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# Laser treatment of tattoos in darkly pigmented patients: Efficacy and side effects

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**Background:** Many modalities for the treatment of tattoos and pigmented lesions produce a greater risk of complications in Fitzpatrick types V and VI skin because of an increased incidence of adverse pigmentary changes and keloidal scarring. In fair-skinned persons, Q-switched lasers have proved effective in removing pigmented lesions and tattoos without scarring.

**Objective:** This study was conducted to determine the efficacy and effects of Q-switched lasers on a small series of darkly pigmented patients with tattoos.

**Methods:** Four patients of Ethiopian origin with facial and neck tribal tattoos were treated with both the Q-switched ruby and Nd:YAG lasers. One black woman with a multicolored tattoo on the mid chest was treated with the Q-switched ruby laser.

**Results:** Clearing of all lesions was seen. The treatments did not result in scarring or permanent pigment changes other than the ones intended.

**Conclusion:** Our results indicate that in darkly pigmented patients, Q-switched laser treatment of tattoos can be performed successfully. The longer wavelength Q-switched Nd:YAG laser is recommended when removing tattoos in darker complected persons. A test treatment is advised before treatment of large skin areas.

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With the advent of short and ultrashort pulsed lasers for the treatment of pigmented lesions and tattoos, novel applications are being discovered. The Q-switched Nd:YAG laser at 1064 nm (QSYAG) is now widely used in the treatment of blue/black amateur and professional tattoos, as well as dermal melanocytoses, such as nevus of Ota.<sup>1-3</sup> The Q-switched ruby laser at 694 nm (QSRL) is used to treat both epidermal and dermal pigmented lesions as well as blue/black and green tattoos.<sup>4-6</sup> Many modalities for the treatment of pigmented lesions and tattoos are often considered to be at greater risk of complications in Fitzpatrick types V and VI skin on the basis of a presumed increased incidence of adverse pigmentary changes and keloidal scarring. However, this assumption may not be valid. This study focuses on the use of these two laser systems in darker skinned persons. In a small group of

patients with skin types V and VI, efficacy and side-effect profiles of laser treatment were determined.

## PATIENTS AND METHODS

A total of five patients with Fitzpatrick skin types V or VI were treated with the Q-switched lasers (Table I). Four Ethiopian women (patients 1 through 4) with tribal tattoos were treated predominantly with the QSYAG laser (1064 nm). Their tattoos were on the face or neck, composed of charcoal injected into the skin, and had been present for 9 to 12 years before treatment.

In addition, one black woman (patient 5) was treated with the QSRL. This patient had a multicolored professional tattoo on the mid chest for 10 to 15 years. None of the patients had a history of keloid formation or postinflammatory pigmentary changes.

Two lasers were used: the QSYAG laser (Continuum Biomedical, Livermore, Calif.) at 1064 nm, with a pulse width of 10 nsec and the QSRL (Spectrum Medical Technologies, Natick, Mass.) at 694 nm, with a pulse width of 20 nsec. The QSYAG laser had a 3 mm spot size and was used with fluences ranging from 4.5 to 7.3 J/cm<sup>2</sup>. The QSRL had a 5 mm spot size and was used with fluences ranging from 4.5 to 6 J/cm<sup>2</sup>.

EMLA cream (eutectic mixture of local anesthetics) (Astra USA Inc., Westboro, Mass.) was applied 2 hours

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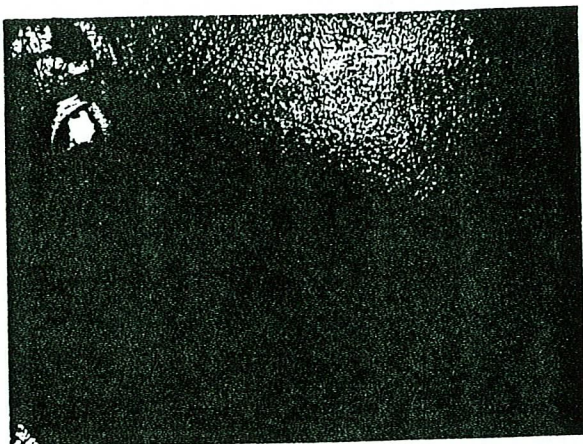


Fig. 1. Patient 4 with tribal tattoo before treatment.

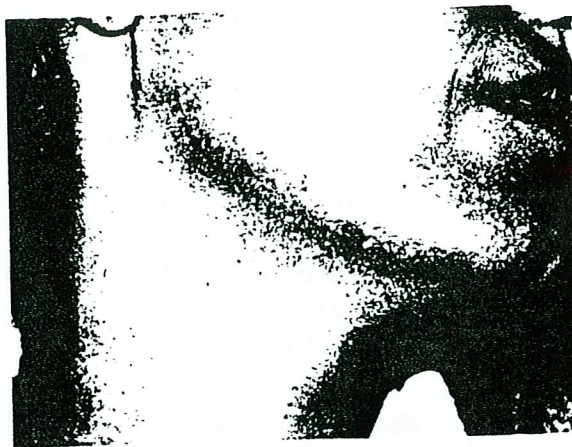


Fig. 2. Patient 4 after five treatments with QSYAG (1064 nm).

before treatment in all patients. In the postoperative period, bacitracin zinc ointment was applied under a Telfa dressing.

In the removal of the tribal tattoo in patient 4, test sites on the mandible were performed with both lasers. The QSRL left a small area of depigmentation, so the QSYAG laser was chosen to treat the remainder of the tattoos. No keloid formation occurred in these test sites. Photographs were taken before treatment and at each follow-up visit. The number of treatments varied from three to eight. The treatment intervals varied ranging from at least 4 weeks after the previous laser exposure up to 6 months. Patients were observed for 4 months to 2 years after their last treatment. Percent clearing of tattoo was scored by two independent investigators on the basis of quartile rating scales (0% to 25% = 1, 26% to 50% = 2, 51% to 75% = 3, 75% to 99% = 4, 100% = 5). Pigmentary changes and textural change were graded on a scale of none, mild, moderate, or severe.

## RESULTS

Treatment outcomes are summarized in Table II. After six treatments, patient 2 had achieved 90% clearing, with transient mild hypopigmentation. Patient 3 achieved 50% clearing after four treatments; mild hypopigmentation was noted without evidence of scarring. After six treatments, patient 4 had 95% clearing without pigmentary changes or scarring (Figs. 1 and 2). Patient 5 experienced 60% clearing with no adverse events. Patient 1 is still being treated. She has had no adverse pigmentary or textural changes after three treatments.

## DISCUSSION

Treatment of skin lesions in darkly pigmented persons is considered to carry a greater risk of com-

plications such as hypertrophic and keloid formation, depigmentation, and hypopigmentation, as compared with fair-skinned persons. The incidence ratio of keloids in blacks to whites ranges from 2:1 to 19:1.<sup>7-9</sup> Even treatment with topical agents such as tretinoin can result in hyperpigmentation, hypopigmentation, or depigmentation.<sup>10</sup> Chemical peels and dermabrasion can produce scarring and permanent hypopigmentation and depigmentation in darker skinned persons.<sup>11-13</sup> Skin types IV to VI are, therefore, often considered a *relative* contraindication for treatment. However, in this study of six darkly pigmented persons treated with Q-switched lasers, no significant permanent adverse changes were observed.

The results of this study can be compared with data concerning treatment of tattoos in light-skinned persons. QSRL, which emits red light, is absorbed by melanin and therefore has the potential to destroy melanocytes. Treatment of tattoos in lighter skinned persons frequently causes transient textural and pigment changes during healing. Treatment less frequently causes hyperpigmentation, rarely causes permanent depigmentation, and has less than a 5% incidence of scarring. Treatment of blue-black or green tattoos usually requires 4 to 6 treatments for amateur tattoos and 6 to 10 treatments for professional tattoos to achieve near complete clearance.<sup>1,6</sup>

Kilmer et al.<sup>14</sup> demonstrated that, in light-skinned persons, the QSYAG clears black tattoos: in 77% of patients lesions cleared by more than 75% in four treatments, and in 28% of patients lesions cleared by more than 95% in four treatments. In that study, 2 of 39 patients treated with the QSYAG had trace



**Table I.** Patient demographics and description of lesions treated with the lasers

Patient No.	Age (yr)	Sex	Skin type*	Site	Chromophore	Duration (yr)
1	20	F	VI	Face	Charcoal	12
2	29	F	VI	Neck	Unknown	Unknown
3	30	F	VI	Neck	Charcoal	9
4	40	F	VI	Face, neck	Charcoal	10
5	34	F	VI	Chest	Multicolored	10

\*Based on scale defined by Thomas B. Fitzpatrick, MD.

**Table II.** Treatment modality with rate of clearing and side effects

Patient No.	Laser	Follow-up time	No. of treatments	Result in % clearance	Pigmentary change	Textural change
1	QSYAG	6 mo	3	In progress	None	None
2	QSRL	12 mo	1	90	Transient	None
3	QSYAG	10 mo	4	50	Transient	None
4	QSRL	27 mo	1	95	Ruby test site: depigmented	None
5	QSYAG	24 mo	5	60	YAG: none	None
	QSRL		6		Slight	
	QSYAG		2			

QSRL, Q-switched ruby laser (694 nm); QSYAG, Q-switched Nd:YAG laser (1064 nm).

transient textural changes during the 4-week healing period. No hypopigmentation or scarring occurred in treated tattoos. Three patients (darker skin types II through IV) experienced hyperpigmentation.<sup>14</sup>

In contrast to the aforementioned studies, all of the patients in this study had skin types V or VI. Lesions of two patients cleared by more than 90% after six treatments. Lesions of the other patients were 50% and 60% cleared after four and eight treatments, respectively. Therefore, in comparison with the aforementioned two studies on light-skinned patients, dark skin only slightly decreased the efficacy of the Q-switched lasers.

Transient hypopigmentation was observed in two patients. Slight hypopigmentation was observed in two patients treated with the QSRL. The patient population is too small to assess the statistical difference in incidence of hypopigmentation when compared with light-skinned persons. Pigmentary changes are partially a wavelength-dependent phenomenon. In our clinical experience, when treating tattoos the ruby laser commonly causes hypopigmentation, whereas the QSYAG laser at appropriate fluences appears to induce hypopigmentation less

frequently. At the 1064 nm wavelength, lentigines are left largely untouched. Therefore the QSYAG laser appears to exert its effect at a dermal level, often leaving the overlying epidermal melanocytes intact.

No scarring was observed in our patients, although transient textural changes associated with the healing response were seen during the multiple treatments. In patient 5, a black woman with a tattoo in the keloid-prone mid-chest region, no scarring was observed even after six treatments with the QSRL. This emphasizes the atraumatic characteristics of this treatment. Previous studies have shown that these lasers selectively affect melanin or tattoo pigment in intracellular or extracellular compartments.<sup>15</sup> Because these lasers exert a highly selective effect on their pigmented targets, the tissue injury is not sufficient to initiate uncontrolled reparative mechanisms such as keloids and hypertrophic scars.

The results indicate that in the treatment of deeper dermal pigment, the QSYAG is preferable to the QSRL; this is especially true in darker-skinned persons. We recommend treatment of tattoos in blacks should first be tried with the QSYAG laser.

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