

A temporary henna tattoo causing hair and clothing dye allergy

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Contact dermatitis following the application of temporary paint-on henna tattoos indicates a potentially serious problem of active sensitization. We describe 2 cases involving sisters who travelled to Bali together and acquired a temporary black henna tattoo to the lower back region. Both sisters subsequently developed a contact dermatitis at the tattoo site, the dermatitis disseminating in one sister. There was persistent hyperpigmentation at the tattoo site in both sisters several months after the application. Patch testing revealed a positive reaction to para-phenylenediamine (PPD) in both sisters. One sister also showed reactions to other hair dyes and to multiple organic dyes. Allergic contact dermatitis to PPD contained in temporary henna tattoos is an increasing problem worldwide, with cross-reaction to related compounds and permanent skin changes, a frequent consequence of sensitization to this significant allergen.

Key words: p-phenylenediamine; temporary henna tattoo; allergic contact dermatitis; patch testing.

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Temporary henna tattoos have become popular in Western populations. They are especially popular with travellers, particularly teenagers and children who perceive them to be attractive and harmless. Concurrently, there have been an increasing number of reports of allergic contact dermatitis to such tattoos whereby what is applied as a temporary tattoo may result in a permanent scar, pigmentary change and problems with contact sensitization (1–6). We present 2 sisters who developed allergic contact dermatitis to temporary henna tattoos obtained while travelling in Bali.

Case Report

Case 1

A 17-year-old female had a temporary black henna tattoo to her lower back while holidaying in Bali. A repeat application of the black henna

mixture was performed 4 days later. She developed a pruritic vesicular reaction in the area of the tattoo 10 days after the original application. The reaction became vesico-pustular and rapidly disseminated to her feet, thighs, axillae, arms, trunk, face and later, her scalp. The patient had a slow response to topical betamethasone dipropionate cream with wet dressings. Symptomatic resolution took over 5 weeks. The dermatitis was most persistent in the axillae. After her dermatitis settled, the patient had one episode of dermatitis on her fingers, which settled rapidly with betamethasone dipropionate cream. She developed residual post-inflammatory hyperpigmentation at the tattoo site, which was still present 5 months later.

The patient had a history of hay fever and a first-degree family history of atopy. She had no history of dermatitis and had no relevant past medical history or medications. She had never used hair dyes.

The patient was patch tested with the Skin and Cancer Foundation Australia Westmead standard series, hairdressing series and textile dyes series. She was also patch tested with her own topical products and sunscreens.

The allergens from the standard, hairdressing and textile dyes series were supplied by Raza Associates (Como) except for *N*-Isopropyl-*N*-phenyl-4-phenylenediamine and disperse blue mix

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(124/106), which were supplied by Trolab® (Hermal, Sydney, Australia) and applied to the patient's back using Finn chambers on Scanpor® tape (Epitest Oy, Tuusula, Finland). The patient's own topical products including the sunscreens she used (Ultra30⁺ Banana Boat, UV Tripleguard 15⁺, Reef Suntan SPF15) were all applied to her back using Finn chambers on Scanpor tape. The patches were left on for 48 hr and read at 72 hr and at 7 days. There was a vesicular reactivation of dermatitis at the tattoo site during patch testing.

Patch testing confirmed a strongly positive, extreme and spreading vesicobullous reaction to para-phenylenediamine (PPD). The patient also reacted to other hair dyes; there was a strong vesicular reaction to isopropyl-*N'*-phenyl para-phenylenediamine and weak reactions to nitro-phenylenediamine and diaminotoluene sulfate. There were also reactions to multiple textile dyes including disperse orange 1, disperse yellow 3, disperse blue mix 124/106, disperse red 1 and direct orange 34. These weaker reactions to textile dyes were true positives as they were non-adjacent.

All other patch testing were negative, including other allergens in the standard, hair, textile and sunscreen batteries and topical corticosteroids, creams and sunscreens used by the patient. Positive patch test results of the standard, hairdressing and textile dyes series are summarized in Table 1.

The patient was advised not to use any permanent hair dyes due to the risk of developing allergic contact dermatitis. She was told that due to her reaction to a number of textile dyes, she may develop a clothing dermatitis, particularly in hotter weather and with darker garments. In the absence of garment labelling of dye content, specific dye avoidance is difficult.

Case 2

A 15-year-old female accompanied her sister (Case 1) on a holiday in Bali and together with her had a temporary 'henna' tattoo applied to her lower back. She had a repeat application of the black henna mixture 4 days later. 10 days after the original application, she developed a pruritic vesicular eruption at the site of the tattoo. The rash remained localized and took 4 weeks to settle with topical betamethasone dipropionate cream. At 5 months, there was prominent post-inflammatory hyperpigmentation over the tattoo site simulating the original tattoo.

The patient had a history of eczema as a young child but had no other relevant past medical history or medications. She had never used hair dye products.

Patch testing was performed as for Case 1. There was a weak reaction to PPD. All other patch testing were negative, including textile dyes and the patient's sunscreens.

The patient was advised that permanent and semi-permanent hair dyes, particularly the darker colours, contain this allergen. Real Henna, temporary pigment dyes, metallic dyes (Grecian formula) and hair colouring mousses were advised as a safe alternative.

Discussion

Henna powder is obtained from the dried leaves and stems of a shrub cultivated in India, Sri Lanka and North Africa (*Lawsonia inermis*, family Lythraceae). Lawsone (2-hydroxy-1, 4-naphthoquinone) is the active ingredient. It is used as a hair and body dye, which lasts a few weeks and has a long history of use in the ancient custom of henna tattooing in Hindu and Islamic women.

Table 1. Summary of positive patch testing findings from the standard, hairdressing and textile dyes series

Allergen	Concentration (%)	Patch test reaction
Standard series		
4-Phenylene diamine base (p-phenylenediamine)	1.0	Strong reaction – vesico-bullous
<i>N</i> -isopropyl- <i>N'</i> -phenyl-PPD	0.1	Moderate reaction – vesicular
Hairdressing series		
Nitro-phenylenediamine	1.0	Weak reaction – non-vesicular
Diaminotoluene sulphate	1.0	Weak reaction – non-vesicular
Textile dyes series		
Disperse yellow 3	1.0	Weak reaction – non-vesicular
Disperse blue mix (124/06)	1.0	Weak reaction – non-vesicular
Disperse red 1	1.0	Weak reaction – non-vesicular
Disperse orange 1	1.0	Moderate reaction – vesicular
Direct orange 34	1.0	Weak reaction – non-vesicular

Reports of allergic reactions to pure henna are rare, constituting a contact dermatitis (7) or an immediate-type hypersensitivity reaction with urticaria, sneezing and respiratory symptoms (8). The addition of PPD to the traditional mixture of henna hastens the dye process, enhances darkness and improves pattern definition. Such a practice is common with tattoos applied by street vendors in holiday resorts in Asia and the Middle East, and increasingly, with tattoo artists in the Western world including Australia. PPD is a potent skin sensitizer which can cause allergic contact dermatitis or less commonly, immediate-type hypersensitivity reactions with angioneurotic oedema and collapse (9). It occurs in permanent and semi-permanent hair dyes, shampoos, cosmetics and textiles. Individuals who are allergic to PPD may also be sensitive to other chemicals and drugs, which have a similar structure such as azo dyes which are organic dyes used in textiles (10).

Increasing reports of contact dermatitis following the application of temporary paint-on henna tattoos indicate a potentially serious problem of a high level of active sensitization (2, 4, 11, 12). These products appear to be marketed as henna but actually contain synthetic colouring agents. Mass spectrometry of commercial black henna powder used by local Asian artisans revealed PPD (not Lawsone) to be the major ingredient (11). High performance liquid chromatography has been used to demonstrate PPD in a black henna tattoo mixture at a concentration of 15.7% (13), which is considerably higher than the concentration used in commercial hair dyes.

Elicitation of a contact dermatitis is directly proportional to the exposure time and concentration of PPD (14). This may explain why sensitization to PPD through temporary tattoos appears to be a particular problem.

The causative agent for most allergic contact dermatitis arising from temporary tattooing with black henna is therefore PPD, not henna. In a review of 48 reported cases of patients with allergic contact dermatitis to temporary tattoos, all of the 43 cases patch-tested were positive to PPD (2). Of concern, 10/48 (21%) were children or teenagers (≤ 18 years). There was also a high incidence of multiple sensitizations to related dyes.

The explosion in popularity of temporary henna tattoos could prove to have long-term sequelae. Post-inflammatory pigmentary change following allergic contact dermatitis can result in a permanent tattoo as in both cases described in this report. Keloidal scarring may follow an episode of contact dermatitis at the tattoo site (6).

The patient may develop a permanent sensitization to PPD and related compounds and be severely disadvantaged by contact dermatitis or immediate-type hypersensitivity reactions, if they want to use hair dyes. Where PPD sensitization occurs, a cross reaction with a clothing dye can be a consequence, as in *Case 1* of this report where positive patch tests to multiple hair and multiple textile dyes represent cross-reactions with PPD. Such an occurrence can have long-term consequences, such as dermatitis with dark-coloured clothing.

Currently, henna tattooing escapes legislation in many parts of the world. There is no upper limit of PPD concentration legally enforced in many countries, including Australia where temporary tattoos are available. The European union (EU) mandates an upper limit of 6% PPD in hair dyes (15), but in Australia there is no such limit. The Therapeutic Goods Association of Australia (TGA) currently has no official stance on henna tattooing. The only requirement by TGA is that the labelling of the cosmetic product containing PPD satisfies the criteria for classifying hazardous substances, which includes appropriate warnings about toxicity by inhalation, direct skin contact and ingestion if the concentration of PPD in the cosmetic product is greater than 5% (16).

In the USA and the EU, the only legal use of PPD in cosmetics is as a hair dye. The USA specifically prohibits the importation of temporary tattoos which do not have the required ingredient declaration on the label or which contain PPD. However, cosmetic samples, including henna tattoos which are used exclusively by professionals – in a salon, at a booth at a fair or on a boardwalk – do not require ingredient declaration (17). Some states in the USA prohibit the tattooing of minors. In Canada, it is illegal for cosmetics containing PPD that are applied directly to the skin to be sold – this includes ‘black henna’ temporary tattoos (18).

The 2 cases reported in this article serve to emphasize that the practice of henna tattooing can result in permanent sequelae. The name ‘temporary henna tattoo’ is misleading and gives a false sense of security about the safety of this procedure. It is concerning that the allergic reactions described were due to a practice which is increasingly popular among young people and due to an allergen (PPD) which is contained in products such as hair dyes, textiles and fur and leather dyes which are widely used.

Guidelines need to be set for the acceptable content and use of PPD in commercially available products, particularly henna tattooing,

in countries like Australia. The practice of temporary henna tattoo application should be actively discouraged. The public needs to be educated about the risk of allergic contact sensitization and of the serious life-long consequences that a sensitization to PPD could have in one's occupational and non-occupational future.

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