

Inflammation in Green (Chromium) Tattoos during Patch Testing

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We report three patients with permanent tattoos and chronic dermatitis. During patch testing, the patients' dermatitis worsened, and the previously quiescent green-colored portions of the tattoos became inflamed. All three patients were patch-tested and had positive reactions to potassium dichromate 0.25% in petrolatum. Avoidance led to the resolution of both the dermatitis and the tattoo inflammation. We recommend assessment of permanent tattoos for inflammation in all patients undergoing patch testing, for additional diagnostic correlation.

MILLIONS of people are tattooed worldwide for social and cultural purposes. A recent survey estimated the prevalence of tattooing among people aged 18 to 50 years in the United States to be close to 25%.¹

Permanent tattoos are made through the injection of a variety of metal-based pigment dyes into the dermis (Table 1). This practice has inherent medical risks, such as infections, koebnerization of underlying inflammatory skin conditions, foreign-body reactions, and allergic contact dermatitis (ACD).² Combinations of metals may be used to formulate a pigment,³ and there is a potential for trace metals to be deposited by the tattooing instruments themselves; these factors, combined with the difficulty of designating the source of the tattoo dyes, make identifying the exact metals that are causing a reaction within a tattoo a challenge.

Case Reports

Three patients with a history of permanent tattooing presented to the contact dermatitis clinic with generalized pruritus and chronic dermatitis. All three were patch-tested with the North American Contact Dermatitis Group standard series and individually pertinent supplemental

trays, according to the International Contact Dermatitis Research Group's guidelines. During patch testing, the patients' dermatitis worsened, and their previously quiescent tattoos became pruritic and inflamed in the green portions (correlating to suspected deposition of chromium oxide) (Fig 1). Because the tattoos had been done years previously, the pigments were not available for testing. At the 96-hour reading, all three patients had ++ patch-test reactions to potassium dichromate 0.25% in petrolatum. Of note, a chromium avoidance regimen resulted in marked improvement of all three patients' dermatitis and tattoo inflammations.

Discussion

Localized allergic reactions to chrome pigments in green tattoos have been previously reported.^{4,5} In our chromium-allergic patients, however, the activation of inflammation in the green pigment in their tattoos clinically correlated with a worsening of their dermatitis and pruritus during patch testing and with an improvement

Table 1. Tattoo Pigments and Corresponding Elements or Compounds

Dye Color	Elements or Compounds
Black	Carbon
Blue	Cobalt
Purple	Manganese
Brown	Ferric hydrate
Green	Chromium oxide
Red	Mercury
Yellow	Cadmium sulfide
White	Titanium dioxide, zinc oxide

Adapted from Kazandjieva J, Tsankov N.²

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Figure 1. The patient's tattoo during patch testing; note the inflamed green portion. Pigment contamination, combination, or both are possible during the tattooing process, placing chromium in some of the red areas. This may explain why some of the red areas appear to be inflamed along with the green areas.

of both with avoidance. Similarly, a case of systemic contact dermatitis from mercury in a swordfish dinner was reported to be associated with the patient's red tattoo.⁶

The following items were listed in the suggested chromium avoidance regimen: chromium-tanned leather products (ie, shoes, boots, and gloves), dietary supplements containing chromium⁷; eye cosmetics (eye shadow and eyeliner); concealers, foundations, and powders that contain chromium oxide greens or chromium hydroxide green ultramarines as pigments⁸; and certain skin care

products that also contain chromium green pigments (eg, Eucerin Redness Relief Daily Perfecting Lotion SPF 15 [with color neutralizers], Beiersdorf Inc., Wilton, CT).⁹

Notably, foods high in chromium, such as potatoes, green beans, broccoli, frozen or canned vegetables, canned fruits, apple peel, high-bran cereals, chicken, eggs, seafood (oysters, mussels, clams, and cockles), meat, spices, tea, coffee, beer (brewer's yeast), wine, and chocolate,^{10–12} may exacerbate chromate dermatitis.⁷ Dietary restrictions resulted in clearance of the pruritus in two of our three patients and significant relief for the remaining patient.

Our cases highlight the potential for permanent tattoos to be a sustained source of chromium salts and the importance of dietary intervention for exquisitely sensitized patients. Therefore, we recommend (1) evaluation of permanent tattoos for signs of inflammation in all patients undergoing patch testing and (2) further investigations of the role of tattooing in metal sensitization.

References

1. Laumann AE, Derick AJ. Tattoos and body piercings in the United States: a national data set. *J Am Acad Dermatol* 2006;55:413–21.
2. Kazandjieva J, Tsankov N. Tattoos: dermatological complications. *Clin Dermatol* 2007;25:375–82.
3. Corazza M, Zampino MR, Montanari A, et al. Lichenoid reaction from a permanent red tattoo: has nickel a possible aetiological role? *Contact Dermatitis* 2002;46:114–5.
4. Bjornberg A. Allergic reactions to chrome in green tattoo markings. *Acta Derm Venereol* 1959;39:23–9.
5. Cairns RJ, Calnan CD. Green tattoo reactions associated with cement dermatitis. *Br J Dermatol* 1962;74:288–94.
6. Tsuruta D, Sowa J, Higashi N, et al. A red tattoo and a swordfish supper. *Lancet* 2004;364:730.
7. Contact dermatitis and other reactions to metals. In: Rietschel RL, Fowler JF, editors. *Fisher's contact dermatitis*, 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2001. p. 620.
8. Kang EK, Lee S, Park JH, et al. Determination of hexavalent chromium in cosmetic products by ion chromatography and postcolumn derivatization. *Contact Dermatitis* 2006;54:244–8.
9. Scheman A, Jacob S, Zirwas M, et al. Contact allergy: alternatives for the 2007 North American Contact Dermatitis Group (NACDG) standard screening tray. *Dis Mon* 2008;54:7–156.
10. Anderson RA, Bryden NA, Polansky MM. Dietary chromium intake—freely chosen diets, institutional diets and individual foods. *Biol Trace Elem Res* 1992;32:117–21.
11. Environmental Protection Agency. Health assessment document for chromium. Research Triangle Park (NC): Environmental Assessment and Criteria Office, Environmental Protection Agency (US); 1984. EPA 600/8-83-014F.
12. Bratakos MS, Lazos ES, Bratakos SM. Chromium content of selected Greek foods. *Sci Total Environ* 2002;290:47–58.