

A Widespread Allergic Reaction to Black Tattoo Ink Caused by Laser Treatment

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Background and Objective: This is the first reported case of a local and widespread reaction in a 39 year old woman, to black tattoo ink, induced by Q-switched laser treatment.

Study Design/Patients and Methods: A 39 year old woman was treated with the Q-switched Nd:YAG laser for removal of a decorative tattoo of her lower back.

Results: Subsequent to laser treatment, a severe, widespread allergic reaction developed within and surrounding the treated tattoo.

Conclusions: Tattoo reactions subsequent to laser treatment should be considered in addition to reactions to topical antibiotics or wound dressings, following laser treatment of tattoos. *Lasers Surg. Med.*

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Key words: tattoo; allergy; treatment; ink; black; laser

INTRODUCTION

Decorative tattoos are quite prevalent, with one study finding 24% of those randomly surveyed by phone having at least one decorative tattoo [1]. Despite how widespread tattoos are in the U.S. and worldwide, few regulations are in place governing tattoo ink composition. In the U.S., the Federal Food, Drug and Cosmetic Act covers regulation of tattoo inks as cosmetics and color additives, while placement of tattoos is regulated by individual states [2]. In addition, no tattoo inks are approved for injection into the skin by the U.S. Food and Drug Administration (FDA). The FDA has not traditionally regulated tattoo inks due to a previous lack of safety concerns, although recent evidence of tattoo reactions has now prompted the FDA to study tattoo ink safety [2]. Among the myriad adverse reactions to tattoos are allergic reactions to tattoo inks [3,4], and more rarely, allergic reactions to inks once they have been altered by laser treatment for their removal [5].

CASE REPORT

A 39 year-old woman presented for removal of a decorative tattoo on her central lower back. Many years previously, she had a multi-colored tattoo on her ankle removed by a series of laser treatments. She reported intermittent "itching, like mosquito bites" in this tattoo at various times, but was unable to correlate the pruritus temporally to the laser treatments. When she presented to

our clinic for removal of her tattoo located on her lower back, which was placed by a different tattoo artist than the tattoo previously located on the ankle, the ankle tattoo site showed no evidence of a tattoo, scarring, or pigment alternation. The tattoo she wished to have removed at presentation was on her lower back and was a black annular wreath, 6 cm in diameter, flat, and demonstrating no inflammation, scale or other reaction (Fig. 1). It was completely asymptomatic.

Prior to treatment, the tattoo was injected with lidocaine 0.5% with 1:200,000 epinephrine and then covered with a clear hydrogel dressing (Vigilon; CR Bard, Inc., Covington, GA) to protect the epidermis and prevent aerosolizing blood and skin particles during treatment. The entire tattoo was then treated with a Q-switched, 1,064 nm, neodymium-doped, yttrium-aluminum-garnet (Nd:YAG) laser (Con-Bio Revlite SI, Cynosure, Inc., Westford, MA), using a fluence of 7.6 J/cm² with a 4.6 mm-diameter treatment beam. Post-laser treatment consisted of applying a petrolatum-based ointment (Aquaphore; Beiersdorf, Inc., Wilton, CT) with a non-stick dressing. Her recovery was uneventful until 10 days post-treatment when she reported severe pruritus in the area of the tattoo, as well as pruritic papules surrounding the tattoo and extending midway up her back. She reported no crusting, scabbing or blistering during the 10 days following treatment, only darkening of the tattoo with minimal surface reaction. Since she was out of town, fluocinonide ointment was prescribed by phone, which she used twice daily to the tattoo and surrounding area, with minimal-to-moderate relief. She was able to present to our office for evaluation 3 days later, where she stated that the papules had extended further up her back and the pruritus was increasing in intensity (Fig. 2a). The patient refused a skin biopsy and oral prednisone at the time of presentation. She agreed to have the site of the tattoo injected with intralesional triamcinolone acetonide 5 mg/ml, and the patient

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Fig. 1. Cross-polarized photograph of the black tattoo prior to treatment.

was prescribed clobetasol proprionate ointment to be applied twice daily to the pruritic papules surrounding the tattoo and involving her lower and mid-back. Diphenhydramine 25 mg was also prescribed nightly. The pruritus and erythematous papules improved slowly over the next month, with complete resolution 2 months following their initial presentation. The tattoo healed with scarring in some areas, presumably due to the intense inflammation with blister formation resulting from the allergy to the laser-treated intradermal pigment (Fig. 2b).

DISCUSSION

Although allergic reactions to tattoo ink are somewhat uncommon, they are regularly seen by dermatologic laser surgeons due to the prevalence of tattoos in general [1–24]. Many types of allergic reactions to tattoo ink have been reported, in addition to the more typical allergic contact dermatitis [6], including: lichenoid reactions [11], pseudo-lymphomatous reactions [7,8], morphea like reactions [13] granuloma annulare-like reactions [17], vasculitis [18], angioedema [19], and even anaphylactic reactions [22]. Allergic reactions to red ink [5,11,14–16,18,21,22,25], are by far the most common allergic tattoo reactions. Photo-allergic reactions to yellow ink have also been reported and are commonly seen by dermatologists treating tattoo reactions [6,8,16]. Virtually every color of ink has elicited an allergic reaction in someone, with one patient experiencing an allergic reaction to green tattoo pigment who then demonstrated an exacerbated reaction upon patch testing to chromium salts [20]. Allergic reactions to black tattoo ink are quite rare, but have been reported [3,10]. Although most allergic tattoo reactions are localized to the specific color a person is sensitized to, some reactions to tattoo inks spread well beyond the tattoo location in the skin, and have even resulted in systematized allergic reactions.

Widespread allergic reactions to tattoo inks, that result from lymphatic spread of ink particles beyond the tattoo site or from an id reaction, have been described; [4,15,18,19,22,24–26] although localized reactions limited

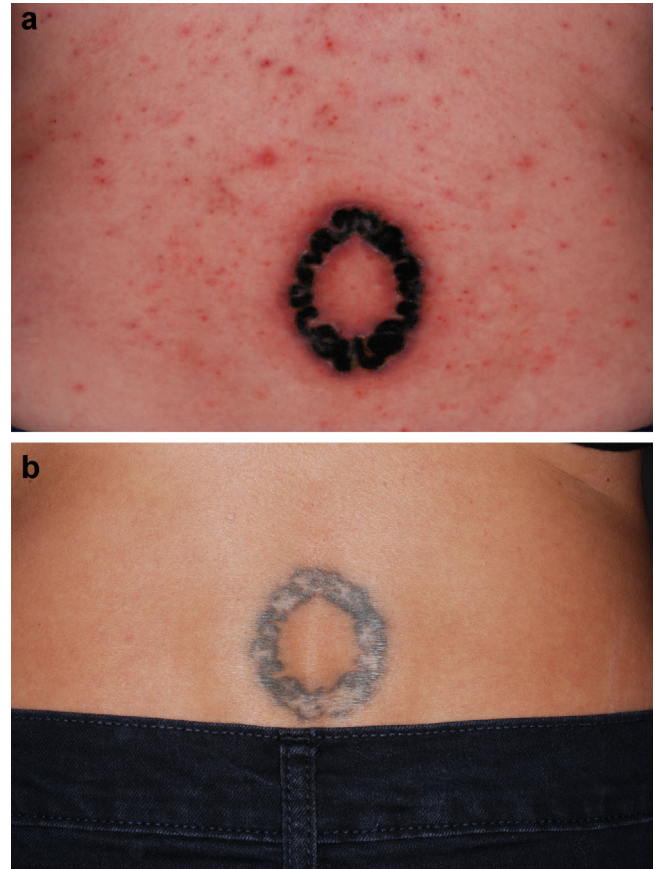


Fig. 2. **a:** Local and distant allergic reaction following laser treatment of a black tattoo. **b:** Resolution of the allergic reaction with some scarring 10 weeks following laser treatment.

to the site of the offending ink are far more common. Severe anaphylactic reactions to tattoo ink have also been reported following application of tattoos [22], or following their treatment [19,24]. An anaphylactic reaction was reported on two separate occasions after application of multicolored ink to one patient [22], while another experienced an anaphylactic reaction following treatment of a multicolored tattoo with a 1,064 nm, Nd:YAG, Q-switched laser [19]. Although Q-switched lasers, carbon dioxide (CO₂) lasers, and dermabrasion have been successfully used to remove tattoos, including those exhibiting an allergic reaction, even destructive modalities, like the CO₂ laser have caused anaphylactic reactions when used to treat tattoos which are eliciting an allergic reaction [24]. Both local and widespread allergic reactions following laser treatment have been reported [5,12,19,24,25]. Reactions post-laser treatment may be due to laser energy altering the composition of tattoo inks and creating new antigens which the patient then reacts to, or due to the inflammatory response to laser treatment revealing the tattoo ink to the immune system [5]. Laser treatment of tattoos which are already experiencing an allergic reaction can be quite dangerous, as severe, systemic

allergic reactions following such treatments have been reported [19,24].

In this current case, the patient experienced a widespread allergic reaction involving the majority of her back, with a much more severe reaction in the site of the tattoo itself. Symptoms eventually abated after administration of intralesional corticosteroids and oral antihistamines, and the tattoo eventually flattened out and became completely asymptomatic; although some scarring resulted from the severe allergic inflammatory reaction. It is unlikely that the scarring was simply due to the laser treatment, because the patient experienced very little reaction during the 10 days following laser treatment, despite the relatively high fluence administered. The blisters and reaction occurred a full 10 days following treatment, and were associated with extreme pruritus. Also, in a study of 13 tattoos treated with the identical laser, hydrogel dressing, and physician administering treatments, the average fluence delivered for the first treatment was 6.6 J/cm² with a maximum fluence of 7.6 J/cm², with fluences up to 9.2 J/cm² being administered on subsequent treatments and no blisters were noted [27]. We were unable to obtain histopathologic examination to determine the exact type of allergic reaction she was experiencing because the patient refused a skin biopsy, as she was quite convinced that she was experiencing an allergic reaction due to the severe pruritus. Presumably, future treatments of this tattoo would result in a similar or even a more severe reaction, so the patient was strongly advised against having more laser treatments. She has for now elected to not pursue excision. Further fading may occur if an asymptomatic, continued, low-level inflammatory response persists.

Numerous laser treatments have been performed on tattoos that are causing allergic reactions without consequence [14,23], often with prior administration of intralesional or oral corticosteroids and oral antihistamines; however, the possibility of a severe reaction following treatment should raise caution with this approach. Excision is a safer option, and should be considered if feasible when considering the size and location of the tattoo [16]. Future standardization and testing of tattoo inks should reduce the number of allergic tattoo reactions and result in greater safety for people choosing to place decorative tattoos, while advances in laser technology should make tattoo removal possible in fewer treatments.

REFERENCES

1. Laumann AE, Derick AJ. Tattoos and body piercings in the United States: A national data set. *J Am Acad Dermatol* 2006;56:413–421.
2. <http://www.fda.gov/forconsumers/consumerupdates/ucm048919.htm>.
3. Treudler R, Tebbe B, Sven K, Orfanos CE. Allergic contact dermatitis from black tattoo. *Contact Dermatitis* 1997;37:295.
4. Bhardwaj SS, Brodell RT, Taylor JS. Red tattoo reactions. *Contact dermatitis* 2003; 48: 236–237.
5. Ashinoff R, Levine VJ, Soter NA. Allergic reactions to tattoo pigment after laser treatment. *Dermatol Surg* 1995;21: 291–294.
6. Ortiz AE, Alster TS. Rising concern over cosmetic tattoos. *Dermatol Surg* 2012;38:424–429.
7. Gardair Bouchy, Kerdraon C, Kluger R, Armingaud N, Wakosa P, Estève A. Cutaneous lymphoid hyperplasia (pseudolymphoma) on the red dye of a tattoo. *Ann Pathol* 2013;33:273–277.
8. Blumental G, Okun MR, Ponitch JA. Pseudolymphomatous reaction to tattoos: Report of three cases. *J Am Acad Dermatol* 1982;6:485–488.
9. Yoong C, Vun YY, Spelman L, Muir J. True blue football fan: tattoo reaction confined to blue pigment. *Australas J Dermatol* 2010;51:21–22.
10. Gallo R, Parodi A, Cozzani E, Guarrera M. Allergic reaction to India ink in a black tattoo. *Contact Dermatitis*. 1998;38: 346–347.
11. Corazza M, Zampino MR, Montanari A, Pagnoni A, Virgili A. Lichenoid reaction from a permanent red tattoo: Has nickel a possible aetiologic role. *Contact Dermatitis* 2002;46:114–115.
12. England RW, Vogel P, Hagan L. Immediate cutaneous hypersensitivity after treatment of tattoo with Nd:YAG laser: A case report and review of the literature. *Ann Allergy Asthma Immunol* 2002; 89:215–217.
13. Mahalingam M, Kim E, Bhawan J. Morphea-like tattoo reaction. *Am J Dermatopathol* 2002; 24:392–395.
14. Dave R, Mahaffey PJ. Successful treatment of an allergic reaction in a red tattoo with the Nd-YAG laser. *Br J Plast Surg*. 2002;55:456.
15. Greve B1, Chytry R, Raulin C. Contact dermatitis from red tattoo pigment (quinacridone) with secondary spread. *Contact Dermatitis* 2003;49:265–266.
16. Zwad J, Jakob A, Gross C, Rempel R. Treatment modalities for allergic reactions in pigmented tattoos. *J Dtsch Dermatol Ges* 2007;5: 8–13.
17. Bagwan IN, Walker M, Theaker JM. Granuloma annulare-like tattoo reaction. *J Cutan Pathol* 2007;34:804–805.
18. Hermida MD, Otero M, Della Giovanna, García P, Cabrera S. Cutaneous vasculitis following an intradermal tattoo. *J Eur Acad Dermatol Venereol* 2007;21:1268–1269.
19. Stephan F, Moutran R, Tomb R. Hypersensitivity with angioedema after treatment of a tattoo with Nd: YAG laser. *Ann Dermatol Venereol* 2010;137:480–481.
20. Jacob SE, Castaneda-Tardan MP, Blyumin ML. Inflammation in green (chromium) tattoos during patch testing. *Dermatitis* 2008;5:E33–E34.
21. Taffe A, Knight AG, Marks R. Lichenoid tattoo hypersensitivity. *Br Med J* 1978;1:616–618.
22. Lee-Wong M, Karagic M, Silverberg N. Anaphylactic reaction to permanent tattoo ink. *Ann Allergy Asthma Immunol* 2009;103:88–89.
23. Ibrahim OA, Syed Z, Sakamoto FH, Avram MM, Anderson RR. Treatment of tattoo allergy with ablative fractional resurfacing: A novel paradigm for tattoo removal. *J Am Acad Dermatol* 2011;64:1111–1114.
24. Zemstov A, Wilson L. CO2 laser treatment causes local tattoo allergic reaction to become generalized. *Acta Derm Venereol* 1997;77:497.
25. Harper J, Losch AE, Otto SG, Zirwas M, Delaney KO, Wakelin JK. New insight into the pathophysiology of tattoo reactions following laser tattoo removal. *Plast Reconstructive Surg* 2010; 126:313e–314e.
26. Goldberg HM. Tattoo Allergy. *Plast Reconstr Surg*. 1996; 98:1315–1916.
27. Bernstein EF, Civiok JM. A continuously variable beam-diameter, high-fluence, Q-switched Nd:YAG laser for tattoo removal: Comparison of the maximum beam diameter to a standard 4-mm-diameter treatment beam. *Lasers Surg Med* 2013;54:621–627.