

Photo Developer Allergic Contact Dermatitis in a Photographer Following Paraphenylenediamine Sensitization from a Temporary Henna Tattoo

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Background: Paraphenylenediamine (PPD) is a coloring agent and potent sensitizer commonly added to henna tattoos to darken tattoo color. Photographic developers contain compounds that cross-react with PPD. Allergic contact dermatitis (ACD) from photo developers has been documented in the literature.

Objective: We describe the rare case of a photographer who presented with a 4-year history of recurrent ACD following exposure to photochemicals. History taking revealed that 10 years before presentation, he had received a temporary henna tattoo.

Methods: The patient was patch-tested with 4-methylaminophenol sulfate (Metol), the North American Contact Dermatitis Group (NACDG) series, and select other allergens.

Results: Patch testing results revealed strong positive reactions to 4-methylaminophenol sulfate and PPD.

Conclusion: This is the first report to our knowledge of ACD from a photo developer occurring as a consequence of previous sensitization to PPD from a temporary henna tattoo. Due to the potential for long-term sequelae, an awareness of the risks associated with henna tattoos is warranted.

Contexte: La paraphénylénédiamine (PPD) est un colorant et un puissant sensibilisateur souvent ajoutée aux tatouages au henné afin d'en foncer les couleurs. Les révélateurs photographiques contiennent des composés qui interagissent avec la PPD. La documentation fait déjà état de cas de dermatite de contact allergique (DCA) liés à l'emploi de révélateurs photographiques.

Objectif: Sera exposé ici le cas rare d'un photographe souffrant de DCA récidivante depuis 4 ans après une exposition à des produits photochimiques. L'anamnèse a révélé que le patient avait été exposé, 10 ans auparavant, à un tatouage temporaire au henné.

Méthode: Le patient a été soumis à des tests épicutanés au sulfate de 4-(méthylamino)phénol (Metol), à la série North American Contact Dermatitis Group (NDCAG) ainsi qu'à certains autres allergènes.

Résultats: Les tests épicutanés ont révélé une forte réaction positive au sulfate de 4-(méthylamino)phénol et à la PPD.

Conclusions: Il s'agit à notre connaissance du premier rapport de DCA consécutive à une exposition à un révélateur photographique et liée à une sensibilisation antérieure à la PPD, substance présente dans un tatouage temporaire au henné. Les conséquences possibles à long terme de l'exposition à cette matière justifient une prise de conscience des risques associés aux tatouages au henné.

Case Report

A 39-year-old photographer presented with a severe allergic contact dermatitis on the dorsal aspect of his

hands and forearms (Figure 1). Over the past 4 years, he had experienced repeated episodes of an acute vesiculo-bullous eczematous dermatitis, often in linear distribution, involving the hands and forearms, and sometimes with autoeczematization to the body. At the time of presentation, there was evidence of secondary infection, with significant lymphadenopathy in the left axillary vault.

The patient reported that he frequently hand-processed photographic prints due to his involvement in photography education for the last 4 years. As a result, his hands were often in contact with photochemicals, including a photo developing agent (Kodak Developer D-76, Eastman Kodak Company, Rochester, NY). Although he wore

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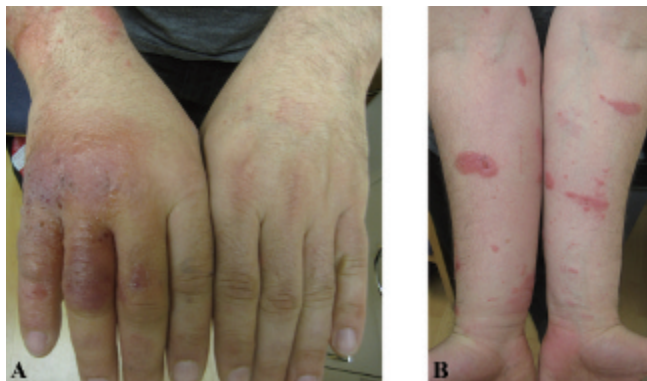


Figure 1. Allergic contact dermatitis on the hands (A) and forearms (B) of a 39-year-old photographer.

nitrile gloves in the work environment, he noted that the eczematous eruptions always coincided with recent exposure to the photochemicals. The Kodak Developer D-76 contained the following: sodium sulfite, hydroquinone, 4-methylaminophenol sulfate (Metol), boric anhydride, sodium tetraborate and pentahydrate.

On history, it was revealed that 10 years before presentation, the patient had developed a severe allergic contact dermatitis 10 days after receiving a temporary black henna tattoo on his left posterior shoulder while in Thailand. Prior to that episode, he had no history of dermatitis. He had never used hair dye products and was not working with photochemicals at the time of the tattoo. The patient had no relevant past medical history, medications, or family history.

The patient was given oral cephalexin 500 mg four times daily for 8 days and betamethasone valerate 0.05% ointment topically twice daily. A course of oral prednisone 40 mg daily was prescribed. The dosage of prednisone was tapered over 3 weeks, resulting in improvement in the dermatitis.

The patient was patch-tested to North American Contact Dermatitis Group (NACDG) standard screening series (AllergeEAZE, Smartpractice, Phoenix, AZ);

the Chemotechnique photography series (Chemotechnique Diagnostics AB, Malmö, Sweden), including 4-methylaminophenol sulfate; select textile allergens; and 3-aminophenol and 4-aminophenol from the Chemotechnique hairdressing series. Patch testing was performed with a standardized technique with Finn Chambers (Epitest Ltd Oy, Tuusula, Finland) on Scanpore tape (Norgesplaster Alpharma A/S, Vennesla, Norway). The patches remained in place for 48 hours, and the test sites were evaluated at 48 hours and again at 120 hours after initial placement according to the NACDG guidelines.¹

The results of the patch testing at 120 hours confirmed a 3+ strongly positive reaction to 4-methylaminophenol sulfate. The patient also reacted strongly (3+) to paraphenylenediamine (PPD), as well as to 4-aminophenol from the hairdressing series. There were also reactions to multiple disperse textile dyes. Positive patch test results are summarized in Table 1.

The patient was advised to avoid the photo developer due to his severe allergy. The option of assuming a more supervisory role or transferring to a “dry” job was discussed. The patient was also advised not to use any permanent hair dyes. Due to his reaction to a number of textile dyes, he was told that he may develop a clothing dermatitis, particularly with exercise or in hotter weather, when sweating is increased. He was advised to avoid synthetic fibers such as polyester, nylon, and acetate, which contain these problematic azo and anthraquinone dyes, and to opt for loose-fitting clothing made from natural fibers such as cotton, linen, and silk, which do not contain these dyes.

Discussion

Henna powder is obtained by grinding the leaves and flowers of the *Lawsonia inermis* plant. For centuries, Hindu and Islamic cultures have combined henna powder with oil or water for use as a hair and body dye.² Traditional henna tattoos last several weeks and stain the skin a red-brown color.³ On its own, henna has been noted to be a very low-level allergen.⁴

Recently, the practice of henna tattooing has gained popularity in North America.⁴ Henna tattoos are appealing as they offer a more convenient and self-limited alternative to permanent tattoos.³ At the same time, however, reports of reaction to temporary henna tattoos have increased worldwide.⁵ In the vast majority of such cases, the offending allergen has not been found to be henna itself but rather an additive substance, PPD.

PPD is a coloring agent that is widely used in hair dyes, rubber manufacturing, and textiles. Since its introduction

Table 1. Results at 120 Hours

Patch Test Reaction	Allergen
+++	Methylaminophenol sulfate (Metol)
+++	Paraphenylenediamine
++	4-Aminophenol
++	Disperse orange dye no. 3
+	Disperse orange dye no. 1
+	Disperse red dye no. 1
+	Disperse yellow dye no. 3
+	Disperse blue dye no. 124

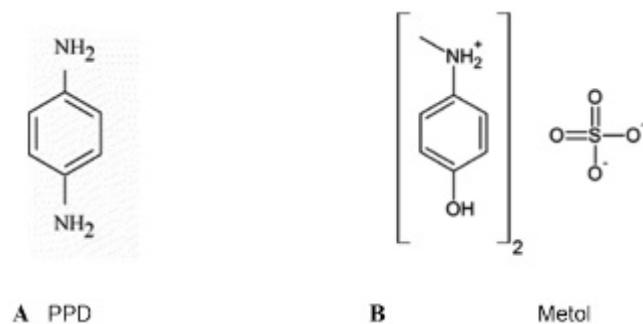


Figure 2. Chemical structures of paraphenylenediamine (PPD) (A) and methylaminophenol sulfate (Metol) (B).

in the 1880s, PPD has been a problematic substance, not only because it can cause severe allergic contact dermatitis but also because it is known to cross-react with a number of chemically related chemicals and drugs.³ Cross-reactivity with other substances containing an amino group in the para position of the benzene ring, such as para-aminobenzoic acid (PABA), sulfa drugs, benzocaine, azo dyes, and black rubber (isopropylparaphenylenediamine), has been reported.⁶

In recent years, new routes of exposure to PPD have emerged that have intensified concerns about its use. One growing route of exposure is the temporary black henna tattoo. According to numerous reports, tattoo artists are increasingly adding PPD to the traditional mixture of henna to darken the tattoo color and lessen drying time.²⁻⁶ Because this addition is performed by the artists themselves, the concentration of PPD in temporary black henna tattoos varies greatly. One report found the concentration of PPD in black henna tattoo mixture to be 15.7%,³ well above the recommended concentration of up to 5% in hair-coloring products. Currently, the only Food and Drug Administration–approved use of PPD is as a hair dye.²

Given the high level of PPD contained in black henna tattoos, patients with a history of receiving such tattoos are likely to be strongly sensitized to PPD. As a result, these patients require only minimal repeat exposure to PPD or cross-reacting substances for elicitation of an allergic response. Although hair dye remains the most common route of exposure to PPD,⁷ recent reports suggest that the incidence of positive patch-test reactions to hair dye has leveled off.⁴ Instead, reactions caused by occupational exposures seem to be increasing.⁴ Textile dyes, fur and leather dyes, black rubber products, and photo developers make up the broadening array of products that contain PPD or cross-reacting substances to which individuals may be exposed in the work environment.

Contact dermatitis from photo developers is well known and was first reported by Buckley in 1958.⁸ Today, however, increasing automation of the photo-developing process has reduced direct exposure to hazardous photochemicals; therefore, reports of contact dermatitis from photo developers are uncommon.^{9,10}

Our case is of special interest because it is the first reported case to our knowledge of allergic contact dermatitis to a photographic developer as a consequence of temporary black henna tattoo. Our patient likely became sensitized to PPD from the henna tattoo 10 years earlier; subsequent cross-reactivity with the photo developer occurred, resulting in his current presentation. The chemical structures of 4-methylaminophenol sulfate and PPD are pictured in Figure 2.

Conclusion

Despite automation of the photo-developing process, PPD-sensitized individuals who handle photochemicals, such as photographers, may continue to be at risk for occupational allergic contact dermatitis. We report the unusual case of occupational ACD from a photo developer occurring as a consequence of previous sensitization to PPD from a temporary henna tattoo. We agree with Matulich and Sullivan that the term “temporary” *black henna tattoo* is misleading because it gives a false sense of security about the safety of this procedure.² Sensitization to PPD as a result of henna tattooing is a serious, lifelong problem that can limit occupational activities, affect career decisions, and pose significant health hazards.

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