

CONTACT POINT

Allergic contact dermatitis caused by 1-naphthol, a red coupler, in a purple permanent oxidative hair dye

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Patients patch tested for the evaluation of dermatitis possibly related to hair dyes are routinely tested with *p*-phenylenediamine (PPD) in the European or national baseline series, and usually with an additional “hair series” containing important “indicator” hair cosmetic ingredients.¹ In a critical review, Uter et al. in 2015 recommended a core European hair cosmetic series, with suggested temporary additions for monitoring purposes. Despite such extended testing, a causative allergen is not always identified, and it is therefore important to test with all of the ingredients of any hair dye product when allergy is suspected.^{1,2} We present a case of allergic contact dermatitis caused by 1-naphthol in a purple oxidative hair dye with negative patch test results with PPD and other common hair dye allergens.

CASE REPORT

A 43-year-old woman was admitted with severe oedematous, eczematous dermatitis on her scalp and face, and weeping eczema on the back of her neck, which appeared to have triggered secondary generalized eczema. She had applied a purple permanent oxidative hair dye 2 days before. She had previously been patch tested because of hand dermatitis in 2007 and 2013, including with the British baseline series, with a positive reaction only to nickel.

We proceeded to patch test with an extended British baseline series, a hairdressing series, a clothing and dye series, and a corticosteroid series. This included most of the core hair cosmetic allergens suggested by Uter et al.,¹ and some of the additional suggested “temporary” allergens (Table 1). Additionally, ingredients of the hair dye product, provided by the manufacturer, not present in these series were tested, prepared in concentrations recommended by de Groot,³ including 1-naphthol 1% pet. (Table 2). The allergens were applied

with Finn Chambers, and the results were read on day (D) 2 and D4, according to ESCD guidelines.⁴

A positive reaction was observed to 1-naphthol 1% pet. (+++/+++ (Figure 1), with additional positive reactions to nickel sulfate 5% pet. (++/++) and cetearyl alcohol 20% pet. (-/+). Thus, the reaction to hair dye was most likely attributable to type IV hypersensitivity to 1-naphthol. Cetearyl alcohol was also present in the hair dye, and may have been a contributory allergen; however, it may have been of greater relevance to the patient's hand dermatitis, being found in the corticosteroid creams that she noticed had made her hand dermatitis worse. A further 8 patients presenting with a history suggestive of allergic contact dermatitis caused by hair dye were tested with the same baseline

TABLE 1 Hair cosmetic series tested

Substance	Concentration (%)	Vehicle
<i>p</i> -Phenylenediamine	1	pet. ^a
Resorcinol	1	pet. ^a
Toluene-2,5-diamine	1	pet. ^a
Glyceryl thioglycolate	1	pet. ^a
Ammonium thioglycolate	2.5	pet. ^a
Ammonium persulfate	2.5	pet. ^a
<i>m</i> -Aminophenol	1	pet. ^a
<i>p</i> -Aminophenol	1	pet. ^a
Zinc pyrithione	1	pet.
Chloracetamine	0.2	pet. ^b
Cocamide DEA (coconut diethanolamide)	0.5	pet. ^b
Cocamidopropyl betaine	1	aq. ^b
Lauryl glucoside	3	pet. ^b

^a Suggested for core European hair cosmetic series.

^b Suggested as temporary additions by Uter et al.¹ *p*-Methylaminophenol sulfate 1.0% (pet.) from core series not tested.

TABLE 2 Ingredients of purple hair dye provided by the manufacturer, additionally tested

Substance	Concentration (%)	Vehicle
Octyldodecanol	5.0	pet.
Cetearyl alcohol	5.0	pet.
Ceteareth-20	5.0	pet.
Ethanolamine	2.0	pet.
Linoleamidopropyl PG-dimonium chloride phosphate	1.0	pet.
Tetrasodium EDTA	1.0	aq.
<i>Prunus armeniaca</i> (apricot) kernel oil	10.0	pet.
1-Hydroxyethyl 4,5-diamino pyrazole sulfate	1.0	pet.
1-Naphthol	1.0	pet.
Fragrance	1.0	aq./alcohol

**FIGURE 1** A positive patch test reaction with 1-naphthol 1.0% pet on day (D) 4

and extended hair cosmetic series, plus the residual sample of 1-naphthol 1% pet. Seven had negative results and 1 had an irritant reaction to 1-naphthol.

DISCUSSION

In oxidative (permanent) hair dyes, a chemical reaction occurs between a precursor and a coupler, with an oxidizing agent. 1-Naphthol is a red coupler.⁵ Of 229 identified hair dye substances, it was 1 of 172 predicted to be strong/moderate sensitizers by Søstet et al. in 2004.⁶ Among these strong/moderate sensitizers, it was also identified as 1 of 28 hair dye substances used in excess of 2 tonnes per annum in 2002, with 6 vs 90 tonnage of usage in comparison with the coupler resorcinol. Of these 28, 1-naphthol was 1 of the 20 that had not been reported as clinically relevant hair dye contact allergens, and 1 of the 23 not available in commercial patch test preparations. In a recent sample of >200 hair dyes found for sale on UK

websites, 1-naphthol was found in 1 black and 1 blonde hair dye, and in 28 brown and/or red hair dyes.

A review in 2013 reported that, in 736 patients in Europe tested with 1-naphthol 1% pet., there were 15 doubtful but no definite positive reactions.² Subsequently, in 2015, it was not included as 1 of the routinely recommended allergens in the hair cosmetic series in Europe.¹ Allergic contact dermatitis caused by 1-naphthol has previously been reported in textile workers,^{7,8} but, to the best of our knowledge, this is the first report of allergic contact dermatitis caused by 1-naphthol in hair dye.

In conclusion, we have described a case of allergic contact dermatitis secondary to the use of a hair dye, attributable to contact allergy to 1-naphthol, in a patient without positive reactions to PPD and other hair dye ingredients in a recommended hair cosmetic series.¹ This case highlights the importance of testing with all suspected hair dye ingredients to detect less common allergens.

Conflict of interest

The authors declare no potential conflict of interests.

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