

Efficacy of New Barrier Socks in the Treatment of Foot Allergic Contact Dermatitis

Monica Corazza, Federica Baldo, Michela Ricci, Oriele Sarno and Anna Virgili

Department of Clinical and Experimental Medicine, Section of Dermatology, University of Ferrara, via Savonarola, n°9, IT-44100 Ferrara, Italy. E-mail: czm@unife.it

Accepted March 30, 2010.

The prevalence of allergic shoe dermatitis in patch-tested patients for foot dermatitis is reported in the literature to be in the range 3–24.2% (1, 2). It affects both sexes and any age group, including children.

The most common shoe allergens reported are potassium dichromate, p-tertiary butylphenol formaldehyde resin, rubber chemicals and dyes present in leather tanning, rubber processing and adhesives. As nickel sulphate may be present in shoe buckles and studs, this may be considered a further shoe allergen (1–8). The warm and humid environment within the shoe provides an ideal situation for the development of allergic contact dermatitis (ACD), favouring both allergen dissemination and skin absorption.

The first step in treating ACD is the removal of exposure to the causative allergens, but, for social, environmental or professional reasons (e.g. safety footwear or uniform), this may be difficult in the case of foot ACD.

Textile engineering has recently developed socks made of a technological fabric Microair® barrier (Alpretec, Venice, Italy), a three-layer fabric designed to provide a physical barrier to allergens and irritants as well as high perspirability (9). The two external layers are made of a polyester microfibre with piqué construction (fabric with a raised woven design) and the internal layer is made of a microporous membrane. This membrane is reported by the manufacturer to provide the fabric with total impermeability to liquids, ions and gas, and high wicking due to very high water vapour transmission rate (1062 g/m²/24 h).

We studied the efficiency of these devices in a selected group of patients affected by ACD to footwear allergens.

MATERIALS AND METHODS

Patients with ACD of the feet due to shoe allergens, confirmed by epicutaneous tests, were enrolled in the study. Only relevant positive reactions to patch test were taken into consideration for inclusion criteria.

Nine female patients with foot ACD were enrolled in the study. Their mean age was 46 years (age range 13–62 years) (Table I). Six out of nine patients were affected by chronic foot eczema; the dorsum of the foot was always involved. The patients were non-atopic and did not have other dermatoses. The mean duration of the disease was 70 months (range 4–360 months).

Eight patients were poly-sensitized; one patient was exclusively allergic to potassium dichromate. The positive allergens were potassium dichromate (8 out of 9 patients), cobalt chloride (5 patients), nickel sulphate (5 patients), colophony (2 patients), disperse blue 124 (1 patient), thiuram mix (1 patient) (Table I). All the patients had been recently patch-tested at time of enrolment and they were not aware of their allergy prior to the test; therefore no precautions to avoid exposure to the allergens had been instigated.

On initial evaluation, ACD was classified as acute (erythema, oedema and vesicles), subacute (less oedema, papules, scaling), and chronic (scaling, skin fissuring and lichenification), according to the clinical pattern. For 8 weeks patients were asked to wear their own shoes only in association with Microair® barrier socks. No topical drugs were applied, except for emollients, if necessary.

The assessment of clinical severity was performed by two dermatologists at the enrolment examination and at each further control (first control after 4 weeks, second and last after 8 weeks) using a decimal visual analogue scale (VAS). Investigators asked patients to quantify separately, from 0 to 10, itch, soreness/pain, and inability to walk due to foot eczema. A total final score was obtained adding each numeric parameter (maximum score 30).

Investigators took photographs of the lesions at enrolment and during follow-up under the same environmental conditions. Images were compared by the same investigators.

Table I. Characteristics of enrolled patients and results of the trial

Pat. No.	Age (years)	Foot location	Clinical pattern	Duration of ACD (months)	Clinical severity (VAS)	Clinical severity (VAS)		
						Baseline	4 weeks	8 weeks
1	62	Dorsum, instep	Chronic	60	PD, p-tbfr, DB	9	3	0
2	40	Dorsum, heel	Chronic	4	PD, CoCl ₂	19	16	12
3	37	Dorsum, plant	Chronic	360	PD, Thiuram 1%, NiSO ₄ , CoCl	18	12	5
4	59	Dorsum	Chronic	12	PD, Colophony 20%	10	6	2
5	41	Dorsum	Subacute	156	PD, NiSO ₄ , CoCl ₂	23	7	25
6	59	Dorsum	Acute	6	PD, Colophony 20%, NiSO ₄ , CoCl ₂	26	15	5
7	13	Dorsum, toes	Acute	12	PD	22	9	12
8	52	Dorsum, toes	Chronic	18	PD, NiSO ₄	12	8	2
9	48	Dorsum, toes	Chronic	6	NiSO ₄ , CoCl ₂ , p-tbfr	10	4	0

ACD: allergic contact dermatitis; VAS: visual analogue scale; PD: potassium dichromate 0.5%; p-tbfr: p-tert-butylphenol-formaldehyde resin 1%; DB: disperse blue 124 1%; CoCl₂: cobalt chloride 1%; NiSO₄: nickel sulphate 5%.

RESULTS

After 8 weeks patients reported a reduction in itch in 6 out of 9 cases (66%) and a decrease in pain in 7 out of 9 cases (77%). All patients reported an improvement in their ability to walk.

By week 4 the symptom average score (total score divided by the number of patients) decreased from 17 to 9 by the same week (Fig. 1).

At the end of the study, patients reported a further relief of subjective symptoms and disturbances, achieving a reduction of 58% in the symptoms total score (from 149 to 63).

Two patients (patient numbers 5 and 7) showed only a slight improvement followed by an aggravation of the symptoms during the last 4 weeks of therapy. These patients admitted a sporadic, but not strict, adherence to the protocol after the first month.

The comparative photographic examination revealed a reduction in eczematous lesions in 7 out of 9 patients (77%) at 8 weeks.

Six out of 9 (66%) patients declared that it was difficult to always wear Microair® barrier socks, both for social reasons and/or discomfort.

DISCUSSION

Previous studies have reported improvements in skin lesions in eczematous diseases (atopic dermatitis, ACD) with the use of barrier textiles (9). For example, two studies of patients with atopic dermatitis demonstrated that the use of a special silk fabric reduced the severity of symptoms due to the barrier effect and possible antibacterial activity (10–12). It is often very difficult to avoid exposure to a specific shoe allergen due to lack of information about all the materials present in shoes, and because people are sometimes required to wear safety footwear or uniforms even if they contain allergens.

This study shows the therapeutic efficacy of newly-developed allergen-proof fabric socks (Microair® barrier socks) in patients who were sensitized to shoe allergens. After 2 months of treatment good clinical results were obtained, showing improvement in symptoms and recovery from foot eczema. The best results were observed in those patients who followed the protocol strictly, wearing the socks every time they wore shoes.

The limitations of the present study are the relatively small study population, the open design and the absence of a control group.

Conflict of interest: The authors report no conflict of interest. The study was not sponsored by Alpretec, who only kindly provided the socks.

REFERENCES

1. Chowdhuri S, Ghosh S. Epidemio-allergological study in 155 cases of footwear dermatitis. *Indian J Dermatol Venereol Leprol* 2007; 73: 319–322.



Fig. 1. Clinical evaluation at week 0 (W0) and 8 (W8) (end of study) in Case No. 3.

2. Nardelli A, Taveirne M, Drieghe J, Carbonez A, Degreef H, Goossens A. The relation between the localization of foot dermatitis and the causative allergens in shoes: a 13-year retrospective study. *Contact Dermatitis* 2005; 53: 201–206.
3. Holden CR, Gawkrödger DJ. 10 years' experience of patch testing with a shoe series in 230 patients: which allergens are important? *Contact Dermatitis* 2005; 53: 37–39.
4. Oztas P, Polat M, Cinar L, Allı N. Shoe dermatitis from para-tertiary butylphenol formaldehyde. *Contact Dermatitis* 2007; 56: 294–295.
5. Trattner A, Farchi Y, David M. Shoe contact dermatitis in Israel. *Am J Contact Dermatitis* 2003; 14: 12–14.
6. Van Coevorden AM, Coenraads PJ, Pas HH, van der Valk PG. Contact allergens in shoe leather among patients with foot eczema. *Contact Dermatitis* 2002; 46: 145–148.
7. Warshaw EM, Schram SE, Belsito DV, DeLeo VA, Fowler JF Jr, Maibach HI, et al. Shoe allergens: retrospective analysis of cross-sectional data from the North American contact dermatitis group, 2001–2004. *Dermatitis* 2007; 18: 191–202.
8. Rani Z, Hussain I, Haroon TS. Common allergens in shoe dermatitis: our experience in Lahore, Pakistan. *Int J Dermatol* 2003; 42: 605–607.
9. Borghesan F, Bellotti M. Use of new “barrier socks” in contact allergic dermatitis. *Eur Ann All Clin Immunol* 2007; 39: 202–203.
10. Ricci G, Patrizi A, Benandini B, Menna G, Varotti E, Masi M. Clinical effectiveness of a silk fabric in the treatment of atopic dermatitis. *Br J Dermatol* 2004; 150: 127–131.
11. Ricci G, Patrizi A, Mandrioli P, Specchia F, Medri M, Menna G, et al. Evaluation of the antibacterial activity of a special silk textile in the treatment of atopic dermatitis. *Dermatology* 2006; 213: 224–227.
12. Giménez-Arnau A, Silvestre JF, Mercader P, De la Cuadra J, Ballester I, Gallardo F, et al. Shoe contact dermatitis from dimethyl fumarate: clinical manifestations, patch-test results, chemical analysis, and source of exposure. *Contact Dermatitis* 2009; 61: 249–260.