

Type IV hypersensitivity reaction to a temporary tattoo

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A 6-year-old boy developed a skin eruption 10 days after application of a temporary tattoo advertised as a “natural black henna tattoo.” The eruption was a delayed hypersensitivity reaction to the tattoo ink. The textile dye paraphenylenediamine (PPD) is a common industrial allergen and can be found in some temporary tattoo inks. This case describes the reaction and reviews the international literature pertaining to PPD and temporary tattoos.

A 6-year-old healthy Caucasian boy had a temporary tattoo applied by a street vendor while vacationing at a Texas beach resort. The tattoo was painted by a street artisan on the child’s upper right arm with a preparation advertised as “black henna.” The artisan described the ink as an “all-natural product.” No injectable ink was used. The skin art was noted to have a very dark ebony pigment. Ten days after application of the black henna, the skin erupted in an erythematous papulovesicular weeping lesion. The eruption followed the contours of the tattoo (*Figure 1*) and was pruritic. The child had no prior history of atopy, eczema, or any allergic reactions.

The eruption had been present for 1 week when the boy presented to his pediatrician for evaluation. The parents also indicated that his 4-year-old sister (*Figure 2*) and 5-year-old cousin had much smaller temporary tattoos by the same ven-



Figure 1. The untreated eruption, 17 days after application of the “black henna” tattoo ink.



Figure 2. The patient’s sister with the black henna tattoo immediately after application.



Figure 3. The eruption after 1 week of treatment.

dor, which displayed similar eruptions but on a smaller scale. A diagnosis of a type IV delayed hypersensitivity reaction was made. A course of topical 0.1% triamcinolone ointment twice a day for 3 weeks resolved the eruption (*Figure 3*). Postinflammatory hypopigmentation, following the contours of the tattoo, persisted over the region.

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DISCUSSION

Henna is a green powdered extract from the leaves of *Lawsonia alba*. The plant is indigenous to North Africa, the Middle East, and India. The active ingredient is lawsone (2-hydroxy-1,4-naphthoquinone). In many Eastern and Middle Eastern countries, henna has long been used as a cosmetic dye on the skin, hair, and nails. Some cultures utilize henna as a folk remedy as well.

Henna skin painting plays an important role in various religious and cultural ceremonies. Its use can be traced back at least 5000 years. Natural henna imparts a brownish-orange pigment to the skin when applied. A variety of oils, powders, and dyes are often added to henna to obtain various colors. Pure henna alone is a relatively safe product, and reported allergic reactions are rare (1, 2). Natural henna can take several hours to dry and fix to the skin. The pigmentation henna imparts is not permanent.

A contemporary technique to darken the henna pigment and hasten the drying time involves adding paraphenylenediamine (PPD). PPD is a low-toxicity diamine used as a component of synthetic polymers, aramid fibers, cosmetic dyes, latex chemicals, textile dyes, and pigments. PPD is one of the industrial allergens that most frequently evokes a reaction in patients with contact dermatitis. It is commonly used in hair dyeing and photographic film processing. Contact dermatitis to PPD is common among hair stylists, with an incidence of up to 24% in this group (3).

The combination of PPD and henna is marketed as “black henna.” No natural black henna exists. It is often applied by street artisans at traveling carnivals or fairs (4). Black henna tattoo ink commonly induces hypersensitivity reactions. Reports of angioneurotic edema and anaphylaxis exist as well (2). PPD is a potent T-cell stimulator (5). Patch testing patients with PPD shows a reaction consistent with a type IV delayed hypersensitivity reaction. Clinically, these eruptions are seen 3 to 10 days after application of the PPD-henna preparation. If a patient has been previously sensitized to PPD, the reaction can occur more acutely.

PPD's potency as an allergen is directly related to the concentration and duration of direct exposure. Previous studies showed that skin patch testing of .01% PPD for 15 minutes elicited no reaction. Increasing the concentration to 1.0% caused reactions in 37.5% of subjects. Using the 1.0% concentration for a 120-minute exposure increased the reaction rate to 69% (3). One study found that a 10% PPD solution sensitized 100% of the test subjects (6). Black henna tattoo inks have been found to have PPD concentrations as high as 15% to 30% (3). The inks are typically left in contact with the skin for several days after application.

In the USA, PPD is approved by the Food and Drug Administration (FDA) for human use as a hair dye. PPD is not permitted for use as a skin product at any concentration (7).

Canadian health officials have outlawed PPD for skin use. European Union countries restrict PPD concentrations in hair products to 6% or less. Australia requires a warning label for



Figure 4. Hypopigmentation on the arm of the patient's cousin, 5 weeks after application of the tattoo ink.

PPD concentrations >5%. Most countries have no regulation about skin application of PPD (8).

Compounding the public health management of these reactions is the nature of black henna artisans. They typically operate from a transient shop or kiosk that moves from town to town following a carnival, fair, or similar troupe. By the time the delayed hypersensitivity reactions erupt, the responsible vendor has moved on and can be difficult for public health officials to track. Vacationing travelers have often returned home before the dermatitis erupts.

Hypersensitivity reactions to PPD tattoos carry long-term risks. The intense inflammatory reaction can impart scarring, keloid formation, and permanent postinflammatory pigment changes over the site of the tattoo (8, 9). The hypopigmentary changes are more frequent in children (1) (*Figure 4*). These risks alter the notion of these tattoos being “temporary.”

Subsequent allergic sequelae are another long-term issue with PPD sensitization. Since PPD is found in hair and textile dyes, patients sensitized to PPD can manifest long-term contact dermatitis to these products (8). PPD-sensitized patients should be cautioned about the use of dark hair dyes and darkly dyed clothing (10). PPD can also sensitize patients to other allergens, inducing hypersensitivity to natural rubber latex, azo dyes, thiurams, PABA sunscreen, para-aminosalicylic acid, and benzocaine (9–11). Subsequent reactions to lawsone have been noted in some patients (12). The actual incidence of these cross-reacting sequelae is unknown.

Consumers should be wary of skin paint artists or temporary tattoos utilizing darkly colored pigments. Since these products are more common outside the USA, skin painting or temporary tattoos should be avoided during foreign travel. Black henna use has been identified at many resort locations around the globe and at some beach resorts in the USA. With the rise in popularity of body art and temporary tattoos, PPD reactions could become more common. Any products advertised as black henna or a henna product with dark pigment should be avoided.

Clinicians identifying cases of black henna reactions from a domestic vendor should report the situation to the state de-

partment of health or local FDA office. Aggressive topical corticosteroid therapy is often warranted. Observation for allergic sequelae to a variety of environmental allergens is important.

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