CASE REPORT

Treatment of traumatic tattoo with the Q-switched Nd:YAG laser

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Abstract
Traumatic tattoos are undesirable tattoos caused by different foreign bodies such as fireworks' particles, sand, metals, glass, gunpowder, asphalt, dust, or petroleum products embedded forcefully in the dermis. We report the case of a 54-year-old man who presented with sand and asphalt tattooing on his face following a bomb explosion 15 years ago. Q-switched Nd:YAG laser at a wavelength of 1064 nm with a spot size of 4 mm and a fluence of 7.96 J/cm² were applied to treat the patient. The patient tolerated the treatment very well. Most of the blue dots became whitened immediately after the procedure and remained almost clear after a 6-month follow-up.

Key words: Nd:YAG laser, traumatic tattoo

Introduction
Traumatic tattoos are caused by foreign bodies such as fireworks' particles, sand, metals, glass, gunpowder, asphalt, dust, or petroleum products embedded forcefully in the dermis. Various types of treatment, including surgical excision, dermabrasion, chemical methods, cryosurgery and electrosurgery, applied in the past, have been associated with hyperpigmentation and textural alterations (1–4). Q-switched lasers (ruby, alexandrite, and Nd:YAG) appear to be effective modalities in the removal of traumatic tattoos (1,5–7). We report a case of facial traumatic tattoo treated successfully by Q-switched Nd:YAG laser.

Case report
A 54-year-old man (Fitzpatrick skin type IV) presented with sand and asphalt tattooing on his face following a bomb explosion 15 years ago (Figure 1A). Physical examination revealed an irregular pattern of dark blue dots 1–5 mm in diameter on his forehead, cheeks, nose and upper and lower eyelids. A test spot performed to determine if explosive particles were present in the tattoo revealed no identifiable particles. A clear explanation of the procedure was provided and informed consent was obtained.

Treatment was performed with a Q-switched Nd:YAG laser (Spectra VRM; Max Engineering, South Korea) at a wavelength of 1064 nm with a spot size of 4 mm and a fluence of 7.96 J/cm². At first, three small areas were tested to determine any abnormal reactions. Then, each half of the face received a single laser treatment in two separate sessions. An ice compress was used as local anesthesia prior to laser treatment and as a measure to reduce edema afterwards.

The patient tolerated the treatment very well. Most of the blue dots became whitened immediately after the procedure. After a day, crusts appeared over the treated area and then healed within the following week. At 3, 5, and 6-month follow-ups a clearance rate of 75–100% was observed for most of the tattoos and the patient was satisfied with the cosmetic result (Figure 1B). No complications occurred during or after the procedure.

Discussion
In cases of traumatic tattoos, the immediate removal of foreign bodies, before wound healing and fibrosis occur, is highly recommended (1–3); however, most patients fail to receive such initial therapy. Among many different techniques applied for the late
removal of traumatic tattoos, modern short-pulsed lasers (Q-switched Nd:YAG, ruby, and alexandrite) are associated with desirable outcome and minimal complications (1,5-7).

A precisely selected laser with a correct wavelength targeting tattoo chromophores may determine the final result. The Q-switched Nd:YAG laser emits two wavelengths of light: 1064 nm used for the removal of black and dark blue pigments as well as 532 nm for the treatment of red pigments. The longer wavelength with deeper penetration is well absorbed by dark tattoo pigments, though it is less absorbed by melanin pigments. In fact, this feature makes Q-switched Nd:YAG lasers appropriate for the treatment of traumatic tattoos, especially in individuals with dark skin with a low risk of pigmentation changes.

As discussed, immediate post-treatment whitening of tattoos with considerable clearance of pigments was seen in our patient. It appears that laser light vaporizes or breaks up the tattoo’s particles or induces chemical reactions which make these particles grossly invisible (1,8).

Multiple treatments with Q-switched lasers are usually applied for traumatic tattoos to achieve considerable outcome (1,2,5-7). Chang et al. (7) suggested an average of 1.7 treatment sessions with the Q-switched alexandrite laser for penetrated tattoos and 2.4 sessions for abrasive tattoos. Besides, Suzuki (5) reported successful results after an average of 1.7 sessions of Q-switched Nd:YAG laser treatment. In our case the result was highly satisfying after a single session of treatment. It seems that many different factors, such as pigment properties, laser specification, and patient skin type, will predict the rate of tattoo clearance and the number of sessions needed for complete removal of the pigments.

Recently, picosecond lasers, such as the 795-nm titanium:sapphire laser, are being compared with current Q-switched technology. It is theorized that by confining thermal and photomechanical damage to the target particle more effectively, these lasers may optimize tattoo removal either by increased phagocytosis or through transdermal elimination. Initial animal studies (9) have been promising, as has a study in humans that showed a higher success rate of tattoo clearing with fewer laser treatments (10). Further confirmatory studies need to be initiated to compare these new technologies with Q-switched lasers.

Pigmentary and textural changes as well as allergic reactions are infrequent side effects of treatment with Q-switched Nd:YAG lasers (5,11). However, pock-like scars due to microexplosion of tattoo fragments and spreading of pigments were reported for gun-shot wounds with a high density of gunpowder exposed to this type of laser irradiation (12). Bomb explosion resulted in diffused and low pigment load tattoos on the face of our case, which responded significantly to the treatment without any adverse effects. It is worthwhile performing a test before the treatment of traumatic tattoos in order to avoid such complications.

References