

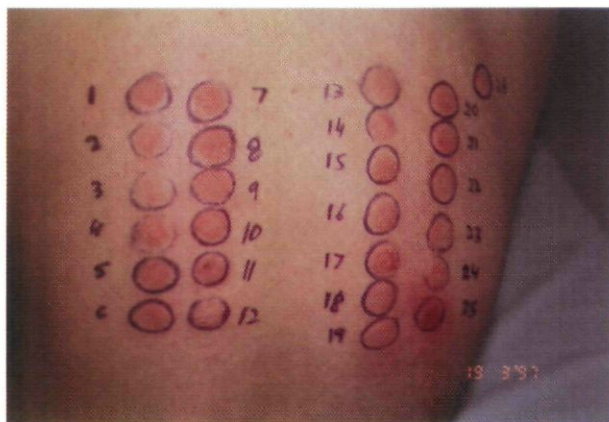


Fig. 1. Patch test results on D2.

ically, he was treated for trichomoniasis and moniliasis without improvement. He was then patch tested with newly-introduced CODFI (Contact and Occupational Dermatoses Forum of India) allergens, plus cetrimide and chloroxylenol, using aluminium chambers on Micropore®. On D2, all the tests showed positive reactions of varying intensity (Fig. 1). On D4, all the tests were still positive, though a few of them showed reactivity mainly at the rim margin, including an aqueous control.

The patient was retested after 15 days with nitrofurazone 1%, paraben mix 15%, cetrimide 0.5%, polyethylene glycol 400 as is, propylene glycol 2% aq., aluminium sulfate and aluminium chloride, both 2% aq. The patches were applied without chambers, using filter paper, gauze and Micropore®; ++ reactions were given to both aluminium salts, while cetrimide showed a +++ reaction and nitrofurazone a + reaction. Other tests were negative.

Discussion

Contact sensitization to uninjected aluminium is a rarity (1, 2). The typical route of sensitization is the injection of aluminium-adsorbed vaccines and such children may present with a granulomatous nodule at the site (3, 4). Application of antiperspirants and topical medicaments can also lead to allergic contact dermatitis (2, 5, 6). Most often, the diagnosis is made accidentally during patch testing (2, 5–8), and rim margin reactivity has been seen in most instances.

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Allergic contact dermatitis from oxidized *d*-limonene

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Key words: allergic contact dermatitis; patch test; oxidized *d*-limonene; occupational; mechanic; hand cleanser. © Munksgaard, 1997.

d-limonene, the main constituent of the volatile oil of citrus fruits, is produced mainly from citrus peel by pressing and distillation. The distillate (peel oil) contains more than 90% *d*-limonene. *d*-limonene has been widely used in fragrances and flavorings in low concentrations. Recently, solvents with a high content of *d*-limonene have been used increasingly in industry and the home, instead of chlorinated hydrocarbons, chlorofluorocarbons and other toxic organic solvents. Products containing as much as 95% *d*-limonene are used for degreasing

metal before industrial painting and for cleaning assemblies, as well as for a hand cleanser. *d*-limonene is supposedly regarded as "natural, harmless" and "environmental friendly".

Case Report

A 42-year-old male mechanic with chronic hand eczema was patched to an extended standard Series, using 8-mm Finn Chambers on Scanpor tape (Epitest Ltd Oy,

Table 1. The rate of positive reaction to oxidized *d*-limonene on patch testing

Ref.	Study population	Patch test materials	n	Positive rate
Meding et al. (5)	car mechanics with hand eczema	oxidized <i>d</i> -limonene 5% pet.	105	2/105 (1.9%)
Karlberg & Doooms-Goossens (6)	patch test patients	oxidized <i>d</i> -limonene 2%, 3%, or 5% pet.	2800	49/2800 (1.8%)
		<i>d</i> -limonene hydroperoxides 0.5% or 1% pet.	1554	23/1554 (1.5%)
Chang et al.	patch test patients	oxidized <i>d</i> -limonene 2% pet.	88	2/88 (2.3%)

Finland). The patches were applied to the back for 2 days and read at 4 days. He had ++ reactions to oxidized *d*-limonene 2% and 1% pet.. Upon discontinuing the use of his *d*-limonene hand cleanser, his hand eczema resolved.

Discussion

Karlberg et al. (1) have done extensive research on *d*-limonene. In guinea pigs, *d*-limonene of high purity gave no significant allergic reaction, while *d*-limonene exposed to air for 2 months sensitized animals. Gas chromatographic analyses indicated that the content of limonene oxide in *d*-limonene increased with prolonged air exposure (1). Some oxidation products of *d*-limonene, R(-)-carvone and a mixture of cis and trans isomers of (+)-limonene oxide, and hydroperoxides in oxidized *d*-limonene, were identified as potent contact allergens (2, 3). The addition of the antioxidant butylated hydroxytoluene (BHT) prevented autooxidation of *d*-limonene for periods depending on the purity of *d*-limonene and room temperature (4). Cold storage in closed vessels was recommended to avoid prolonged air exposure and oxidation of *d*-limonene which enhance sensitization.

105 car mechanics with hand eczema were patch tested to a standard series and a special car mechanics series: 2 reacted to oxidized *d*-limonene (5). A study performed in Stockholm and Belgium showed that, among dermatitis patients, 1.1% to 2.4% reacted to oxidized *d*-limonene, and 0.9% to 2.8% reacted to *d*-limonene hy-

droperoxide on patch testing (6). In our screening, 2 of 88 patients (2.3 %) reacted to oxidized *d*-limonene; probable relevance was documented in 1 (this case report). The rates reported of positive reaction to oxidized *d*-limonene on patch testing are shown in Table 1. With the increasing use of *d*-limonene, dermatologists might consider adding oxidized *d*-limonene to a hand eczema series.

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The provocative use test (PUT) [repeated open application test (ROAT)] in topical corticosteroid allergic contact dermatitis

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Allergic contact dermatitis from corticosteroids has been found in 2% to 6% of patients attending contact dermatitis clinics (1-5). Cross-reactions occur more frequently within the same structural group (6-7), which is supported by conformational analysis (8).

Case Report

A 46-year-old woman had eczema of lower limbs, hands, and hips recalcitrant to treatment intermittently for years. Flare-up of dermatitis was noted after taking oral

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