

Contact dermatitis caused by dimethyl fumarate in wallets

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Dimethyl fumarate (DMF; CAS 624-49-7) has been responsible for clusters of severe contact dermatitis cases related to furniture and footwear in Europe. Allergic contact dermatitis caused by DMF in a piece of clothing has also been reported (1–3).

Case Reports

Case 1

A 30-year-old male presented with an inflammatory plaque on the posterior thigh region (Fig. 1) that developed two days after he started carrying a new wallet in the



Fig. 1. Patient 1. The lesion consisted of an erythematous–oedematous, sharply demarcated plaque, with violaceous areas and vesicles on its surface, measuring several centimetres in diameter.

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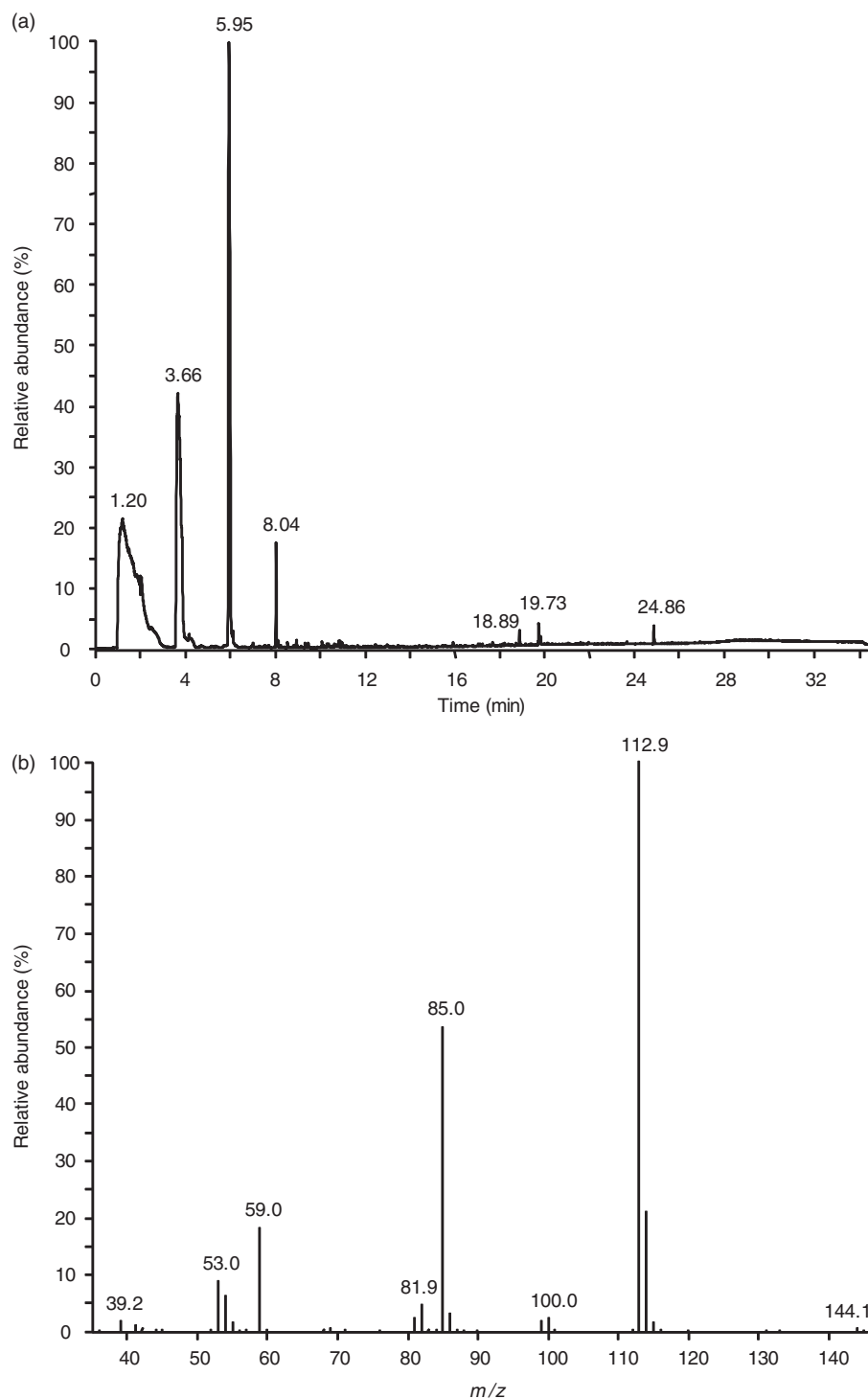


Fig. 2. Gas chromatography–mass spectrometry (GC-MS) chromatogram of a sample obtained in the static headspace (a), and the mass spectrum for the chromatographic peak at 8.04 min (b). Chemical analysis: a static headspace sampling procedure was applied. A thin slide of the outer surface of the wallet material was excised with a scalpel. Approximately 0.1 g of the sample was transferred into a 2-ml vial, which was sealed with hole caps and a polytetrafluoroethylene (PTFE)-faced silicone septum. The sample was then heated for 5 min in a thermostatic bath at 75°C. One millimetre of the gas obtained in the headspace was extracted with a gas-sealed syringe, and injected into a gas chromatograph coupled with a mass spectrometer. (a) The GC-MS chromatogram relevant to the analysis of an excised wallet sample. One of the main chromatographic peaks ($t_R = 8.04$ min) was attributed to dimethyl fumarate by matching the relevant MS spectrum (b) against those present in the National Institute of Standards and Technology database. The analysis process was duplicated. GC parameters: carrier gas, helium at a constant flow rate of 1 ml/min; transfer line temperature, 300°C; injection mode splitless, 1 min; injection volume, 1 ml; injector temperature, 250°C; oven temperature program, 35°C (for 2 min), increased to 300°C (10 min) at 10°C/min. MS conditions: ionization source, electronic impact; source temperature, 300°C; ionizing energy, 70 eV; analyser, triple quadrupole; recording mode, 'full scan' (between 35 and 200 m/z). Materials and instrumentation: PTFE luer lock syringes of the brand Dynatech Precision Sampling (Restek Corporation, Bellefonte, PA, USA); capillary column for GC, HP5-MS, 30 m $\times$ 0.25 mm internal diameter, film thickness 0.25 μ m (J & W, Folsom, CA, USA); GC/MS system, TSQ Quantum XLS (Thermo Fisher Scientific Inc., Waltham, MA, USA).

back pocket of his trousers. A few hours after moving the wallet into his front pocket, he noticed the appearance of a new lesion on the anterior aspect of his thigh, with a shape that mirrored the silhouette of the wallet. Histopathological investigation showed a spongiotic psoriasiform superficial perivascular dermatitis with lymphocyte exocytosis, papillary dermis oedema and an intense infiltrate composed of lymphocytes and eosinophils involving both the perivascular and the interstitial spaces of the dermis. Keratinocyte necrosis was also noted, involving both individual cells and aggregates of cells at all levels of the epidermis, some of them surrounding the acrosyringium.

Patch tests with the Spanish Contact Dermatitis Research Group baseline series (GEIDAC) and shoe series gave negative results. However, patch tests with DMF 0.01% pet. and a sample taken from the wallet were positive (++ and + + +, respectively) at the readings performed on D2 and D4.

Qualitative chemical analysis by gas chromatography–mass spectrometry confirmed the presence of DMF on the wallet (Fig. 2).

Case 2

A 49-year-old male presented with an acute dermatitis involving the external sides of both hips (Fig. 3). The areas had been in contact with, respectively, a wallet and a cardholder, both made of leather, that he had carried in his trouser pockets one week before presentation. Patch tests with the baseline series of the GEIDAC and the shoe series gave negative results at readings performed at D2, D4, and D7, but patch tests with fragments of the wallet, cardholder, DMF 0.1% pet. and DMF 0.005% pet. gave positive results.

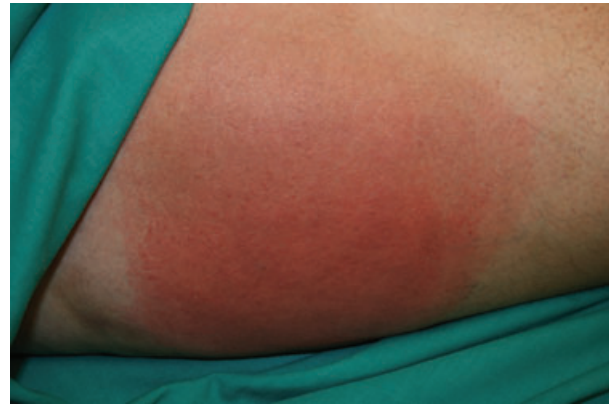


Fig. 3. Patient 2. A painful inflammatory acute reaction with significant oedema involving the external side of the right hip.

Discussion

This is the first time that a wallet has been reported to be a source of exposure to DMF and a cause of contact dermatitis resulting from this chemical compound. These cases were both diagnosed at the beginning of 2009. Later that year, the European Commission banned goods contaminated with DMF from being marketed in or imported into the EU (4), which is why it is unlikely that we will see similar cases in the future, although the possibility of isolated cases remains, owing to illegal importation or the purchase of products outside of the EU.

Histopathological investigations showed features of both an allergic and an irritant contact dermatitis (5). This was consistent with what has previously been described in the literature: DMF triggers an intense toxic reaction that is commonly complicated by sensitization, often occurring immediately after the initial exposure.

References

- 1 Lamintausta K, Zimerson E, Hasan T et al. An epidemic of furniture-related dermatitis: searching for a cause. *Br J Dermatol* 2010; **162**: 108–116.
- 2 Silvestre J F, Toledo F, Mercader P, Giménez-Arnau A. A summary of shoe allergic contact dermatitis caused by dimethylfumarate in Spain. *Contact Dermatitis* 2011; **65**: 115–123.
- 3 Foti C, Zambonin C G, Cassano N, Aresta A, Damascelli A, Ferrara F, Vena G A. Occupational allergic contact dermatitis associated with dimethylfumarate in clothing. *Contact Dermatitis* 2009; **61**: 122–124.
- 4 European Commission. Commission Decision 2009/251/EC requiring Member States to ensure that products containing the biocide dimethylfumarate are not placed or made available on the market. *Off J Eur Union* 2009; **L74**: 32–34. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:074:0032:0034:EN:PDF>.
- 5 Ackerman A B, Mendonça A M N, Guo Y. Allergic contact dermatitis versus irritant contact dermatitis. In: *Differential Diagnosis in Dermatopathology I*, 2nd edition, Ackerman A B, Mendonça A M N, Guo Y (eds); Malvern, Pennsylvania, Lea & Febiger, 1992; pp. 14–17.