

Treatment of tattoo allergy with ablative fractional resurfacing: A novel paradigm for tattoo removal

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Background: Q-switched lasers are the gold standard for tattoo treatment. Allergic tattoo reactions present a treatment dilemma. We present the application of ablative fractional resurfacing (AFR) as a novel method for tattoo removal.

Objective: We describe two patients with tattoo allergies, referred to us for treatment.

Methods: AFR was used in a series of treatments to remove the allergic-ink portion of a multicolored tattoo on the upper extremity of a 52-year-old man. In a 31-year-old woman with a red and black tattoo on her lower extremity, AFR was combined with a Q-switched neodymium:yttrium-aluminum-garnet laser.

Results: After a series of treatments, both patients experienced significant to complete removal of the offending tattoo inks with substantial or complete resolution of their symptoms.

Limitations: This uncontrolled observational series is based on two patients.

Conclusions: AFR appears to be safe and effective for removal of allergic tattoos. AFR can be combined with other treatments such as Q-switched lasers. The potential for a series of AFR treatments to remove tattoos, including allergic tattoos and inks of any color, merits further study. (J Am Acad Dermatol 2011;64:1111-4.)

Key words: laser therapy; Q-switched lasers; tattoo allergy.

One quarter of Americans are estimated to have tattoos, of which 20% are dissatisfied with their tattoo.¹ The gold standard for tattoo removal is the various Q-switched (QS) lasers. QS ruby, alexandrite, and neodymium (Nd):yttrium-aluminum-garnet (YAG) lasers operate at wavelengths of 694, 755, and 1064 nm, respectively, and have been shown in multiple studies to be effective at removing blue, black, and green ink.²⁻⁵ At 532 nm, the frequency-doubled Nd:YAG laser is efficacious in

Abbreviations used:

AFR: ablative fractional resurfacing
Nd: neodymium
QS: Q-switched
YAG: yttrium-aluminum-garnet

removing red pigment.^{3,6} White, orange, yellow, and brown tattoo inks are particularly challenging to treat.

Occasionally, patients develop an allergy to their tattoo.⁷ The most commonly reported allergies are to red inks (containing organic dyes or mercuric sulfide), although many other colors can cause allergic reactions. Treatment of allergic tattoo reactions is challenging, particularly when surgical excision is not practical or desired. QS frequency-doubled Nd:YAG lasers have been used for the removal of red allergic tattoos.⁸ However, there have been several cases of generalized allergic reactions after laser treatment, presumably because of release of antigenic tattoo ink particles into systemic/lymphatic circulation.^{9,10}

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Fractional photothermolysis uses laser microbeams to damage (nonablative) or remove (ablative) an array of thousands of microscopic columns of skin.¹¹ We hypothesized that tattoo ink would be particularly amenable to removal with ablative fractional resurfacing (AFR) as the technique directly removes a portion of the tattoo, with the microscopic columns then providing a direct egress through which additional tattoo ink can be extruded.

METHODS

Two patients with an allergic reaction to pigment in their tattoos were referred to us for treatment.

Case 1

A 50-year-old man presented to us with a large multicolor professional tattoo on his left forearm (Fig 1, A). He developed intractable pruritus at the site 1 week after placement. Examination revealed eczematous plaques with crusting in the areas specifically associated with brown ink (bamboos and part of tiger), consistent with an allergic tattoo reaction. The patient refused biopsy for clinicohistopathological correlation, and expressed a desire to avoid surgical excision of this large tattoo. Because brown tattoo inks are not particularly amenable to QS lasers, he was treated with erbium:YAG 2940-nm AFR (Sciton ProFractional, Palo Alto, CA) to the areas with brown pigment after infiltration with lidocaine. The patient underwent 7 treatments at 1- to 2-month intervals at the following settings: treatment depth gradually increasing from 400 to 1200 μm , density varying between 10% and 20%, and a spot size setting of 5. The patient was given prednisone starting at 70 mg (1 mg/kg) orally once daily, and tapered by 10 mg daily for 1 week, to avoid a systemic hypersensitivity reaction, with each treatment course. He developed a generalized pruritic morbilliform eruption after a test spot treatment. Wound care after each treatment included wet-gauze soaks every 3 hours for 24 hours, and petrolatum to the treated area 4 times daily.

Case 2

A 31-year-old woman presented after obtaining a professional red and black tattoo on the side of her left leg (Fig 1, C). She developed intense itching, and weeping a few weeks after having the tattoo placed.

Before presenting to us, she began to develop firm induration on portions of her tattoo suggesting a fibrosing granulomatous response (scarring). She consulted several dermatologists who recommended surgical excision followed by skin graft repair. The patient refused biopsy for clinicohistopathological correlation. She was treated with a combination

of erbium:YAG 2940-nm AFR (Sciton ProFractional), and a QS Nd:YAG laser device operated at 1064 nm for black ink areas and at 532 nm for red ink areas (MedLite C3, HOYA ConBio, Freemont, CA) after infiltration with lidocaine. The patient underwent 4 such treatments at 1- to 2-month intervals. Her entire tattoo was first treated with erbium:YAG AFR at the following parameters: depth ranging from 1000 to 1200 μm , density varying between 10% to 20%, and a spot size setting of 5. Black areas of her tattoo were then treated with the QS Nd:YAG laser at

the following parameters: wavelength 1064 nm, fluence of 5 J/cm², repetition rate of 10 Hz, and a 3-mm spot size. Red areas of her tattoo were then treated with the frequency-doubled QS Nd:YAG laser at the following parameters: wavelength 532 nm, fluence of 5 J/cm², repetition rate of 10 Hz, and a 4-mm spot size. The wound care regimen is as described in case 1.

RESULTS

Case 1

On 6-month follow-up after the final treatment, brown pigment in the treated areas (Fig 1, B) was no longer seen, and the patient's symptoms of intractable pruritus had also completely abated. Notably, there was clinically complete removal of the brown tattoo ink, which in our experience can be quite recalcitrant to treatment with QS lasers. The remainder of the tattoo that was not treated was completely intact.

Case 2

There was significant lightening of the patient's tattoo on 8-month follow-up after her fourth treatment (Fig 1, D), with resolution of her pruritus. Clinically, there did not appear to be any residual red tattoo ink remaining.

CAPSULE SUMMARY

- Ablative fractional technology is a novel approach for tattoo removal.
- The potential for fractional ablative laser treatments to remove tattoos, including allergic tattoos and inks of any color, merits further study.
- The mechanisms by which ablative fractional resurfacing are thought to facilitate tattoo removal include: physical removal of a portion of the tattoo, the transepidermal elimination of tattoo ink through the newly created microscopic channels, and further tattoo ink removal through the wound-healing process.



Fig 1. Ablative fractional resurfacing (AFR) for tattoo removal. **A**, Large professional tattoo of tiger (orange, black, white, and brown inks) in background of bamboo (brown ink) and leaves (green ink) on left forearm of 50-year-old man with suspected allergy to brown ink. **B**, On 6-month follow-up after seventh treatment of AFR, brown pigment was no longer seen in treated areas. **C**, Large professional red and black dragon tattoo on side of left leg of 31-year-old woman with suspected allergy to red ink. **D**, On 8-month follow-up after fourth treatment of combination of AFR and Q-switched neodymium:yttrium-aluminum-garnet laser, there was significant lightening of patient's tattoo.

DISCUSSION

Tattoo removal presents a challenging dilemma, especially when there is an intense allergic reaction. If the tattoo is small and amenable to simple excision, this may be the treatment of choice. Dermabrasion¹² or classic laser resurfacing may be used to remove the tattooed dermis, but these treatments commonly cause significant scarring. Topical/intralesional corticosteroids may be useful for mild local reactions, but only provide temporary relief.

QS lasers have a very low risk of scarring, and are thought to result in tattoo ink removal by 3 mechanisms: (1) transepidermal elimination; (2) removal via lymphatics; and (3) rephagocytosis by other cells in the dermis.¹³ Disadvantages of QS laser treatment include treatment resistance and potential darkening of some ink colors,¹⁴ the need to match laser wavelength with tattoo ink color, the need for multiple treatments, and occasional pigmentary side effects. The QS frequency-doubled Nd:YAG laser has been shown to be effective in the removal of red allergic tattoos.⁸ However, there have also been several cases of generalized allergic reactions after laser treatment, presumably because of release of antigenic ink particles into systemic or lymphatic circulation after each treatment.^{9,10}

AFR uses laser microbeams to create an array of very small, deep zones of tissue removal with intervening areas of normal-appearing skin.¹⁰ AFR stimulates rapid remodeling of the skin, as the microscopic zones of ablation are replaced with de novo skin, and has a very low risk of scarring. Tattoo ink removal likely occurs because AFR physically removes a portion of the tattoo with each treatment. Secondly, the newly created microscopic channels then provide a conduit for the elimination of additional tattoo ink. Finally, the wound-healing process might permit additional tattoo ink removal.

In conclusion, we show that AFR is capable of significant to complete removal of tattoo pigment in a series of treatments, and provides an entirely novel and alternative means for tattoo removal. Combination of AFR with QS lasers was also successfully performed. This combination may be synergistic, as the mechanisms for removal are different. In addition, the channels created by AFR likely enhance the ability of QS lasers to result in transepidermal elimination of tattoo ink. AFR may also permit removal of ink colors, such as yellow, orange, brown, and white, that are recalcitrant to QS lasers. This study is limited as an uncontrolled observational series of two patients.

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