

Wide dye reactors



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CASE REPORT

A 47-year-old man with a remote history of childhood atopic dermatitis (AD) presented with an acute pruritic, burning rash on the face, arms, hands, and back and for 1 year. The perioral area, including the oral mucosae, were also affected (Fig 1). The patient reported prior episodes of dermatitis around belt buckles and watches. As a janitor at a health care facility, he wore nitrile gloves and blue or gray scrubs to work. He denied use of hair dye, although his wife dyed her hair. Biopsy of his dermatitis found spongiotic dermatitis. Treatment with triamcinolone 0.1% ointment, an oral prednisone taper, and 300 mg of intramuscular dupilumab every 14 days did not lead to lasting noticeable improvement in the dermatitis, although his pruritus decreased.

During the patient's sixth month receiving dupilumab, he was referred for patch testing. He was tested with the North American Contact Dermatitis Group standard series as well as the Fragrance, Rubber Additives, and Textile Colors & Finish series (Chemotechnique Diagnostics, Vellinge, Sweden). Results included 3⁺⁺ to 4-phenylenediamine base and nickel sulfate hexahydrate; 3⁺ to disperse orange 3, reactive orange 107, new dye mix, diaminodiphenylmethane, p-toluenediamine sulfate; 2⁺ to disperse orange 1 and black rubber mix; and 1⁺ to disperse yellow 3, disperse yellow 9, disperse red 17, direct orange 34, n-cyclohexyl-n-phenyl-4-phenylenediamine, n-Isopropyl-n-phenyl-4-phenylenediamine, hydroperoxide of linalool, perfume mix, and benzalkonium chloride. The patient was counseled to avoid all dyed clothing and bedding, including his colored scrubs, sheets and

Abbreviations used:

AD: atopic dermatitis
 ACD: allergic contact dermatitis
 PPD: paraphenylenediamine

pillowcases. He was also cautioned to stop using his green-colored mouthwash, given his lip and oral dermatitis. At 2-month follow-up, the patient exhibited significant improvement in his dermatitis and pruritus, including the oral and perioral areas (Fig 2).

DISCUSSION

Textile dye allergic contact dermatitis (ACD) is considered rare, although the incidence in published studies ranges from 0.05% to 32.6%.¹⁻³ The widely varying estimates likely reflect differing levels of physician suspicion for textile dye allergy before patch testing. Lack of clinical suspicion leads to undertesting of dye allergens, which are not included universally in all standard screening trays. Additionally, although paraphenylenediamine (PPD) was previously considered to be an appropriate screening compound for textile allergy, multiple studies have found that PPD shows a low level of sensitivity for textile dye allergy.^{1,3,4} Accordingly, a negative test to PPD does not rule out allergy to textile or other cross-reacting dyes. Thus, expanded series testing should be considered if textile dye allergy is suspected, particularly in a patient who tests negative to PPD on the T.R.U.E test.

Dye-related contact allergy can be narrow—ie, one allergy to 1 class of dyes—or wide, with allergy

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Fig 1. Perioral and periorbital edema and erythema before patch testing.

demonstrated to multiple dyes across different categories. In narrow dye reactors or patients with history of PPD⁺ limited series patch testing with new-onset dermatitis or recalcitrant dermatitis, expanded series testing with textile dyes should be considered.

Our patient's extreme reaction to textile dyes and multiple related compounds—such as hair dyes and cross-reacting black rubber mix constituents—provides an example of what we consider to be a wide dye reactor or an individual with positive reactions to more than 2 classes of dyes or dye cross-reacting chemicals. Patch testing series with multiple classes of dyes (such as the North American Standard Series by Chemotechnique or SmartPractice) or a dedicated dye series should be used in cases of suspected dye allergy.

Disperse dyes—the most commonly sensitizing textile dyes—are typically used on synthetic fabrics such as polyester, acetate, and nylon. Reactive dyes are generally used to color cotton or cotton blend fabrics.⁵ PPD, a disperse dye found in permanent and semipermanent hair dyes, is one of the most potent allergic sensitizers.⁶ Importantly, PPD can cross react with both disperse dyes and components of black rubber mix, which are colored chemicals used in a wide variety of industrial and consumer rubber products including black rubber gloves and boots, tires, earphones, pen grips, and black elasticized clothing.⁵ Finally, in wide dye-reacting patients close association with another person who uses products containing PPD or P-toluenediamine could also trigger a reaction.

Clinically, textile allergy occurs in areas in close contact with clothing, particularly those subjected to



Fig 2. Significant improvement in dermatitis, including the oral and perioral areas, after dye avoidance.

friction or sweat, such as the axillary folds, waistband area, flexor surfaces, and posterior neck (shirt collars). Textile dye allergy can in some rare cases induce widespread autoeczematization reactions with rapid spreading.¹ Allergy to PPD and other hair dye components, on the other hand, often results in dermatitis on glabrous, non-hair-bearing skin surrounding the scalp, including the forehead, ears, neck, and periorbital areas.⁷ ACD to textile or hair dye should be considered in individuals with a history of hair dye allergy and a new-onset dermatitis, particularly on the trunk, as described above, or in individuals with recalcitrant dermatitis and a prior positive patch test result to PPD. In general, the appearance of new-onset localized dermatitis in an adult with AD should raise clinical suspicion for superimposed ACD. Additionally, individuals with longstanding AD may be at an increased risk for contact sensitization and the subsequent development of ACD for several reasons, including the chronic use of emollients and topical corticosteroids on a dysfunctional epidermal barrier and an inflamed cutaneous milieu caused by increased bacterial colonization.⁸

In wide dye-reacting patients, it is important to be aware of potential cross-reactors. Besides black rubber mix and disperse dyes, PPD is also known to cross-react with sunscreen components (PABA and padimate O) and a number of medications including thiazide diuretics, benzocaine and other -caine anesthetics, sulfonylurea antidiabetics, and the COX-2 inhibitor celecoxib.⁹ The wide range of cross-reacting agents to PPD can result in multiple concurrent allergies in a PPD-allergic patient, including to rubber grips and tools, black shoes, cosmetics, printer ink, contaminated street henna ink, and elastic.^{6,10} Dyes in processed foods and drinks should also be considered in a patient with lip involvement. Several food colorants, including Yellow 6, Ponceau 4R (brilliant scarlet), and Red 5

are azoic dyes¹¹ and have been reported to cross-react with the azo groups in PPD and disperse dyes. Our patient's perioral and oral involvement after avoiding his mouthwash and other food coloring for 2 months indicate that synthetic food coloring was a relevant cross-reacting allergen for him.

CONCLUSION

Dermatologists should have a low threshold of suspicion for ACD to dyes, particularly in individuals with new-onset widespread dermatitis, dermatitis in areas of friction with clothing, treatment-resistant dermatitis, or a history of allergy to PPD. Expanded testing with textile series may be necessary to uncover any potential source of dye allergy.

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