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Abstract

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Generalized eczematous reaction after fractional carbon dioxide laser therapy of tattoo allergy

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Abstract

Allergic tattoo reactions form a therapeutically difficult entity. Treatment with conventional quality-switched lasers, does not completely remove the allergenic particles and may lead to generalized hypersensitivity reactions. Recently, ablative fractional laser therapy was introduced as a treatment for allergic tattoo removal. We present two cases of allergic reactions to red tattoo ink treated with the 10,600 nm fractional CO₂ laser. At the end of treatment, almost complete removal of red ink accompanied by a significant reduction of symptoms was observed in the first patient, whereas the second patient developed an acute generalized eczematous reaction after five treatments. These findings confirm that ablative fractional laser therapy is capable of significant removal of tattoo ink in an allergic tattoo reaction. However, it implies a risk of generalized hypersensitivity reactions. To our knowledge, this is the first case of a generalized hypersensitivity reaction following treatment of tattoo allergy with the fractional CO₂ laser.

Keywords: Fractional CO₂ laser, tattoo, contact dermatitis

Introduction

Tattoos have shown an increasing popularity over the past decades.(1) Therefore, the occurrence of adverse cutaneous reactions to tattoo dyes becomes a more and more important issue.(2)

Ablative fractional laser therapy has been reported as a treatment option for allergic tattoo reactions.(3) We present two cases of allergic reactions to tattoo ink treated with the fractional carbon dioxide (CO₂) laser, one being successfully cured, whereas the other developed a generalized eczematous reaction.

Cases

Patient 1

A 36-year-old Caucasian woman presented to us with tattoos on the wrists (Fig. 1a) and the dorsal region of both feet consisting of red and black ink. She had developed pruritus and local thickening of the skin in all tattoos one to three years after placement. On examination sharply demarcated erythematous squamous plaques were observed in the red areas. The affected areas were initially treated with local intralesional 40 mg/ml triamcinolone acetonide injections, resulting in some improvement of the itching and thickening after two months. After treating three test regions with the fractional 10,600 nm CO₂ laser (Lumenis Ultrapulse Encore, DeepFX handpiece, Lumenis Ltd., Santa Clara, CA, USA), treatment of all lesions was started at 30 mJ/microbeam and 25% coverage under infiltration anesthesia. The patient underwent four treatments (five treatments for the tattoo on the right foot; energy 30-40 mJ/microbeam, coverage 20-25%, interval 2-5 months). The patient received after-treatment with 20 mg/g fusidic acid cream to prevent infection. The lesions were injected with intralesional 40 mg/ml and 10 mg/ml triamcinolone acetonide injections after the first two treatment sessions, respectively. After the third to fifth laser treatment triamcinolone 40 mg/ml was dripped on the lesion, enabling uptake via fractional ablation channels. Red ink gradually disappeared from all tattoos and after four treatment sessions almost no signs of inflammation were observed in most tattoos (Fig. 1b). There was a significant reduction in itching. Healing was uncomplicated. Two years after the last laser treatment, the patient still reported no itching.

Patient 2

An 18-year-old Caucasian woman presented with edema, itching and pain at the site of a professional tattoo on the right ankle since eight months (Fig. 1c). She developed the symptoms four to five months after placement of the tattoo. Examination revealed sharply demarcated erythematous squamous plaques in areas with red ink. Multiple small intradermal nodules could be palpated within the affected area. Previously, the patient had been unsuccessfully treated with 0.5 mg/g fluticasone propionate cream during two weeks. After treating four test regions with the fractional 10,600 nm CO₂ laser, the entire lesion was treated at 25 mJ/microbeam and 20% coverage under both topical and infiltration anesthesia. The patient was treated six times (energy 25-35 mJ/microbeam, coverage 15-20%, interval 2-4 months). The treated area was after-treated with 10 mg/g silver sulfadiazine cream under occlusion. In addition, the patient was advised to apply 20 mg/g fusidic acid cream three times daily for at least five days after each treatment session. One month after each treatment, she was also treated with intralesional 10 or 40 mg/ml triamcinolone acetonide injections. After five treatments, no evident improvement was reported by the patient. Moreover, within one day after the fifth laser treatment (35 mJ, 20%), she developed pruritus, erythema and papules, primarily in the area surrounding her tattoo, but also on the arms, face and knees, resembling acute contact dermatitis (Fig. 1d). She had no history of atopy or allergy. She was instantly treated with oral levocetirizine 20 mg/day, 0.5 mg/g clobetasol propionate cream twice a day (arms) and 1 mg/g mometasone ointment (face) once a day. As a result, the signs of eczema gradually subsided, but could still be observed seven months after the last laser treatment. Recovery of the laser induced erosions was delayed, probably due to the intralesional steroid injections and repeated scratching (Fig. 1e). As the patient experienced persistent itching on the site of the tattoo, a sixth laser treatment at 35 mJ and 20% was carried out in an attempt to reduce the antigenic load. Despite after-treatment with hydrocolloid dressings, one month after the last laser treatment ulceration of the area was observed. Complete recovery took almost one year and the ulcer healed with scar formation. At 13 months follow-up, the signs of eczema had almost disappeared and no more red ink was visible within the tattoo. At 24 months follow-up, the patient was still free of complaints (Fig. 1f).

Discussion

To date, several cases of localized and generalized allergic reactions have been reported following laser tattoo removal in both patients with a preexistent allergic reaction to tattoo ink and in previously non-allergic patients. Both immediate and delayed type reactions have been described after treatment with Q-switched lasers.(4-6) In addition, regional lymphadenopathy after treatment with the Q-switched ruby laser, was reported by Izikson.(7)

Hypersensitivity reactions due to treatment with lasers acting by selective photothermolysis are caused by systemic uptake of antigenic pigment that is released extracellularly by fragmentation of pigment-containing macrophages and mast cells.(2,4,6) Hypothetically, antigenic determinants may also be altered by the laser therapy itself. This might explain the occurrence of hypersensitivity reactions after laser treatment of previously non-allergenic tattoos.(4)

Beside the risk of induction of allergic reactions, treatment efficacy of most widely used Q-switched lasers, such as the frequency doubled Nd:YAG laser, is compromised by the limited penetration depth of these modalities.

Contrarily, ablative lasers definitively eliminate antigenic ink particles, hereby reducing antigenic load and preventing systemic uptake. Besides, CO₂ laser energy is not selectively absorbed by ink particles, preventing chemical alteration of potentially antigenic particles.(3,8) Ablative fractional lasers have the advantages of conventional full surface ablative lasers, whereas the risk of scarring is minimized, even when ablation is deep. Beside the removal of tattoo ink, fractional laser treatment may also facilitate intradermal delivery of topical steroids. Recent literature suggests that numerous topical substances, including corticosteroids, can be effectively delivered through fractional laser ablation channels.(9)

In this article, we describe, as far as we know, the second case of successful treatment with ablative fractional laser of an allergic tattoo reaction and the first case of a generalized eczematous reaction.(3) There is one previous report of a generalized urticarial reaction occurring three weeks after conventional CO₂ laser therapy of an eczematous tattoo reaction.(8) We hypothesize that antigenic pigment from a small zone of heat conduction, where coagulation takes place instead of ablation, is released extracellularly resulting in systemic spread.

The reason why patient 2 developed a generalized eczematous reaction whereas patient 1 did not, remains unclear. We speculate that in patient 2 laser treatment at high energy and coverage settings at a vulnerable location as the lower leg followed by scratching by the patient induced a strong local inflammatory response, increased uptake of antigenic ink particles by macrophages and subsequently both local and systemic spread of these particles. As laser coverage and energy settings were gradually increased over the treatment sessions, the combination of the relatively high energy and coverage settings of 35 mJ and 20% respectively was used for the first time during the fifth laser treatment in patient 2, after which the generalized eczematous reaction was first noticed.

Also, differences in after-treatment may be partially responsible for the differences in response in our two patients. Application of topical corticosteroids directly after fractional laser treatment may enable uptake through the fractional ablation channels and may hence prevent a severe local reaction. Furthermore, recent evidence indicates that silver sulfadiazine cream may impair wound healing potentially causing a state of persistent local inflammation.(10)

In conclusion, our findings in the first case suggest that ablative fractional laser therapy may be capable of significant removal of tattoo pigment in an allergic tattoo reaction. The removal of tattoo pigment combined with laser-assisted delivery of topical steroids may lead to a reduction of the inflammatory reaction. However, as the second case shows, the laser treatment implies a risk of generalized hypersensitivity reactions.

Conflicts of interest: none

Funding sources: none

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Figure Legend

Figure 1. Ablative fractional laser therapy in the treatment of allergic tattoo reactions. (a) Allergic reaction in a tattoo on the wrist in a 36-year-old woman. (b) No signs of inflammation and substantial reduction of red ink after three treatments with the 10,600 nm fractional CO₂ laser (Deep FX handpiece). (c) Allergic reaction in a tattoo on the ankle in an 18-year old woman. (d) Excoriated erythematous papules on her left wrist. (e) Eczematous reaction surrounding the tattoo and ulceration after the fifth laser treatment. (f) Site of the tattoo at two years follow-up.

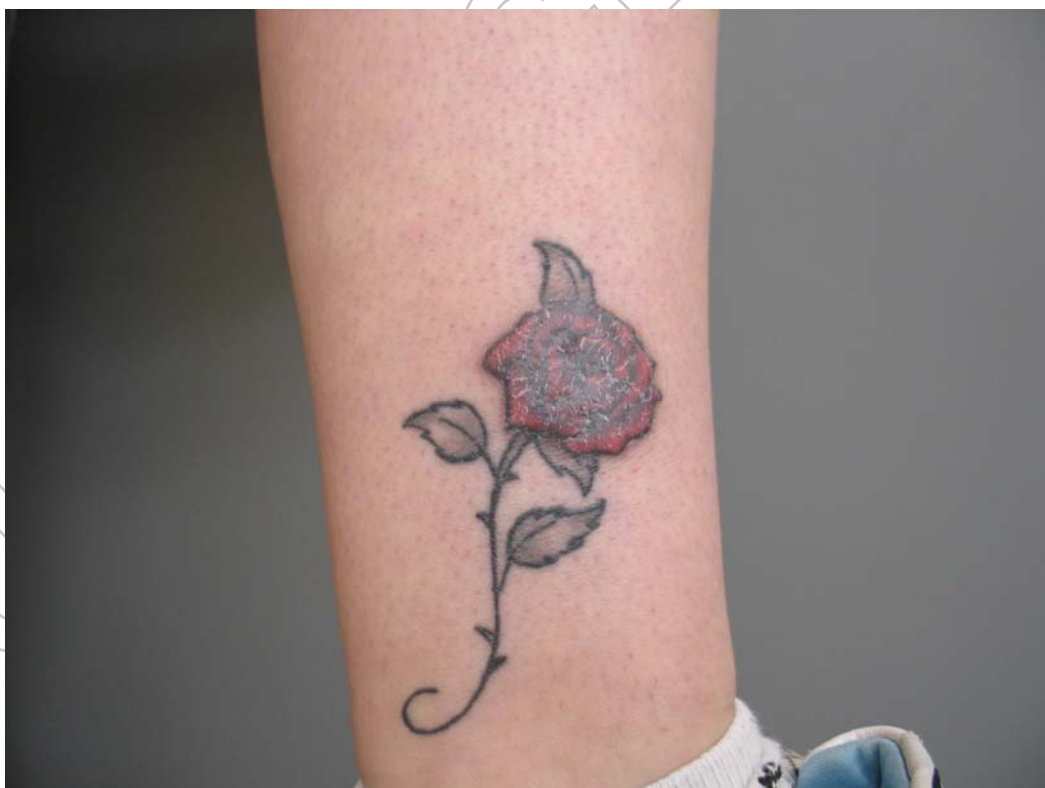
(a)



(b)



(c)



(d)



(e)



(f)

