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Severe intractable eyelid dermatitis probably caused by exposure to hydroperoxides of linalool in a heavily fragranced shampoo

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Air-oxidized linalool, and specifically the hydroperoxides of linalool, have been recognized as a frequent cause of fragrance contact allergy (1–3), but also as giving a relatively high proportion of irritant reactions (4). Thus, when the only positive patch test response observed is to hydroperoxides of linalool, there may be uncertainty about the clinical relevance of this singular finding. We present a case, with follow-up and chemical analysis, which suggests that a solitary positive patch test reaction to hydroperoxides of linalool can indeed be the one critical clue needed to resolve a patient's dermatitis.

Case Report

A 7-year-old atopic girl with a 6-month history of a severely pruritic, burning, oozing eruption confined to her eyelids was referred to our patch test clinic. The patient's mother was a highly motivated, knowledgeable medical professional who had been assiduously protecting her daughter from all products known to contain fragrances or other common contact sensitizers. The patient was under the care of a paediatric dermatologist, but topical therapy with corticosteroids and calcineurin inhibitors had yielded almost no benefit.

Examination revealed erythematous, eczematous lichenified plaques on both upper and lower eyelids, with

extensive serous crusts (Fig. 1a and b). The patient underwent patch testing with IQ Ultra[®] chambers and hapten preparations from Chemotechnique Diagnostics (Vellinge, Sweden). Sixty haptens were used in testing, including a subset of the North American Comprehensive Series plus hydroperoxides of limonene and linalool [see File S1 for a list of the 60, which included methylchloroisothiazolinone (MCI)/methylisothiazolinone (MI) and MI]. The only positive reaction was to hydroperoxides of linalool, with a weak 1+ reaction on day (D) 2 and a clear 1+ reaction on D4 (crescendo reaction). As the patient was apparently already avoiding all fragrances, we were not able to provide any specific recommendations.

One week later, the patient's mother provided new information: every Thursday evening, the child's nanny gave the patient her shower, whereas all other showers/baths were supervised by the parents. Unbeknownst to the mother, the nanny always chose to give the patient her father's PERT PLUS[®] 2 in 1 Shampoo and Conditioner (see File S1 for details), instead of the child's usual fragrance-free shampoo and conditioner. The patient's mother removed the bottle of PERT PLUS[®] shampoo from the household (delivering it to our research office for further analysis), and insisted that the nanny use only the fragrance-free shampoo on her daughter. Three months later, the patient's eyelid dermatitis had completely resolved, owing to this single intervention (Fig. 1c and d).

The patient refused to undergo repeated open application testing with a diluted sample of the shampoo, but, because we had the suspect bottle of shampoo in hand, we were able to perform chemical analysis directly on the contents.

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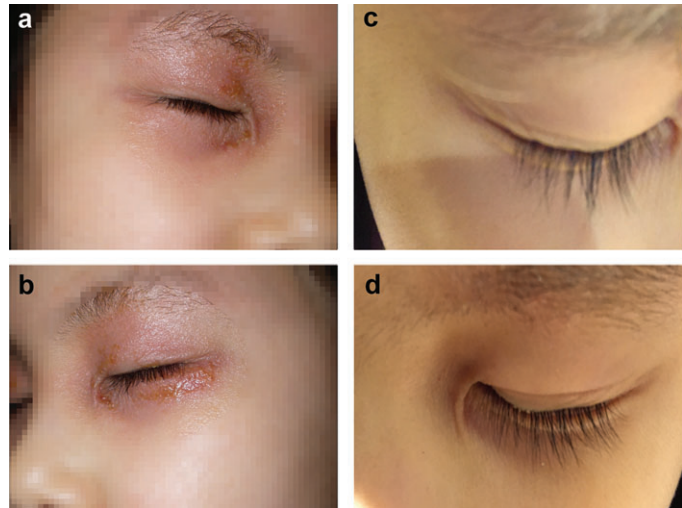


Fig. 1. Photographs of the patient's eyelids taken just prior to application of patches (a and b) and 3 months later (c and d). In (a) and (b), normal skin surrounding the affected area has been pixelated to help conceal the patient's identity, as requested by the patient's mother.

Discussion

Review of the ingredients list on the bottle of PERT PLUS® shampoo indicated that our patch testing had ruled out contact allergy to the majority of frequent contact allergens contained in the product, for example MCI/MI. However, 'parfum' (North American labelling) had possibly been implicated. To further characterize the nature of the 'parfum', we performed static headspace gas chromatography–mass spectrometry analysis directly on an aliquot of the shampoo, which showed that it contained easily detectable amounts of linalool and the major linalool oxide [the furan derivative: 2-(5-methyl-5-vinyltetrahydrofuran-2-yl)propan-2-ol]. An aliquot of the shampoo was sent from Edmonton to Stockholm, where liquid chromatography–mass spectrometry analysis showed that it contained 87 µg/g linalool (Relative Standard Deviation [RSD] 4%), 0.8 µg/g linalool oxide (the furan derivative) (RSD 3%), and 0.2 µg/g linalool hydroperoxides (RSD 9%) (see File S1 for detailed methods and corroborating results).

Although not conclusive, our results strongly suggest that hydroperoxides of linalool present in the shampoo were a critical factor contributing to this patient's eyelid dermatitis.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

File S1. Details of haptens used in patch testing, ingredients listed on the shampoo bottle, and analytical chemistry methods utilized and results obtained.

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