

## **Contact dermatitis due to Para-Phenylenediamine (PPD) on a temporal tattoo with Henna. Cross reaction to azoic dyes.**

*María Cristina Di Prisco<sup>1</sup>, Lluís Puig<sup>2</sup> and Agustín Alomar<sup>2</sup>.*

<sup>1</sup>Instituto de Biomedicina (MSDS-UCV), Laboratorio de Inmunopatología y Consulta de Alergia, Universidad Central de Venezuela. Caracas, Venezuela y

<sup>2</sup>Servicio de Dermatología, Hospital de la Santa Creu i Sant Pau. Barcelona, España. Correo electrónico: mdiprisco@telcel.net.ve

**Key words:** Henna, temporary tattoos, p-phenylenediamine, contact dermatitis

**Abstract.** Henna is used as a hair dye and to make temporary tattoos on the skin. It is usually mixed with p-phenylenediamine (PPD) to increase colour intensity and to reduce the time of fixation on the skin proteins. PPD can cross react with azoic dyes which are used as textile dyes. We studied a patient with skin eczema in the area of a henna temporary tattoo. The epicutaneous tests performed with the standard Trolab and Chemotecnique® hair dressing and textile batteries, showed positive results to PPD, p-toluendiamine, 5-4aminophenol, Yellow 3, Orange Red and Red 1, and negative results to three types of henna. The eczema in this patient was due to sensitisation to PPD on a henna tattoo with cross reaction to azoic dyes. The recent fashion of applying temporal tattoos in occidental countries may produce an increase in the frequency of contact dermatitis due to henna mixtures with cross- reaction to related compounds and possibly producing permanent skin changes.

## **Dermatitis por contacto a para-fenilendiamina en un tatuaje temporal con Henna. Reacción cruzada con colorantes azoicos.**

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**Palabras claves:** Henna, tatuajes temporales, p-parafenilendiamina, dermatitis por contacto.

**Resumen.** La henna se utiliza como tinte para el cabello y para realizar tatuajes temporales sobre la piel. Con frecuencia se le agrega para-fenilendiamina (PPD) para acortar el tiempo de fijación del tinte a las proteínas de la piel y aumentar la intensidad del color. La PPD puede ocasionar reacción cruzada con los colorantes azoicos utilizados como tintes en los productos textiles. Estudiamos un paciente con eccema en el área de piel donde se había practicado un tatuaje temporal. Las pruebas epicutáneas se realizaron con la batería estándar de Trolab y baterías de peluquería y textiles de Chemotecnique®. Se obtuvieron resultados positivos a PPD, p-toluendiamina, 5-4 aminofenol, Amarillo 3, Naranja-Rojo y Rojo 1 y negativos a tres tipos de henna. El eccema en este paciente se debió a la sensibilización a PPD en un tatuaje con henna con reacción cruzada a colorantes azoicos. La reciente moda de aplicar tatuajes temporales en países occidentales está originando un aumento de la frecuencia de dermatitis por contacto debida a mezclas con henna con reacción cruzada con compuestos relacionados y posiblemente ocasionando cambios permanentes en la piel.

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### **INTRODUCTION**

Henna (*Lawsonia inermis*) is a plant from the *Lythracea* family cultured in North America, India, Sri Lanka and subtropical zones of Africa. The powder obtained from its dry leaves is mixed with water to obtain a paste which produces a brownish-red dye that has been used as a hair dye and for producing decorative designs on the skin in the form of temporary tattoos. In India and the Magreb there is a traditional custom of performing coloured designs on the skin due to social and religious motives. The active ingredient is 2-hydroxy-1,4-naphthoquinone (lawsone), has been used with curative purposes in several skin diseases, due to its effect of decreasing the temperature when the liquid content evaporates (1).

Allergic reactions to henna are well known; nevertheless, even though various clinical forms have been described as expression of these allergies, the frequency of these reactions seems to be rare.

Para-phenylenediamine (PPD) is a sensitising component commonly used in hair and textile dyes, and is also frequently added to henna mixtures. This mixture has the purpose of increasing the intensity of the colour and reducing the time for fixation on the skin, but it is forbidden in the United States because of its PPD content (2, 3).

Azoic dyes, which include approximately 40% of all textile dyes, can cross react with PPD. These products are among the most common causes for allergic contact dermatitis to textile dyes.

Since the chemical structure of lawsone is different from that of azoic dyes such as "Solvent Red 1" and "Solvent Red 3", the possibility of cross-reaction between these dyes and lawsone is not probable. Nevertheless, simultaneous sensitisations due to these molecules have been described, probably due to the henna/p-phenylenediamine mixture (4).

The fashion of carrying temporary tattoos has determined that in recent years henna be used more frequently in occidental countries. Even though its use is frequent, the reactions produced by this compound are rare.

This paper presents the study of a patient who attended at the Dermatology Department, Sant Pau Hospital because of eczema in the area of a coloured design made with henna.

### CLINICAL CASE

An atopic, 32 years old, professional theater actor patient, presented with an acute eczema following application of a henna base tattoo on the left forearm. After six days a new application of the henna base was performed on the figure edges. A pruritic edematous eczema appeared after 4 days.

The patient was treated with topical corticosteroids, and symptoms disappeared within a week. Nevertheless, at a three-month evaluation a slight hyper pigmentation persisted on the affected area, conserving the morphology of the original design which suggest chronic or permanent skin changes.

Epicutaneous tests with the standard Trolab battery and the Chemotecnique® hairdressing and textile batteries were applied. The 96-hour reading gave the following results: p-phenylenediamine (PPD) +++, p-toluendiamine +++, 5-4-aminophenol

++, Yellow3 +++, Orange Red + and Red 1 +.

It is probable that sensitisation occurred at the application of the original tattoo, since the patient had no background of previous use of hair dyes and no clinic history of textile allergies.

Unfortunately, it was not possible to obtain from the manufacturers the original henna mixture applied to this patient to perform epicutaneous tests. Nevertheless, we carried out epicutaneous tests with three types of henna obtained from a herb grower, i.e., "mahogany henna" (*Lawsone alba*), "neutral henna" and a type called "black henna", a type of pure henna without PPD content according to the information obtained from the manufacturers. These henna powders were used in 1% and 10% water dilutions for epicutaneous tests which were negative at 48 and 96 hours.

### DISCUSSION

The present fashion of using tattoos has increased henna use in occidental countries. Few contact dermatitis cases due to this product have been reported (1, 5). This suggests that either henna allergy is not frequent, or that the cases occurring have not been published. International literature points out adverse side effects due to henna; a variety of different clinical pictures have been reported such as asthma reactions mediated by type I hypersensitivity (6, 7), contact reactivity due to immediate hypersensitivity (8), abnormal pigmentation of nails (9) and severe toxicity with acute renal insufficiency and tubular necrosis (5), among others. A recent report describes two patients with persistent skin hyper pigmentation at the henna tattoo site several months after the application, which could produce permanent skin changes (10).

It is only since 1997 that publications began to appear demonstrating the mixture PPD and henna and outstanding its importance as the cause of sensitisation in individuals who carry temporary tattoos (2, 11, 12).

The patient studied by us showed strong positive reactions to p-phenylenediamine, p-toluenediamine, 5-4-aminophenol and some azoic dyes. Even though we were not able to obtain the henna mixture used for doing the tattoo, tests with the various types of henna were negative. As the patient was sensitised to PPD, demonstrated by the strong positive patch test to the PPD antigen, the negative results to the epicutaneous tests performed with the various types of henna: "mahogany henna" (*Lawsonia alba*), "neutral henna" and a type called "black henna", a type of pure henna without PPD content according to the information from the manufactures, demonstrate that these types of henna did not contain PPD. Occasionally, a hair dye called indigo is marketed as "black henna" and do not contain PPD, this may be the case in the "black henna" used by us.

Therefore, our results suggest the possibility that the mixture used for the tattoo contained PPD and probably some other substances used to fix dyes to tissues. The positive reactions to azoic dyes can be explained by the presence of cross-reactions to PPD (13). However, the patient had no clinic history of reactions to textile allergies.

There is no possibility of cross reactions between henna and azoic dyes because, even though we can see simultaneous positive reactions, the chemical structures of lawsone and azoic dyes are different (4).

Raison-Peyron *et al.* (14) described a clinical case of contact dermatitis produced by the application of a henna tattoo where the epicutaneous tests were positive for the henna paste used, for PPD, for N-isopropyl-

N-phenyl-para-phenylenediamine and for five textile dyes. On the other hand, the test with pure henna was negative. The authors studied the mixture used for tattooing using a liquid chromatography technique, and it was not possible to detect the presence of either PPD or azoic dyes, which suggests the possibility that some other non-identified hapten was incorporated in the mixture.

Martin *et al.* (15) have recently reported the case of a patient with a henna tattoo and positive patch tests to PPD and thiuram and a positive prick test to latex, these findings support important evidences on the possibility that other substances might be also implicated in the skin reactions to henna pseudo tattoos.

The addition of PPD to hair dyes is allowed in the United States and in the European Community to a maximum 6% concentration in the reconstituted product because in these cases, when the mixture is oxygenated, the period of contact with the skin is very short, thus decreasing its sensitising potential. With tattoos, contact with the skin is much more prolonged and, therefore, the incorporation of PPD is forbidden in products for topical use. The quantification of PPD in temporary henna tattoo has been significantly higher than in commercial hair dye preparations (16). Nevertheless, it is difficult to control the associations of these compounds from diverse origins, so it is possible that PPD or some of its derivatives may be present in henna mixtures, and they may not be necessarily mentioned in the documentation included with the products, if it exists.

The recent fashion of applying temporary henna tattoos has grown in occidental countries, which may originate an increase in the frequency of occurring contact dermatitis due to the use of henna mixtures, emphasizing the importance of this publication (17).

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