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Allergic Contact Dermatitis To Temporary Henna Tattoos

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Abstract. *Introduction.* In the last years there have been increasing reports of adverse cutaneous reactions to temporary black henna tattoos. Black henna does not exist naturally, it is obtained from original henna after the addition of other compounds, among them paraphenylenediamine (PPD), that darken it and facilitate the process of tattooing. Paraphenylenediamine is an aromatic compound that presents cross-reactions with other components that have a benzene ring in their molecular structure. Many of these products may be present in the daily life of any person.
Material and methods. We reviewed patients that have shown erythema, inflammation and/or vesiculation in a previously tattooed area. The patients have undergone a temporary tattoo in street stalls during the summer period (2004-2005). A total of five patients were included, there were four men and one woman with a mean age of 13 years (3-34) and a mean latency period of 9.4 days (5-14). Black ink and plastic stencils were used to perform the tattoo. None of the patients has had previous contact with hair dyes or tattoos and none of them referred a personal history of atopic dermatitis. Patch testing was carried out using the standard set of the Spanish Group for Research in Contact Dermatitis [GEIDC] (TRUE TEST®, Pharmacia, Hillerod, Denmark), with readings at 48 and 96 hours.
Results. Sensitization to PPD is confirmed in three patients, one of them was also sensitized to formaldehyde. Hypopigmented scars persist in three patients.
Conclusions. Black henna pseudotattoos are a source of sensitization to PPD with potential severe consequences in a medium to long term. Currently there is no specific legislation with respect to the practice of this type of tattoos in our country.

Key words: Lawsonia plant, tattoo, 4-paraphenylenediamine, henna.

DERMATITIS DE CONTACTO ALÉRGICA A TATUAJES TEMPORALES DE HENNA

Resumen. *Introducción.* Las comunicaciones de reacciones cutáneas adversas a tatuajes temporales por henna negra son cada vez más frecuentes en los últimos años. La henna negra no existe de forma natural; se obtiene a partir de la henna original añadiéndole otros compuestos que la oscurecen y facilitan el proceso de tatuaje, entre ellos la parafenilendiamina (PPD). La PPD es un compuesto aromático que presenta reacciones cruzadas con otros componentes con anillo bencénico en su estructura molecular. Muchos de estos productos pueden estar presentes en la vida cotidiana de cualquier persona.
Material y métodos. Realizamos una revisión de pacientes que presentaran un cuadro de eritema, inflamación y/o vesiculación en la zona tatuada previamente. Los pacientes se habían realizado un tatuaje temporal en puestos callejeros durante el periodo estival (2004-2005). Se incluyeron un total de 5 pacientes, 4 varones/1 mujer, con una edad media de 13 años (3-34 años) y un periodo de latencia medio de 9,4 días (5-14 días). Para el tatuado usaron tinta de color negro y plantillas de material plástico. Ninguno de los pacientes había tenido contacto previo con tintes capilares ni tatuajes y tampoco refirieron antecedentes personales de dermatitis atópica. Se realizaron pruebas epicutáneas con la batería estándar del GEIDC (TRUE TEST®, Pharmacia. Hillerod. Denmark), con lectura a las 48 y 96 horas.

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Resultados. Se confirma una sensibilización a la PPD en 3 pacientes, en uno de ellos también a formaldehído. En 3 pacientes persisten las cicatrices hipopigmentadas.
Conclusiones. Los pseudotatuajes con henna negra son una fuente de sensibilización a PPD con consecuencias graves potenciales a medio-largo plazo. En la actualidad no existe ninguna ley que regule la práctica de este tipo de tatuajes en nuestro país.

Palabras clave: planta lawsonia, tatuaje, 4-parafenilendiamina, henna.

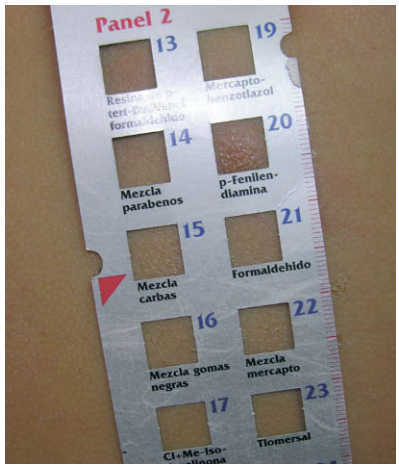

Figure 1. Multiple erythematous vesicles in the area of contact with *p*-phenylenediamine (Case 1).

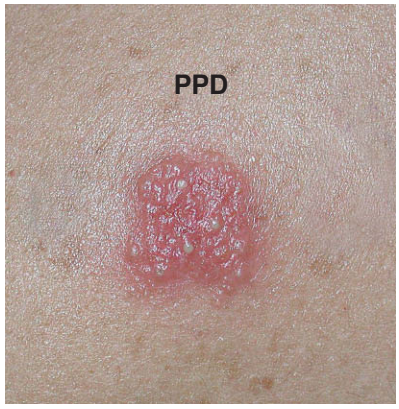

Figure 2. Intense *p*-phenylenediamine positivity (Case 5).

Figure 3. Marked *p*-phenylenediamine positivity and moderate formaldehyde positivity (Case 3).

Introduction

Henna is a natural reddish pigment obtained from the dried leaves of the plant *Lawsonia inermis*. When mixed with water it forms a paste that can be applied directly to the skin. Darker skin tones can be obtained with longer durations of contact. Cases of true sensitization to natural henna are extremely rare.[1] Fake tattoos using black henna are increasingly common in holiday resorts, especially during summer. This seemingly harmless practice, which does not require specialized instruments or knowledge, is becoming a risky practice, as evidenced by the many reports of adverse cutaneous reactions due mainly to *p*-phenylenediamine (PPD),[1-17] a component of commercial henna products. We present 5 cases of adverse reaction to black henna, and in 3 of these we show sensitization to PPD.

Results

Three cases proved strongly positive for PPD (Figures 1 and 2) and 1 was sensitive to both PPD and formaldehyde (Figure 3). The remaining 2 patients refused to undergo patch testing (table).

Figure 4. Depigmented stain on the previously tattooed area (Case 1).

Figure 5. Depigmented stain with mild erythema (Case 2).

Figure 6. Vesicles grouped all over the tattooed area (Case 3).

Case 1

A 3-year-old girl presented with intense inflammation in the area of the black henna tattoo on the left arm 2 weeks after the tattoo was applied. On consultation, a sharply delimited residual vitiligo patch could be observed (Figures 1 and 4).

Case 2

A 7-year-old boy consulted because of a hypopigmented plaque on his right arm after presenting with intense erythema and exudation during the 2 weeks after application of the tattoo. He did not undergo patch testing (Figure 5).

Figure 7. Erythema, vesicles, and inflammation on the previously tattooed area (Case 4).

Case 3

A 9-year-old boy presented with multiple pruriginous vesicles on the black henna tattoo on his back 1 week after the tattoo was applied. The symptoms resolved with topical corticosteroids (Figures 3 and 6).

Results

	Case 1	*Case 2*	*Case 3*	*Case 4*	*Case 5*
Age, y	3	7	9	12	34
Sex	F	M	M	M	M
Time	2 weeks	2 weeks	1 week	1 week	5 days
Symptoms	Erythema and vesicles	Erythema and exudation	Vesicles	Erythema and vesicles	Erythema and inflammation
Outcome	Hypo	Hypo	Resolution	Resolution	Hypo
Patch test	PPD: ++/+++	NP	PPD: +++/+++ Formaldehyde: ++/+++	NP	PPD: +++/+++

Abbreviations: F, Female; M, Male; Hypo, hypopigmentation; NP, not performed; PPD, *p*-phenylenediamine.

Figure 8. Delimited erythema and intense inflammation on the previously tattooed area (Case 5).

Figure 9. Depigmented stain after symptoms resolved (Case 5).

Case 4

A 12-year-old boy consulted because of erythema and vesicles on his left leg 1 week after the tattoo was applied. Symptoms resolved spontaneously after 2 to 3 weeks. He did not undergo patch testing (Figure 7).

Case 5

A 34-year-old man presented with vesicles on an erythematous base on his back 5 days after henna was applied. When the inflammation subsided, a sharply delimited hypopigmented stain was visible (Figures 2, 8, and 9).

DISCUSSION

Henna powder is obtained by drying and grinding the leaves of the bush *L inermis*, which is grown in North Africa and Asia. It is a reddish brown pigment that has been used for thousands of years in Muslim, Hindu, and other diverse cultures to dye the hair and adorn the body and nails; it is known as *Mehandi*. The tattoo is performed by applying henna in the form of a paste directly on the skin. It is necessary to wait 12 hours for the active ingredient, lawsone, to imprint the characteristic color.[2] There have been very few reports of sensitization to natural henna.

Henna can be darkened using additives such as lemon juice, beet root juice, nut shell, sugar, *p*-toluenediamine, and PPD.[3,4] The latter also shortens the fixing process to 1 to 2 hours, improves the outline of the tattoo, and ensures that it lasts longer.

PPD is a known trigger of allergic contact dermatitis and one of the main sensitizing agents associated with permanent and semipermanent hair dyes.[5] It is believed to act on the epidermis in the same way as prohapten and must be converted to benzoquinone before triggering a type IV hypersensitivity process.[5] European Union legislation permits a maximum concentration of PPD of 6% in hair dyes and the direct application of PPD to the skin, eyelashes, and eyebrows is prohibited.[6] Black henna kits do not specify the PPD concentration. In 2 studies analyzing commercial black henna samples, Brancaccio et al[7] discovered a PPD concentration of 15.7% after high-performance liquid chromatography, and Chung et al[8] found that PPD was a majority element using mass spectrometry.

Whereas hydrogen peroxide is used in hair salons to inactivate PPD in hair dyes, this practice is not used for black henna in the tattooing process. The method of applying fake henna tattoos, in which templates containing plastics and glues are used followed by occlusion, enhances the penetration of PPD and can in turn cause a reaction to other compounds such as latex, rosin, and thiuram.[9,10] We do not know the significance of the fact that one of our patients was also sensitized to formaldehyde; this may be a mere coincidence or the result of using a formaldehyde-containing substance during or after application of the tattoo.

Sensitization to PPD is important for 2 reasons. First, its ubiquity—it is present in substances such as hair dye, eye shadow, plastics, rubber, printing ink, and developing fluid.[5]

Second, there may be cross-reactions with other structurally similar classes of compounds,[9-11] including the following: the azo compounds present in many textile dyes, mainly Disperse Orange 3 and Disperse Yellow 3; the sulfonamides, an extensive group including antibiotics, glucose-lowering agents, and drugs to treat inflammatory bowel disease; *p*-aminobenzoic acid (PABA), a common component of sunscreens; benzocaine and procaine, which

are both PABA-derived anesthetics; and some hair dyes with a structure that is similar to that of *p*-toluenediamine or *p*-aminodiphenylamine.[18]

Cross-reactivity with these substances could stem from a common intermediate metabolite, benzoquinone, although other oxidative groups with a similar structure may be present at position 4 of the benzene ring.[12]

Patch testing was carried out using the components of the TRUE TEST (Pharmacia, Hillerod, Denmark). Given the marked positivity that is characteristic of sensitization to PPD, some authors recommend using increasing concentrations (0.01%, 0.1%, and 1%).[13]

We believe that allergic contact dermatitis to black henna is a serious problem due to its possible impact on the daily life of sensitized patients. This was the case of 2 children with a history of rash on the area where a black henna tattoo had been applied who were admitted to the intensive care unit after using hair dye.[14] We consider it necessary to highlight the age of our patients, as 4 were children.

It is important to remember that an initial inflammatory reaction is commonly followed by hyperpigmented or hypopigmented residual lesions that may take a long time to remit and may even leave hypertrophic scars.[15]

To conclude, we believe that temporary black henna tattooing should be controlled by health authority legislation to minimize the appearance of new cases of reaction to PPD and the serious and permanent consequences we have presented.

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. Miguélez A, Ortiz de Frutos FJ, Polimón I, Comunión A, Iglesias L. Allergic contact dermatitis from temporary tattoos. Actas Dermasifiliograf. 2001;92:585-8.
2. Wolf R, Wolf D, Matz H, Orion E. Cutaneous reactions to temporary tattoos. Dermatol Online J. [Electronic journal] 2003;9:3. [Accessed: 08-08-2005]. Available at: http://dermatology.cdlib.org/
3. Neri I, Guareschi E, Savoia F, Patrizi A. Childhood allergic contact dermatitis from henna tattoo. Pediatr Dermatol. 2002;19:503-5.
4. Ruiz Villaverde R, Blasco Melguizo J, Sánchez Cano D, Pacheco Sánchez-Lafuente FJ. Contact dermatitis due to temporary henna tattoos. An Pediatr (Barc). 2005;62:289-90.
5. Arranz Sánchez DM, Corral de la Calle M, Vidaurrazaga Díaz de Arcaya C, de Lucas Laguna R, Díaz Díaz R. Risks of black henna tattoos. An Pediatr (Barc). 2005;63:448-52.
6. Córdoba C, Dorado JM, Sánchez-Pérez J, Vargas E, Alonso A, Fernández Herrera J. Dermatitis de contacto por pseudotatuaje de henna negra. Actas Dermosifiliograf. 2004;95:618-21.
7. Brancaccio RR, Brown LH, Chang YT, Fogelman JP, Mafong EA, Cohen DE. Identification and quantification of para-phenylenediamine in a temporary black henna tattoo. Am J Contact Dermat. 2002;13:15-18.
8. Chung WH, Chang YC, Yang LJ, Hung SI, Wong WR, Lin JY, et al. Clinicopathologic features of skin reactions to temporary tattoos and analysis of possible causes. Arch Dermatol. 2002;138:88-92.
9. Martin JA, Hughes TM, Stone NM. 'Black henna' tattoos: an occult source of natural rubber latex allergy? Contact Dermatitis. 2005;52:145-6.
10. Lim SP, Prais L, Foulds IS. Henna tattoos for children: a potential source of para-phenylenediamine and thiuram sensitization. Br J Dermatol. 2004;151:1271.
11. Hervella M, Durán G, Iglesias M, Ros C, Gallego M. Reasons to advise against temporary henna tattoos. An Sist Sanit Navar. 2005;28:403-7.
12. Martin JM, Revert A, Alonso V, García L, Molina I, Pereda C, et al. Eczema de contacto agudo a parafenilendiamina contenida en tatuajes transitorios con henna. Actas Dermosifiliogr. 2005;96:382-5.
13. Suárez-Fernández R, García P, Chavarría E, Lázaro P. Eczema alérgico de contacto por tatuaje de henna. Allergol et Immunopathol. 2002;30:292-4.
14. Ho SG, White IR, Rycroft RJ, McFadden JP. A new approach to patch testing patients with para-phenylenediamine allergy secondary to temporary black henna tattoos. Contact Dermatitis. 2004;51:213-4.
15. Jasim ZF, Darling JR, Handley JM. Severe allergic contact dermatitis to paraphenylene diamine in hair dye following sensitization to black henna tattoos. Contact Dermatitis. 2005;52:116-7.
16. Matulich J, Sullivan J. A temporary henna tattoo causing hair and clothing dye allergy. Contact Dermatitis. 2005;53:33-6.
17. Lewin PK. Temporary henna tattoo with permanent scarification. CMAJ. 1999;160:310.
18. Aguirre A., Vicente JM. Dermatitis de contacto por textiles y calzado. In: Dermatitis de contacto. Madrid: Aula Médica; 1999. p. 199-224.