

Resorcinol: a strong sensitizer but a rare contact allergen in the clinic

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Resorcinol is a simple aromatic chemical (1,3-benzenediol) that has widespread use as a coupler in hair dyes and food, for example as an anti-browning agent in crustaceans (1), and, because of its antipruriginous, keratolytic and antifungal properties, in topical pharmaceutical products, such as Castellani paint. Moreover, it is present in certain skin markers. According to the local lymph node assay in mice, resorcinol has an EC3 value of 5.5% (2), and was classified as a moderate sensitizer, whereas, according to the Scientific Committee on Consumer Safety, it has an EC3 value of 1.4%, and was classified as a strong sensitizer (1). Here, we report our experience with patch testing (January 1990 to November 2015) with resorcinol 1% in petrolatum (pet.) in 1187 selected subjects: (i) as a part of the hairdressers' series, (ii) when it had been used topically, or (iii) to check for cross-reactivity. Only 5 positive patch test reactions were observed, and these cases will be discussed here.

Case Reports

All patients were tested with the baseline series (Trolab[®], Almirall Hermal GmbH, Reinbek, Germany) with van

der Bend chambers[®] (van der Bend, Brielle, The Netherlands) mounted on Micropore[®] (3M Health Care, Borken, Germany), and fixed with Mefix[®] (Mölnlycke Health Care, Göteborg, Sweden). The duration of exposure was 2 days, and readings were performed on day (D)2 and D4, according to European Society of Contact Dermatitis guidelines (3). The patients' characteristics, the patch tests performed and the results are shown in Table 1. Doubtful or irritant reactions were not observed.

Case 1

This patient consulted our department because of warts (verrucae vulgares) on the left foot and fingers. Treatment was performed with liquid nitrogen and a verrucide pharmaceutical preparation containing salicylic acid, phenol, β -naphthol, resorcinol, and thyme oil 10% wt/wt each in an ointment base. However, 1 month later, the patient consulted with strong itching, and vesicular and bullous eczema on the dorsal and lateral sides of all fingers, to which this preparation had been applied.

Case 2

The patient presented with a history of acute eczema around and in the ear since she had started to wear a new hearing aid a few months earlier. There had been no response to treatment with several ear drops. Previous patch testing had resulted in positive test reactions to potassium dichromate and formaldehyde, which had not been considered to be relevant to the patient's dermatitis. Now, the patient reacted to resorcinol monobenzoate

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Table 1. Patient characteristics, patch tests performed, and results per patient

	Year tested	Age (years)	Sex	Atopy history	Suspected source of sensitization	Patch tests performed (in addition to the European baseline series)	Positive patch test results
Case 1	1993	20	F	Personal/familial: + eczema, asthma	Verrucide pharmaceutical preparation (see text)	Ingredients of local preparation: Salicylic acid 5% pet. Phenol 1% aq. Thyme oil 5% ethanol Resorcinol 1% pet.	Nickel (–, D2; ++, D4) Cobalt (–, D2; +, D4) Resorcinol (–, D2; +, D4)
Case 2	1993	45	M	–	Hearing aid (cross-reaction)	Corticosteroid series Prosthesis series Scrapings from hearing aid Resorcinol 1% pet.	<i>Myroxylon pereirae</i> (++, D2 and D4) Resorcinol monobenzoate 1% pet. (+++; D2 and D4) Benzoyl peroxide 1% pet. (+ D2, ++ D4) Scrapings (–, D2; +, D4) Resorcinol (++, D2; not read on D4) Cooling fluid (50:50) (+, D2; ++, D4)
Case 3	1996	51	M	–	Cooling oil? (ingredients not known)	Oil series Own machine oil and cooling fluid (50:50 in water) Ingredients of Castellani paint: Fuchsine 2% pet., phenol 1% aq., boric acid 2% pet.	Resorcinol (+, D2; ++, D4) Resorcinol monobenzoate (+, D2 and D4)
Case 4	2000	37	F	–	Hair dye	Cosmetic series Trolab® hairdresser's series	Nickel (++, D2; +++, D4) Cobalt (+?, D2; ++, D4) PPD (++, D2; +++, D4) PTD (+, D2; +++, D4) Resorcinol (++, D2; +++, D4)
Case 5	2001	66	F	–	Hair dye	Trolab® hairdresser's series	Thiuram mix (+, D2; ++, D4) PPD (++, D4) Resorcinol (++, D4)

F, female; M, male; PPD, *p*-phenylenediamine; PTD, toluene-2,4-diamine.

and benzoyl peroxide, which are potential ingredients in the hearing aid (we were unable to obtain the exact composition from the manufacturer). We advised the patient to cover the hearing aid with silicone and to avoid direct contact with the skin; she did not attend for follow-up consultations, so we assume that her symptoms disappeared.

Case 3

This patient consulted with a 12-month history of an itching, erythematous and vesicular rash on the second and third fingers and dorsum of the right hand, spreading to the lower eyelids, forehead, and neck. Previous patch testing by a private dermatologist had shown a doubtful reaction to formaldehyde, but a positive reaction to a 'cooling fluid' used at the patient's workplace. His symptoms were significantly less pronounced when he was on holiday. However, ~1 week following the patch testing procedure, the patient consulted again with a striking image: all sites that had been marked with the skin marker

containing Castellani paint showed erythema, infiltration, and papules. We were not able to identify the primary cause of his sensitization, and nor did we obtain the exact composition of the cooling oils used; however, the eczematous reaction to the skin marker was clearly related to the positive reaction to resorcinol in it.

Case 4

This patient consulted with complaints of recurrent 'allergic' reactions for 1.5 years, each time related to hair dyeing, that is, erythema, swelling, vesicles, and severe itching on the forehead. Occasionally, this was accompanied by erythematous maculae on the neck and cervical lymph node swelling. In the meantime, the patient used a hair dye based on henna, to which she showed no reaction. She recalled having also reacted to a deodorant in the armpit and to jewelry. Moreover, this patient also showed a reaction to the skin marker containing Castellani paint. The metal and hair dye allergy was

confirmed, the latter being caused by *p*-phenylenediamine (PPD), toluene-2,4-diamine, and resorcinol.

Case 5

Our last patient consulted because of an itching eruption with infiltrated erythematous-squamous plaques on the neck and scalp for 2 days. Previously, she had already developed similar lesions following visits to a certain hairdresser. The relevance was evident for the reactions to PPD and resorcinol in hair dyes, but could not be determined for thiuram mix. Being aware of the test results, the patient remembered having presented with itching eczematous lesions each time that she had her hair dyed.

Discussion and Conclusion

Only 5 cases of positive patch test reactions to resorcinol were observed among 1187 subjects tested during a 25-year period in an aimed fashion, and were related to various sources of sensitization. Our first patient reacted to resorcinol in an anti-wart ointment that was, at that time, a popular prescription in Belgium and France, where similar cases have been reported (4). The second patient was most probably sensitized by resorcinol monobenzoate, an ultraviolet light absorber used in cellulose plastics and that is known to cause allergic contact dermatitis (5). Hearing aids have only occasionally been mentioned as a source of exposure and sensitization, although spectacle frames seem to be more frequently involved (6). Resorcinol probably cross-reacts with resorcinol monobenzoate, which is most probably transformed

into resorcinol in the skin, thus acting as a prohaptén. Moreover, cross-reactivity between resorcinol monobenzoate and *Myroxylon pereirae* is well known (7), and also occurs with benzoyl peroxide. The latter phenomenon could be explained by the degradation of benzoyl peroxide into benzoic acid, which is a part of *M. pereirae* balsam. Benzoyl peroxide is also used in plastics.

The reactions to resorcinol in the third (and also fourth case) could explain the eczematous reaction to the skin marker based on Castellani paint (8).

Cases 4 and 5 illustrate allergic contact dermatitis caused by hair dyes in which, besides PPD, and in 1 case also toluene-2,4-diamine, resorcinol was an additional allergen. Resorcinol is an exceptional cause of hair dye allergy, although it is present in >80% of oxidative hair-dye products (9). According to this recent review on patch testing with a hair cosmetic series in Europe, it is therefore still proposed to be part of the 'suggested core European hair cosmetic series', but the authors also indicate the need for further comparative studies addressing the optimal patch test concentration, that is, 1% pet. as tested in these cases, or 2% in pet.

Despite its moderate to strong sensitization potential in the local lymph node assay, the low rate of patch test reactivity to resorcinol that we found (5/1187) is in accordance with previous reports [see (9) for a review on the subject], that is, 1/191, 1/283, 3/2939, and 2/501.

Our findings thus indicate that resorcinol remains a potential but infrequent contact allergen in clinical practice.

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