

TEACHING CASE REPORT

Allergic contact dermatitis to paraphenyldiamine in hair dye after sensitization from black henna tattoos: a report of 6 cases

The cases: Over a 2-year period, 6 women have come to our dermatology clinic with an allergic contact dermatitis to paraphenyldiamine (PPD) from hair dye after being previously sensitized to PPD from black henna tattoos. These patients, 14–38 years and previously healthy, all reported similar stories of developing erythema, edema and pruritus in some combination of their scalp, hairline, eyelids or cheeks, 1–2 days after having their hair dyed. All had previously had at least 1 black henna tattoo; 4 of them also reported having a previous local allergic reaction to a black henna tattoo.

When patch testing was performed to identify causative allergens, all 6 patients were found to have strong allergic reactions to PPD. Moreover, their skin reacted to other para-dyes, which can cross-react with PPD: specifically, paratoluenediamine, aminophenol and 2-nitro-4-phenylenediamine.

Black henna tattoos are frequently advertised as “temporary and harmless,” and thus have become a popular and fashionable form of temporary body art for young children and teenagers, especially among travellers and holiday resort guests (Fig. 1). Once applied, they cannot simply be washed off with soap and water;* they last 1–2 weeks and then fade over a few more days. Henna is derived from the leaves of the shrub *Lawsonia inermis*, which grows in India, North Africa and Sri Lanka; lawsone is the active dye ingredient.¹ Henna alone is relatively safe and has

been used for decades in cultural skin tattooing, especially among Hindu or Muslim women. Henna is also used as an ingredient in hair colouring, where it imparts a reddish shade.

It is rare to develop an allergic reaction to pure henna. Black henna tattoos usually contain an additive, paraphenyldiamine (PPD), as well as henna. PPD intensifies the dark colour, sharpens definition, speeds up the tattooing process and makes the tattoo last longer.² PPD is known to be a potent skin sensitizer and to cause allergic contact dermatitis. It can also be found as an ingredient in hair dyes, fur dyes, cosmetics, printer’s inks, photographic work, textile dyes, and some latex gloves and rubber support stockings.

Dermatologists are seeing increasing numbers of patients with allergic

contact dermatitis to the PPD in black henna tattoos (Fig. 2). The rising incidence likely reflects the increased popularity of these “temporary” tattoos. In black henna tattoos, the concentration of PPD has been shown to be as high as 15.7%, which is much stronger than the concentrations used in hair dyes.³ This higher PPD concentration, combined with the extended period of skin exposure without neutralization, results in potent skin sensitization to PPD. Subsequent exposure to PPD — even in low concentrations, such as those in hair dyes — can then lead to a delayed type-IV hypersensitivity reaction manifesting as an acute contact dermatitis. This is particularly common among women and girls who colour their hair with hair dyes containing PPD or other para-dyes after having been sensitized by PPD in a black henna tattoo. Since an estimated 40% or more of women in North America dye their hair, the potential for contact dermatitis to PPD in hair dye is very real. Furthermore, hair dyeing has become increasingly popular among men as well, with some parents reporting that



Fig. 1: A tattoo artist painting a black henna tattoo on a guest at a holiday resort.

*If earlier removal is desired, some artists suggest soaking the tattoo site in salt water, which might lighten the colour.



Fig. 2: Another example of allergic contact dermatitis to a black henna tattoo. The pruritic, eczematous eruption on the left arm, which began 6 days after the tattoo was applied, followed the exact outline of the original tattoo. (Inset: The original black henna tattoo.)

more boys than girls dye their hair in their child's school class.

Contact dermatitis caused by PPD in hair dye often extends beyond the scalp to include the forehead, neck, eyelids and face. It usually manifests as pruritic, edematous, erythematous scaly patches and plaques; vesicular lesions sometimes occur as well. It can take weeks to fully resolve and may require treatment with corticosteroids, orally administered. In addition to more localized reactions, reports of disseminated dermatitic eruptions after PPD exposure that can be quite debilitating

have been reported.¹ Other skin reactions, such as postinflammatory hyper- or hypopigmentation, can also ensue.

All 6 of our patients were told that they had an allergy to PPD and cross-reacting substances. Interestingly, none of them suspected that their contact dermatitis to hair dye had stemmed from their previous black henna tattoo. They were instructed to never again get black henna tattoos and to avoid dyeing their hair with any products containing PPD or other para-dye ingredients. It was pointed out to them that PPD can be in both light and dark shades of hair

dye. The patients were given a list of products that may contain PPD or cross-react with it (Box 1). There are some PPD-free hair dyes that patients with PPD allergies can use. Some patients may be able to tolerate highlights if the hair dye does not touch the scalp when applied, but application of dyes with PPD to hair roots (i.e., where the dye comes into contact with the scalp) must be avoided.

In Canada, section 16 of the Food and Drug Act states that it is illegal for cosmetics containing PPD to be sold for direct application to the skin. This would include black henna tattoos with PPD. However, professionals who apply black henna tattoos at amusement parks or holiday resorts are not required to disclose ingredients. The onus is therefore on the purchaser to inquire about possible harmful ingredients such as PPD.

These apparently harmless temporary tattoos can have serious sequelae. Until legislation is enacted that prohibits the use of PPD in black henna tattoos, we recommend that all family physicians and pediatricians counsel their patients to avoid getting black henna tattoos, since these tattoos can cause potent skin sensitization to PPD that may lead to serious skin reactions with subsequent exposure (i.e., to PPD in hair dye).

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Competing interests: None declared.

Box 1: Products* that may contain paraphenylenediamine (PPD) or cross-react with it to cause allergic reactions

Products that may contain PPD

- Hair dye, permanent or semipermanent
- Fur dyes
- Printer's ink
- Photographic or lithographic work
- Rubber products† such as latex gloves and support stockings

*In order of decreasing frequency of cases seen.
†PPD is sometimes used in rubber processing.

Products that may cross-react

- PABA (used in sunscreens)
- Azo dyes (used in some textiles)
- Certain local anesthetics based on ester groups; e.g., benzocaine, tetracaine, procaine
- Thiazide diuretics

PABA = para-aminobenzoic acid.

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