Copyright © 2016
CASE REPORT
Journal of Drugs in Dermatology

Q-Switched Nd:YAG Laser Removal of Facial Amateur Tattoos in Patients With Fitzpatrick Type VI: Case Series

Josef Haik MD,[a,b] Rachel Kornhaber PhD MN RN,[c] Moti Harats,[b] Hadar Israeli MD,[b] and Arie Orenstein MD[d]

[a]Talpiot Leadership Program, Sheba Medical Center, Tel-Hashomer, Israel
[b]Plastic and Reconstructive Surgery Department, Sheba Medical Center, Tel-Hashomer, Israel
[c]University of Tasmania, Faculty of Health, School of Health Sciences, Tasmania, Australia
[d]The Advanced Technology Center (ATC), Sheba Medical Center, Tel-Hashomer, Israel

ABSTRACT

Introduction: Q-switched neodymium:YAG (Nd:YAG) lasers are reported to be gold standard for laser tattoo removal. In particular, the Q-switched Nd:YAG laser at 1064 nm is widely recognized for the removal of blue/black amateur tattoos. However, treatment modalities in Fitzpatrick Type VI skin carry a greater risk of complications including alterations in pigmentation compared to fairer skin (Fitzpatrick Type I-IV skin). Therefore, the aim of this case series was to describe with the use of the Q-Switched Nd:YAG laser, the removal of carbon-based amateur tattoos on patients with Fitzpatrick Type VI skin as an effective and safe method.

Methods: Twenty-five patients with Fitzpatrick type VI skin, from Ethiopian origins, with facial tribal tattoos, were treated with the Q-Switched Nd:YAG laser at 1064 nm. Digital images were taken upon every treatment and the clearance rates of the tattoo was evaluated by imaging software.

Results: We observed an average tattoo clearance rate of 95% among the 45 facial tattoos in 25 patients presented in the case series with minimal pigmentary and textual changes evident.

Discussion: These positive aesthetic results have a significant psychosocial impact on the lives of those with Fitzpatrick Type VI skin, in particular the Ethiopian Jewish population.

J Drugs Dermatol. 2016;15(11):1448-1452.

INTRODUCTION

A form of body art, tattooing, is the permanent pigmentation of skin that results from the introduction of exogenous substances.[1] The Tahitian word 'tatau' meaning 'to mark something' is one of the etymological origins derived from tattooing.[1] Tattoos can hold significant cultural meaning in certain societies within a specific social context. Subsequently, the art of tattooing among Ethiopian Christian women is well documented with tattoos predominately on their forehead, facial, and other bodily regions.[2] Of significance, Ethiopian Jews who converted to Christianity engaged in these tribal carbon-based amateur tattoos so as to assimilate for fear of persecution.[2] However, upon arrival to Israel, these distinctive tattoo markings have been socially and culturally problematic to this unique population, requiring removal by means of laser therapy.

Removal of tattoos from dark skin patients is consider to be more problematic as the melanin pigment can compete with the tattoo and therefore, hypo and hyperpigmentation may occur. [3] Subsequently, Q-switched neodymium:YAG (Nd:YAG) lasers are reported to be gold standard for laser tattoo removal. In particular, the Q-switched Nd:YAG laser at 1064 nm is widely recognized for the removal of blue/black carbon-based amateur tattoos.[4] Therefore, in this case series, we present the use of the Q-Switched Nd:YAG laser as an effective and safe method for the removal of 45 carbon-based amateur tattoos in 25 patients with Fitzpatrick Type VI skin.

METHODS

Study Sample

Twenty-five patients with Fitzpatrick type VI skin from Ethiopian origins with facial amateur tattoos were included in this case series. Apart from one male patient, the study population was mostly women. The age of the patients ranged from 18 to 53 years with an average age of 21.3 years. Verbal and written informed consent for treatment and the use of digital images[5] were obtained prior to treatment. All tattoos were black/blue tribal charcoal tattoos that were introduced into the skin by a hot needle during childhood. Usually, the tattoos are made by a family or tribal member during early childhood between the ages of five to eight years, and the technique of injection is not uniform in all patients. The tattoos were drawn over the face and neck including the forehead, temples, cheeks, mandible angle, nose, and chin (Table 1) however, upper and lower limbs are also anatomical regions where these tribal tattoos are often also seen. The facial tattoos were composed of lines, spherical symbols and cross shapes.

FIGURE 1. Case 24 (A) prior to removal; (B) after 4 treatments.

FIGURE 2. Case 18 (A) prior to removal; (B) after 4 treatments.

Laser Therapy and Instrumentation

Harmony Pro Q-switched Nd:YAG laser (Alma Lasers, Ltd., Israel) at 1064 nm was used for the removal of all tattoos. The laser parameters were: 3 mm spot size, fluence range of 500-800 mJ/cm^2, repetition rate of 2-5Hz, and pulse width of 20 nano-sec. Throughout the duration of the treatment, a cooling device was applied using the Zimmer Cryo 5 MedizinSyeteme, (LaserMed GmbH, Germany). The patients were treated in six week intervals or longer.

EMLA cream (eutectic mixture of local anaesthetic) was applied approximately one hour prior to the commencement of the laser therapy. After the completion of each treatment session, synthomycine (chloramphenicol) 3% ointment was applied to the treatment area. Furthermore, patients were supplied with synthomycine 3% ointment and educated on the importance of twice-daily application until complete wound healing was achieved.

TABLE 1.

Anatomical Locations of Facial Tattoo		
Anatomical regions	**Patients**	**%**
Forehead	22	88%
Chin	6	24%
Temples	5	20%
Cheek	4	16%
Neck	2	8%
Mandible	5	20%
Nose	1	4%

Digital Analysis

Digital images were taken prior to each initiation of laser therapy and after the last treatment (Figures 1 – 6). The first image was compared to the last using Scion Imaging Software (NIH Image, Scion Corporation, USA). Clearance rates of the tattoo pigmentary and textural changes were also measured. Clearance measurements of the total tattoo surface were performed by counting the pixels on each tattoo, in both the pre- and post-digital images. Clearance of the tattoo was calculated as the subtraction of the total tattooed pixels of the pre- and post-treatment images. Calibration between images was performed according to anatomical locations (distance between medial canthus, distance between lateral canthus, and tragus). Textural changes, scaring, hypo, and hyperpigmentation were scored by two independent physicians who compared the first and last digital images performed. Each parameter was scored as either: none=0, mild=1, moderate=2, severe=3 (Table 2).

FIGURE 3. Case 20 (A) prior to removal; (B) after 4 treatments.

FIGURE 4. Case 21 (A) prior to removal; (B) after 3 treatments.

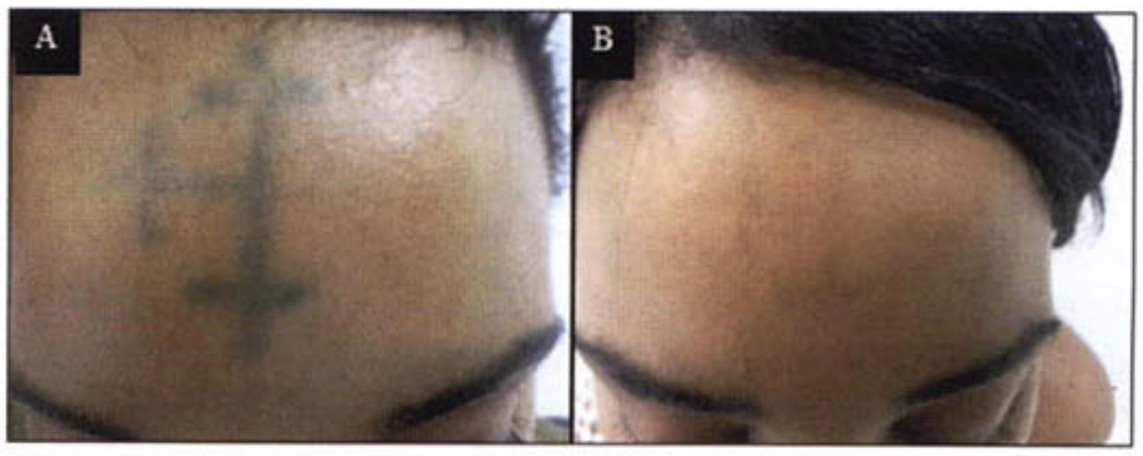


TABLE 2.

Case Demographics and Treatment Outcomes

Case	Age	Gender	Site	Treatment Period (months)	Number of treatments	Clearance %	Pigmentary change	Textual change
1	20	Female	Forehead	19	6	100	None	None*
2	20	Female	Forehead	19	7	93	None	None*
3	20	Female	Forehead	32	12	100	Mild hyperpigmentation	Mild scaring
4	18	Female	Temple Mandible	21	4 4	100	None	None
5	20	Female	Temples Mandible	24	10 10	100	None	None* None
6	20	Male	Temple	24	6	100	None	Mild scaring*
7	19	Female	Forehead	21	7	97	None	None
8	18	Female	Forehead	21	4	89	None	Mild depression
9	20	Female	Forehead	26	10	95	None	None
10	21	Female	Forehead Chin	30	13 13	75 90	Moderate None	Moderate* Mild
11	21	Female	Forehead	26	8	82	None	None
12	21	Female	Forehead	26	9	88	None	None*
13	19	Female	Forehead Chin	12	5 5	100 100	None None	None* None
14	21	Female	Forehead Temple	30	12 12	100 100	None None	None None
15	20	Female	Forehead	16	7	100	None	None*
16	29	Female	Forehead	8	4	100	None	None
17	21	Female	Forehead Chin	24	10 5	100 100	None None	None* None
18	25	Female	Neck Forehead	12	4 4	90 100	None	None
19	53	Female	Neck Forehead Mandible	12	3 3 3	80 90 95	None	None
20	22	Female	Forehead Mandible Chin Cheek	12	4 4 4 4	95 90 85 100	None	None*
21	23	Female	Forehead	16	3	90	None	None
22	20	Female	Forehead	18	6	100	None	None*
23	20	Female	Forehead	19	7	90	None	None*
24	31	Female	Forehead Nose Chin Cheeks Temple Mandible x 2	26	4 4 4 4 4 4	95 100 95 100/100 95 95/100	None	None
25	32	Female	Forehead Chin Temple Cheek	24	3 3 3 3	90 85 95 90	None	None

*Previous scar was observe in the forehead before treatment

FIGURE 5. Case 25 (A) prior to removal; (B) after 3 treatments.

FIGURE 6. Case 25 (A) prior to removal; (B) after 3 treatments.

RESULTS

The treatment period of laser therapy with the Q-Switched Nd:YAG for the removal of 45 amateur carbon-based tattoos was between 8 to 32 months with an average of 20 months (Table 2). The number of laser treatments for each tattoo ranged from 3 to 13 with an average of 6 treatments. The extended treatment periods noted in this case series can be attributed to issues of adherence and also difficulties experienced attending follow up appointments due to the distances patients are required to travel for further laser therapy. Superior clearance rates (90% - 100%, score 0) were achieved in the majority of tattoos treated. The residual tattoos, 9% (n = 4) treated were scored as a 1 (mild) and 2% (n = 1) scored 2 (moderate). Additionally, none of the tattoos treated scored 3 (severe). The majority of tattoos treated showed no evidence of textural changes, scaring, hypo, or hyperpigmentation. There was no incidence reported of infections throughout the treatment period. However, previous scars were observed before treatment in 12 patients.

DISCUSSION

Historically, the history of tattoo removal has involved techniques that have resulted in tissue destruction including surgical excision, dermabrasion, salabrasion, cryosurgery, and electrosurgery.[6] Subsequently, the development of laser therapy was used to vaporise the tattoos resulting in significant scarring and altered pigmentation.[6] Q-switched lasers are routinely used for tattoo removal however, differ in their wavelength: 532 nm (KTP), 694 nm (ruby), 755 nm (alexandrite), and 1064 nm (Nd:YAG).[7]

Our study reported the efficacy of the Q-Switched Nd:YAG laser as a safe method for the removal of carbon-based amateur tattoos in 25 patients with Fitzpatrick Type VI skin. Our results demonstrate viable clearance rates of tattoo removal with minimal textual and pigmented changes observed. These results are echoed by other studies demonstrating similar findings. Grevelink et al[4] reported results of five women with Fitzpatrick type VI skin of Ethiopian origin of which three patients used carbon-based substances to the face and neck region. They reported clearance rates that ranged from 50% – 95% predominately using a QSYAG laser at 1064 nm experiencing minimal adverse results. Furthermore, Grevelink et al[4] states that the 1064 nm wavelength is required to achieve best results with minimal disruption to the dermal layer. Lapidoth et al[2] who also reported on a cohort of 406 Ethiopians of which most were women with carbon-based tribal tattoos, achieved a 92% clearance rate in the majority of patients with minimal alterations in skin pigment and texture using the Q-Switched Nd:YAl laser at 1064 nm. Other studies demonstrate similar results in dark pigmented skin.[8-10]

Dark pigmented tattoos effectively absorb the relatively long, 1064 nm wavelength and therefore enables effective tattoo pigment removal[11] as presented within this case series. Furthermore, removal of black/blue pigment in darker skin types where heavy epidermal melanin content is present, the Nd:YAG laser attributes to a reduction in post inflammatory hyper and hypopigmentation after tattoo removal.[7,12,13]

CONCLUSION

In this Ethiopian cohort of patients with Fitzpatrick type VI skin, amateur carbon-based tattoo removal by the Q-switched Nd:YAG laser, attains very good clearance with minor complications. However, previous damage to the skin occurring during the tattooing process, can be accentuated after pigment removal. These results may have a significant psychosocial impact on the lives of the Ethiopian Jewish population facilitating acceptance and social integration among the Israeli general population.

DISCLOSURES

The authors have no conflicts of interest to declare.

REFERENCES

1. Pesapane F, Nazzaro G, Gianotti R, Coggi A. A short history of tattoo. *JAMA Dermatol.* 2014;150(2):145.
2. Lapidoth M, Aharonowitz G. Tattoo removal among Ethiopian Jews in Israel: tradition faces technology. *J Am Acad Dermatol.* 2004;51(6):906-909.
3. Patil UA, Dhami LD. Overview of lasers. *Indian J Plast Surg.* 2008;41(Suppl):S101-S113.
4. Grevelink JM, Duke D, van Leeuwen RL, Gonzalez E, DeCoste SD, Anderson RR. Laser treatment of tattoos in darkly pigmented patients: efficacy and side effects. *J Am Acad Dermatol.* 1996;34(4):653-656.

5. Kornhaber, R., Betihavas, V., & Baber, R. J. (2015). Ethical implications of digital images for teaching and learning purposes: an integrative review. *J Multidiscip Healthc*, 8, 299.
6. Ortiz AE, Alster TS. Rising concern over cosmetic tattoos. *Dermatol Surg*. 2012;38(3):424-429.
7. Kuperman-Beade M, Levine VJ, Ashinoff R. Laser removal of tattoos. *Am J Clin Dermatol*. 2001;2(1):21-25.
8. Jones A, Roddey P, Orengo I, Rosen T. The Q-switched ND: YAG Laser Effectively Treats Tattoos in Darkly Pigmented Skin. *Dermatol Surg*. 1996;22(12):999-1001.
9. Kilmer SL, Anderson RR. Clinical use of the Q-switched ruby and the Q-switched Nd:YAG (1064 nm and 532 nm) lasers for treatment of tattoos. *J Dermatol Surg Oncol*. 1993;19(4):330-338.
10. Mankowska A, Kasprzak W, Adamski Z. Long-term evaluation of ink clearance in tattoos with different color intensity using the 1064-nm Q-switched Nd:YAG laser. *J Cosmet Dermatol*. 2015;14(4):302-309.
11. Choudhary S, Elsaie ML, Leiva A, Nouri K. Lasers for tattoo removal: a review. *Lasers Med Sci*. 2010;25(5):619-627.
12. Ho SGY, Goh CL. Laser Tattoo Removal: A Clinical Update. *J Cutan Aesthet Surg*. 2015;8(1):9-15.
13. Wenzel S, Landthaler M, Baumler W. Recurring mistakes in tattoo removal. A case series. *Dermatology*. 2009;218(2):164-167.

AUTHOR CORRESPONDENCE

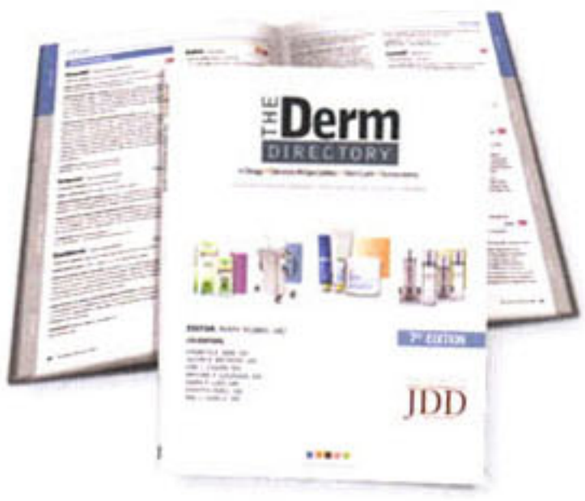
Arie Orenstein MD

E-mail:..... Arie.Orenstein@sheba.health.gov.il

THE Derm DIRECTORY

■ Drugs ■ Devices ■ Injectables ■ Skin Care ■ Sunscreens

7th Edition Now Available



The annual guide to all products in dermatology is now available!

- 600+ product listings for FDA-approved Rx drugs and medical devices, injectables, skin care, and sunscreens
- Convenient side-by-side comparison tools, before-and-after images, and other visual aids
- Extended listings include physician commentary, clinical pearls, and references
- Includes products featured at the Skin of Color Seminar Series
- Fully interactive, online version available at **TheDermDirectory.com**

From the editors of JOURNAL OF DRUGS IN DERMATOLOGY JDD

EDITOR-IN-CHIEF:
Perry Robins, MD

CO-EDITORS:
Kenneth R. Beer, MD
Joseph B. Bikowski, MD
Joel L. Cohen, MD
Mitchel P. Goldman, MD
Mary P. Lupo, MD
Maritza Perez, MD
Neil S. Sadick, MD

TheDermDirectory.com

A product of sanovaworks