposure to water or wearing of occlusive gloves for > 2 h/day. Washing hands for > 20 times per day was previously called 'frequent'. In ICD, the hands have an ongoing hypersensitivity against physical or chemical noxae or water, and much lower exposure to these agents may be required to maintain than to provoke disease flares.[15] Therefore, the individual threshold of irritant damage may vary.

Relevant contact allergies. Contact allergy is a relevant causative factor for CHE. It is a T cell-mediated, delayed type IV hypersensitivity reaction. Relevant allergens for CHE development are metals, rubber chemicals, glues, preservatives, dyes or plant allergens, which are capable of penetrating the skin. Latex or food proteins are also relevant in ACD.[16] Diagnosis of ACD is based on a positive patch test reaction, and on a direct relationship between CHE and allergen exposure or avoidance. A common clinical feature of ACD is dissemination of eczema from the region of primary allergen exposure to unexposed areas. Eczema spreading may therefore be useful to verify the diagnosis.

Atopy. Atopy is often seen in patients with CHE. It is defined as a familial disposition for the production of IgE antibodies against common environmental allergens, with consecutive development of disorders including atopic dermatitis, allergic rhinitis and asthma. Atopy is assumed to be a major individual risk factor for the development and maintenance of CHE.[1,17] About one-third to one-half of patients with CHE can be considered atopic.[1] The criteria for atopy in our patients were presence or history of atopic disorders, atopy stigmata according to the criteria of Hanifin and Rajka,[13] increased IgE levels and/or positive prick testing for common allergens. Atopic CHE was diagnosed in patients with signs of atopy when irritant damage and contact allergy were missing.

Foot involvement. Foot involvement was considered a novel criterion for differentiation of CHE subtypes. Foot involvement may occur in ACD, under occlusive conditions, or in atopic CHE. If foot involvement was seen in patients lacking contact allergy, atopy or irritant damage to the soles, it served as a criterion for idiopathic CHE, irrespective of a history of irritant exposure of the hands.

Morphology. Morphology and localization alone do not allow the diagnosis of a particular type of CHE apart from its aetiology.[18] In our patients with CHE, we distinguished three patterns as described above. In our algorithm, morphology was only used as a descriptive feature; however, it may have important consequences for the choice of external treatment measures and should therefore always be included in the diagnosis of CHE.

Results

Types of chronic hand eczema identified by the algorithm

The algorithm resulted in identification of eight main types of CHE (Table 2): ACD (I, V) and ICD (II, VI), combined ACD and ICD (AICD) (III, VII), each with or without atopy; idiopathic CHE (IV) and atopic CHE

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Table 2 Differentiation of CHE subtypes according to the algorithm and its relevant criteria.

Type	Diagnosis	Irritant damage	Contact allergy	Atopy	Foot involvement
I	ACD without atopy	–	+	–	NR
II	ICD without atopy	+	–	–	–
III	AICD without atopy	+	+	–	NR
IV	Idiopathic CHE	+	–	–	+
		–	–	–	+/–
V	ACD with atopy	–	+	+	NR
VI	ICD with atopy	+	–	+	–
VII	AICD with atopy	+	+	+	NR
VIII	Atopic CHE	–	–	+	NR

ACD, allergic contact dermatitis; AICD, combined allergic and irritant contact dermatitis; CHE chronic hand eczema; ICD, irritant contact dermatitis; NR, not relevant.

(VIII). These major clinical CHE subtypes can be modified by the morphology as given above (a–c).

Validation of the algorithm in patients with chronic hand eczema

Details of the patients with CHE are shown in Tables 3 and 4. They reflect the heterogeneity of CHE, and support known facts about the clinical features, disease course and environmental influences.

When classified according to the algorithm, each patient could be clearly assigned to a distinct type of CHE. The group sizes of ACD (types I and V: 31/137), ICD (II and VI: 29/137) and combined AICD (III and VII: 27/137) were comparable. Slightly fewer patients were found to have idiopathic CHE (26/137; type IV) or atopic hand eczema (24/137; type VIII). Of the 31 patients with ACD, 21 (68%) patients had atopy (type V) and 10 of 31 (32%) did not (type I); of the 29 patients with ICD, 18 (62%) had atopy (type VI) and 11 (38%) did not (type II); and of the 27 patients with AICD, 19 (70%) had atopy (type VII) and 8 (30%) (type III) did not. Regarding morphological subtype, 52 had the hyperkeratotic–rhagadiform pattern (a), 44 the dyshidrotic pattern (b), and 40 the mixed pattern (c) (Table 3).

Association of subtypes and clinical features

The analysis identified several characteristic features for the different CHE forms (Table 3). ICD (types II, VI) more often had a hyperkeratotic–rhagadiform (12/29; 41.38%) or mixed pattern (12/29; 41.38%) than a dyshidrotic morphology (5/29; 17.24%), especially in the presence of atopic predisposition. ACD (types I, V) more often presented with a mixed pattern (13/31; 41.93%). In idiopathic CHE (type IV), a hyperkeratotic–rhagadiform phenotype predominated (16/26; 61.54%) over the dyshidrotic (7/26; 26.92%) or mixed (3/26; 11.54%) patterns (Table 3). For ICD (II, VI) a chronic disease course was more common (20/29; 68.97%) than a relapsing course (9/29; 31.03%), and it was found to be more likely to worsen with water contact (19/29; 65.52%) (Table 4). A greater proportion of patients with idiopathic CHE also had a persistent disease course (21/26; 80.77%; 5 patients were not able to give information about the disease course). Foot involvement was a main feature of idiopathic CHE (IV; 16/26; 61.54%) (Table 4).

Table 3 Distribution of CHE subtypes according to the algorithm.

Classification according to algorithm	Patients, *n* (%)	Hyperkeratotic–rhagadiform		Dyshidrotic		Mixed	
		With atopy	Without atopy	With atopy	Without atopy	With atopy	Without atopy
Types							
ACD	31 (23)	5	3	7	3	10	3
Subtype		Va	Ia	Vb	Ib	Vc	Ic
ICD	29 (21)	9	3	2	3	7	5
Subtype		VIa	IIa	VIb	IIb	VIc	IIc
AICD	27 (20)	7	2	7	3	5	3
Subtype		VIIa	IIIa	VIIb	IIIb	VIIc	IIIc
Idiopathic CHE	26 (19)	NA	16	NA	7	NA	3
Subtype			IVa		IVb		IVc
Atopic CHE	24 (17)	8	NA	12	NA	4	NA
Subtype		VIIIa		VIIIb		VIIIc	
Total	137 (100)	53		44		40	

ACD, allergic contact dermatitis; AICD, combined allergic and irritant contact dermatitis; CHE chronic hand eczema; ICD, irritant contact dermatitis; NA, not applicable.

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Table 4 Clinical characteristics of CHE study population.

Classification according to algorithm	Patients, *n* (%)	Gender		Itching	Worse with water contact	Persistent course	Relapsing course	Foot involvement	Atopy		Occupational relationship	Relevant contact allergy	Positive prick test	IgE > 100 kU/L	Excessive water or irritant contact
		M	F						Present	Family history					
ACD without/with atopy (I/V)	31 (23)	12	19	27	8	15*	15*	15	9	11	5	31	4	9	0
ICD without/with atopy (II/VI)	29 (21)	10	19	23	19	20	9	0	9	8	17	0	11	6	29
AICD without/with atopy (III/VII)	27 (20)	11	16	21	12	13*	13*	10	9	6	23	2	8	10	27
Idiopathic CHE (IV)	26 (19)	13	13	20	9	21*	4*	16	0	0	0	0	0	0	8
Atopic CHE (VIII)	24 (17)	18	6	18	10	9	13	15	19	8	0	0	5	11	4

ACD, allergic contact dermatitis; AICD, combined allergic and irritant contact dermatitis; CHE chronic hand eczema; ICD, irritant contact dermatitis. *Five patients were not able to give information on time course of their CHE.

Excessive water or irritant contact was reported by all patients diagnosed with ICD (II, VI; 29/29; 100%) or combined AICD (III, VII; 27/27; 100%), whereas in the idiopathic CHE group (IV), excessive water contact was reported by only 8 of the 26 patients (30.77%) (Table 4). All eight patients also had plantar eczema, which could not be explained by cumulative toxic skin exposure.

In accordance with the definition, all patients with ACD (31/31; 100%) or combined AICD (27/27; 100%) had relevant contact allergies (Table 4). Slightly more patients with atopic CHE (11/24; 45.83%) or combined AICD (10/27; 37.04%) had increased IgE levels compared with those with the other CHE subtypes. Positive prick testing results were present in fewer patients with ACD (4/31; 12.90%) than in those of the other subtypes. Itching was a common feature of all CHE subtypes (Table 4).

Discussion

To simplify the diagnostic classification of CHE, we developed a diagnostic algorithm, which integrates formerly approved classifications[7] and diagnostic criteria into a comprehensive decision model. Using this algorithm, CHE was categorized in our patients according to clinical and morphological features and causative factors. The analysis showed that patient history, clinical examination and laboratory investigations are all required for a precise diagnosis, taking into account history of irritant and allergen exposure, clinical signs or stigmata of atopy, results of patch and prick testing, serum IgE levels, foot involvement and morphology. When these criteria were arranged in a decision tree, eight main subtypes of CHE emerged: ACD without or with atopy (types I and V; present in 23% of the patients), ICD without or with atopy (types II and VI; 21%) and combined AICD without or with atopy (types III and VII; 20%), idiopathic (type IV; 19%) and atopic (type VIII; 17%) CHE. Using this algorithm, we could clearly assign each patient to one of these CHE subtypes. When clinical morphology was added as a descriptive feature (hyperkeratotic–rhagadiform, dyshidrotic or a mixed pattern CHE), certain CHE subtypes seemed to be preferentially associated with particular clinical features. For example, CHE due to irritant contact dermatitis rarely developed a dyshidrotic phenotype, whereas in contact allergy, a mixed pattern of dyshidrotic and hyperkeratotic lesions predominated.

Our investigation also raised the question how to name CHE in patients with unclear aetiology. In these

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cases, atopy is lacking, contact allergies and contact with water or irritants are absent or inconclusive, and morphology is only a descriptive feature. This subtype may be called idiopathic CHE. It may also be the diagnosis for patients with CHE with foot involvement in the absence of other causative factors, which could explain eczema development in this location. 'Idiopathic' reflects the fact that the origin of this CHE subtype cannot yet be explained by known aetiological aspects. Foot involvement in nonatopic nonallergic CHE may reflect a particular genetic predisposition independent from allergic, atopic or irritant factors. Interestingly, idiopathic CHE largely presented with hyperkeratotic–rhagadiform morphology.

Thus, the algorithm presented here provides a clear decision tool for diagnosing CHE in clinical practice. At the same time, it may help to define subtypes resulting from causes other than contact allergy, irritant damage or atopy.[19–27] We suggest that this algorithm might serve as a diagnostic tool in clinical practice, assigning each patient to a particular CHE subtype, and may also advance the classification and nomenclature of CHE, allowing a more precise analysis of therapeutic outcomes and prognostic perspectives.

What's already known about this topic?

- Classification of chronic hand eczema is complicated, because of its aetiological and morphological heterogeneity.
- Especially in daily clinical practice where diagnostic differences influence therapeutic decisions, a clear distinction of hand eczema subtypes is necessary.

What does this study add?

- A short and new graphical algorithm that is useful as a clear decision tool for diagnosing chronic hand eczema in clinical practice.

References

1 Coenraads PJ. Hand eczema is common and multifactorial. *J Invest Dermatol* 2007; **127**: 1568–70.
2 Agner T, Andersen KE, Brandao FM *et al.* Hand eczema severity and quality of life: a cross-sectional, multicentre study of hand eczema patients. *Contact Dermatitis* 2008; **59**: 43–7.
3 Veien NK, Menné T. Treatment of hand eczema. *Skin Therapy Lett* 2003; **8**: 4–7.
4 Veien NK, Hattel T, Laurberg G. Hand eczema: causes, course, and prognosis II. *Contact Dermatitis* 2008; **58**: 335–9.
5 Veien NK, Hattel T, Laurberg G. Hand eczema: causes, course, and prognosis I. *Contact Dermatitis* 2008; **58**: 330–4.
6 Meding B, Alderling M, Albin M *et al.* Does tobacco smoking influence the occurrence of hand eczema? *Br J Dermatol* 2009; **160**: 514–18.
7 Diepgen TL, Andersen KE, Brandao FM *et al.* Hand eczema classification: a cross-sectional, multicentre study of the aetiology and morphology of hand eczema. *Br J Dermatol* 2009; **160**: 353–8.
8 Meding B, Swanbeck G. Consequences of having hand eczema. *Contact Dermatitis* 1990; **23**: 6–14.
9 Hald M, Berg ND, Elberling J, Johansen JD. Medical consultations in relation to severity of hand eczema in the general population. *Br J Dermatol* 2008; **58**: 773–7.
10 Diepgen TL, Agner T, Aberer W *et al.* Management of chronic hand eczema. *Contact Dermatitis* 2007; **57**: 203–10.
11 Lerbaek A, Kyvik KO, Ravn H *et al.* Clinical characteristics and consequences of hand eczema – an 8-year follow-up study of a population-based twin cohort. *Contact Dermatitis* 2008; **58**: 210–16.
12 Bryld LE, Hindsberger C, Kyvik KO *et al.* Risk factors influencing the development of hand eczema in a population-based twin sample. *Br J Dermatol* 2003; **149**: 1214–20.
13 Hanifin JM, Rajka G. Diagnostic features of atopic dermatitis. *Acta Derm Venereol* 1980; **92**: 44–7.
14 Andersen KE, White IR, Goossens A. Allergens from the standard series. In: *Contact Dermatitis*, 4th edn (Frosch PJ, Menne T, Lepoittevin JP, eds). Berlin: Springer, 2006: 453–92.
15 Keogh SJ, Gawkrodger DJ. Persistent post-occupational dermatitis: report of five cases. *Acta Derm Venereol* 2006; **86**: 248–9.
16 Nielsen NH, Linneberg A, Menné T *et al.* The association between contact allergy and hand eczema in 2 cross-sectional surveys 8 years apart. *Contact Dermatitis* 2002; **47**: 71–7.
17 Lerbaek A, Kyvik KO, Mortensen J *et al.* Heritability of hand eczema is not explained by comorbidity with atopic dermatitis. *J Invest Dermatol* 2007; **127**: 1632–40.
18 Meding B, Wrangsjö K, Järvholm B. Hand eczema extent and morphology – association and influence on long-term prognosis. *J Invest Dermatol* 2007; **127**: 2147–51.
19 Lerbaek A, Kyvik KO, Ravn H *et al.* Incidence of hand eczema in a population-based twin cohort: genetic and

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environmental risk factors. *Br J Dermatol* 2007; **157**: 552–7.
20 Stutz N, Becker D, Jappe U *et al.* Nurses' perceptions of the benefits and adverse effects of hand disinfection: alcohol-based hand rubs vs. hygienic handwashing: a multicentre questionnaire study with additional patch testing by the German Contact Dermatitis Research Group. *Br J Dermatol* 2009; **160**: 565–72.
21 Lind ML, Albin M, Brisman J *et al.* Incidence of hand eczema in female Swedish hairdressers. *Occup Environ Med* 2007; **64**: 191–5.
22 Montnémery P, Nihlén U, Löfdahl CG *et al.* Prevalence of hand eczema in an adult Swedish population and the relationship to risk occupation and smoking. *Acta Derm Venereol* 2005; **85**: 429–32.
23 Skoet R, Olsen J, Mathiesen B *et al.* A survey of occupational hand eczema in Denmark. *Contact Dermatitis* 2004; **51**: 159–66.
24 Heydorn S, Menné T, Johansen JD. Fragrance allergy and hand eczema – a review. *Contact Dermatitis* 2003; **48**: 59–66.
25 Kang YC, Lee S, Ahn SK, Choi EH. Clinical manifestations of hand eczema compared by etiologic classification and irritation reactivity to SLS. *J Dermatol* 2002; **29**: 477–83.
26 Thomson KF, Wilkinson SM, Sommer S, Pollock B. Eczema: quality of life by body site and the effect of patch testing. *Br J Dermatol* 2002; **146**: 627–30.
27 Meding B, Wrangsjö K, Järvholm B. Fifteen-year follow-up of hand eczema: persistence and consequences. *Br J Dermatol* 2005; **152**: 975–80.

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