

Allergic contact dermatitis resulting from cetyl PEG/PPG-10/1 dimethicone in a deodorant cream

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Deodorants may cause allergic contact dermatitis resulting from a variety of allergens, such as fragrances, preservatives, plant extracts, and other components (1–5). The moist and occluded environment of the axillae, the presence of hair follicles and shaving enhance the penetration of the allergen, increasing the sensitization risk (1). Contact dermatitis caused by cetyl PEG/PPG 10/1-dimethicone is described for the first time, following the use of a deodorant.

Case Report

A 47-year-old male, non-atopic patient, working as an ambulance driver, developed a symmetric erythematous



Fig. 1. Symmetrical erythematous rash involving both axillae and the lateral sides of the trunk, and the patient's cream deodorant.

rash involving his armpits and the lateral trunk (Fig. 1). He related the reaction to a fireproof jacket that he had starting wearing at work a few weeks before that made him sweat profusely.

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Table 1. Patch test results

Tested series and products	Readings on D4 and D7 (readings on D2 all negative)
First step:	
Baseline GEIDAC ^a series ^b	Nickel sulfate (++)
Corticosteroid series ^c	Advance Sensitive Byly Deocream [®] deodorant 'as is' ^g (++)
Limone and linalool hydroperoxides series ^d	
Textile series ^e , polo shirt piece and fireproof jacket 'as is' (moistened with aq.)	
Personal care products 'as is' ^f	
Second step:	
Advance Sensitive Byly Deocream [®] deodorant ingredient combinations ^h	Cetyl PEG/PPG-10/1 dimethicone and pentaerythrityl tetra-di-t-butyl hydroxyhydrocinnamate (maximum 5%) (++)
Third step:	
Pentaerythrityl tetra-di-t-butyl hydroxyl hydrocinnamate ^h (0.1%, 0.5%, 1%, and 5% pet.) ⁱ	Protetrem suncare natural invisible 50 plus [®] (with cetyl PEG/PPG-10/1 dimethicone) 'as is' (++)
Sunscreen with cetyl PEG/PPG-10/1 dimethicone (Protetrem suncare natural invisible 50 plus [®]) 'as is'; head lice treatment lotion with dimethicone; propyleneglycol 5% aq. and 20% pet. ^k ; polyethyleneglycol 400 pet. ^e ; epichlorohydrin 0.1% pet. ^k and bisphenol A 1% pet. ^k	
Fourth step:	
Cetyl PEG/PPG-10/1 dimethicone ^l (5% and 30% pet.) ⁱ	(++)

^aGEIDAC: Spanish Contact Dermatitis Research Group.

^bBaseline series: TRUE Test[®] Series supplied by Allergeaze, SmartPractice (Calgary, Canada), and supplementary allergens supplied by Chemotechnique (Vellinge, Sweden).

^cCorticosteroid series supplied by Marti Tor[®] (Barcelona, Spain), AllergEaze[®] (Calgary, Canada) distributor in Spain, including methylprednisolone aceponate, mometasone furoate, prednicarbate, clobetasol propionate, betamethasone-17-valerate, and betamethasone-17,21-dipropionate.

^dLimone hydroperoxides (0.1%, 0.2% and 0.3% pet.) and linalool hydroperoxides (0.25%, 0.5% and 1% pet.; Chemotechnique).

^eChemotechnique.

^fRinse-off products were tested semi-open and leave-on products were patch tested normally.

^gBarberà del Vallès, Barcelona, Spain. Reapplied on D4, and elicited a ++ booster reaction on D3.

^hSupplied by the Advance Sensitive Byly Deocream[®] deodorant manufacturer. The other tested ingredients were cyclopentasiloxane polyglyceryl-4 isostearate, disodium lauriminodipropionate tocopheryl phosphates, hydrolysed silk, butylene glycol, phenoxyethanol, glycerin, and aluminium sesquichlorohydrate.

ⁱIn-house-diluted in the Guadalajara University Hospital Pharmacy Department.

^jFerrer Internacional, Barcelona, Spain.

^kAllergens supplied by AllergEaze[®].

^lCetyl PEG/PPG-10/1 dimethicone (Abil EM 90[®]; Evonik Goldschmidt, Essen, Germany) kindly provided by Ferrer Internacional, Barcelona, Spain.

Patch tests were performed as shown in Table 1, according to ESCD guidelines (6). Positive results were obtained with a cream deodorant on day (D) 4 and D7 (Advance Sensitive Byly Deocream[®]; Byly, Barberà del Vallès, Barcelona, Spain) tested 'as is' (Fig. 1). The patient mentioned applying this deodorant repeatedly to reduce his sweating. Seven controls showed negative test results with this product. The manufacturer provided combinations of ingredients for further patch testing, and only the combination of cetyl PEG/PPG-10/1 dimethicone and pentaerythrityl tetra-di-t-butyl hydroxyhydrocinnamate gave a positive result (maximum 5%). The manufacturer was further requested to provide these two components individually, but only pure pentaerythrityl tetra-di-t-butyl hydroxyhydrocinnamate, an antioxidant (CAS no. 6683-19-8), was supplied. Patch tests with this, diluted in house to 0.1%, 0.5%, 1% and 5% in pet., gave negative results. However, patch tests with a sunscreen lotion containing cetyl PEG/PPG-10/1 dimethicone (Protetrem suncare natural invisible 50 plus[®]; Ferrer Internacional, Barcelona, Spain) gave a

positive reaction (++) on D4 (Fig. 2). Further patch tests with cetyl PEG/PPG-10/1 dimethicone (Abil EM 90; Evonik Goldschmidt GmbH, Essen, Germany) 5% and 30% pet., prepared in house, kindly provided by Ferrer Internacional, gave a positive reaction on D4 (++) (Fig. 2). Five controls tested with the same dilutions had negative results.

Discussion

Cetyl PEG/PPG-10/1 dimethicone (INCI; molecular formula C₂₉H₆₈O₆Si₄; molecular weight 625.2) (7), a skin conditioner, emulsifier, and surfactant, is the copolymer of cetyl dimethicone and an alkoxyated derivative of dimethicone, containing an average of 10 mol of ethylene oxide and 1 mol of propylene oxide. This compound belongs to the group of alkoxy polysiloxane copolymers, which are frequently used in cosmetics because of their properties as hair conditioners, viscosity-increasing agents, emulsion stabilizers, and film formers (8).

Some of the trade names of cetyl PEG/PPG-10/1 dimethicone are: Abil[®] EM 90 (Evonik Goldschmidt;



Fig. 2. Positive patch test reactions to the combination of cetyl PEG/PPG-10/1 dimethicone and pentaerythrityl tetra-di-t-butyl hydroxyhydrocinnamate provided by the deodorant manufacturer, a sunscreen lotion containing cetyl PEG/PPG-10/1 dimethicone from a different brand, and in-house dilutions of cetyl PEG/PPG-10/1 dimethicone (5% and 30% pet.). Patch tests with in-house-diluted pentaerythrityl tetra-di-t-butyl hydroxyhydrocinnamate (0.1%, 0.5%, 1% and 5% pet.) gave negative results.

Biosil Basics® I-90 (Biosil Technologies, Allendale, NJ, USA); BRB 423® (BRB International Ittervoort, The Netherlands); Emulsil® S-290 (Innospec Performance Chemicals, Englewood, Colorado, USA); Mirasil® Balance (Bluestar Silicones, Lyon, France); and SeraSol® SC 83-E (KCC Beauty, Abingdon, UK). According to the Voluntary Cosmetic Registration Program (Food and Drug Administration), cetyl PEG/PPG-10/1 dimethicone was the ingredient of its kind with the third highest use in cosmetics (8). A survey conducted by the Personal Care Products Council showed that its maximum use concentrations (15% for eyebrow pencils and 13.6% for eye shadows) were the second highest of the ingredients of its kind (8).

Copolymers are generally supposed to have a low sensitization potential, because of their large size. However, several cases of contact dermatitis caused by them have already been published (Table S2 in File S1). It has been suggested that the hapten is not the copolymer itself, but an additive, impurity, residual monomer, byproduct, or degradation product (9). In particular,

cetyl PEG/PPG-10/1 dimethicone was not sensitizing to humans or guinea-pigs in maximization tests (8).

Corazza et al. systematically patch tested a population of 310 patients with an emulsifier series including cetyl PEG/PPG-10/1 dimethicone 30% pet., with negative results (10). Cross-reactions among copolymers in cosmetics have not been detected. Interestingly, our patient did not react to several related compounds, including propyleneglycol, polyethyleneglycol 400, and epichlorohydrin, the last of which has been proposed by some authors as a good marker of ethylene oxide sensitization (11). It is likely that sensitization to cetyl PEG/PPG-10/1 dimethicone is not attributable to residual ethylene oxide, at least in this case. A head lice treatment lotion containing dimethicone also gave a negative result.

In conclusion, we would like to raise awareness of the potential risks of copolymers in cosmetics, and particularly highlight the fact that cetyl PEG/PPG-10/1 dimethicone is able to sensitize. However, the risk appears to be low. The increased sweating and occlusion secondary to the use of an impermeable jacket probably played a role in

the sensitization of our patient. Testing with the patient's cosmetics and individual ingredients is indispensable to detect new allergens that would otherwise be overlooked if only commercial series were tested. We believe that both specialists and manufacturers should commit to this task.

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Supporting Information

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

File S1. Supporting information file.

Table S2. Copolymers reported to cause allergic contact dermatitis in cosmetic products.

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Online supplemental table 2. Copolymers reported to cause allergic contact dermatitis in cosmetic products.

Polyvinyl pyrrolidone (PVP)/hexadecene copolymer (1-5) PVP/eicosene copolymer (6-8) PVP/1-triacontene copolymer (9) Methoxy PEG-22/dodecyl glycol copolymer (10,11) Methoxy PEG-17/dodecyl glycol copolymer (12) PEG-22/dodecyl glycol copolymer (13) Phthalic anhydride/trimellitic anhydride/glycol copolymer (14-17) Polyvinyl methyl/maleic acid copolymer (18-22) Hydroxyethylacrylate/sodium acryloyltaurate copolymer (23) C30-38 oleofin/isopropyl maleate/MA copolymer (24,25) Polyester-8 (polycrylene) (26)
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