

IN-DEPTH REVIEW

Pitfalls in Laser-Based Device Tattoo Removal: A Literature Review

Nattanicha Chairsrimaneepan, MD¹, Thunyaporn Khoruamklang, MD², Hataitip Manupeerapun, MD³

¹ Department of Medicine, Texas Tech University Health Sciences Center, Lubbock, TX, USA

² Department of Internal Medicine, Chakri Naruebodindra Medical Institute (CNMI), Faculty of Medicine Ramathibodi Hospital, Mahidol University, Samut Prakan, Thailand

³ Dermatology Clinic, World Medical Hospital, Bangkok, Thailand

ABSTRACT

Laser therapy has been popular and widely used for tattoo removal. Basic principles for utilizing lasers in tattoo removal for different types and colors of tattoos are required to minimize and avoid unwanted side effects. Appropriate parameters of lasers are not the only keys to successful laser removal treatment. In this review, common pitfalls in removing tattoos with lasers are discussed. Several factors should be taken into consideration and realistic goals should be discussed at the first encounter with patients. Non-ablative lasers may apply to a simple tattoo without any cutaneous reaction while ablative lasers are better for traumatic tattoos. Laser is not always the best option for tattoo removal in some circumstances and other measures can be considered for the best interest of patients and outcome.

INTRODUCTION

Several measures have been used in the treatment of tattoo removal. Laser-based devices have proven their efficacy with lesser side effects in tattoo removal¹. There is a misconception in assuming that lasers are harmless, specific, and safe². Lasers, especially Q-Switch lasers, are generally used for removing normally uncomplicated tattoos and were considered the gold standard in this circumstance³. Lately, nano- and picosecond lasers have become a new gold standard tattoo removal and are thought to have higher efficacy when compared to Q-Switch lasers^{1,4}. However, they cannot completely remove unwanted tattoos and

outcomes are not consistent depending on several factors^{3,5,6}.

For tattoo removal, factors that should be considered include individuals' factors like skin type and the characteristics of tattoos¹. Not all tattoos or complications of tattoos are removed by lasers. In this review, the focus is directed towards the pitfalls in tattoo removal by lasers.

Types of Tattoos^{1,6,7}

- Professional tattoos contain pigments that are uniformly injected into the dermis resulting in highly dense pigment deposition.

- Amateur tattoos commonly contain materials that are charcoals and Indian ink. Pigments are less dense, less intense, and less deposited ink and color variations compared to professional tattoos.
- Cosmetic tattoos containing several colors are injected into the dermis using micro-pigmentation technique with mixtures of unknown pigments for natural appearance, or additional layers of pigment deposited on the top of the original tattoo for color correction.
- Traumatic tattoos are accidental exogenous mechanical depositions like metals, glass, dust, or carbon, particles following explosion or trauma deposited into the dermis.
- Medical tattoos are made from Indian ink or carbon-based materials similar to amateur tattoos, usually gray or blue-black. This type is made for medical purposes such as radiation therapy, signs for medical device access, or corneal tattoos.

BASIC PRINCIPLES OF TATTOO REMOVAL IN SUMMARY

Understanding the fundamental principles of lasers utilized in tattoo removal and managing their parameters is crucial, as these may render optimal results and decrease the risk of side effects¹. Selective photo-thermolysis is the underlying concept in the use of pigmented-specific lasers to target chromophores, in this stance tattoo dyes. An appropriate laser wavelength best absorbed by the targeted pigments or chromophores must be carefully chosen⁸. Other than the proper selection of wavelength, this principle requires an appropriate light energy and the right pulse duration. The energy absorbed in the

pigment particle must be sufficient for particle fragmentation⁹.

Q-switched lasers are ultrashort, and intense laser pulses suitable for destroying pigment particles in the skin but may harm the surrounding tissue⁹. Picosecond lasers, on the other hand, permit lower fluences, and shorter pulse width delivery during treatment, which theoretically decreases the risk of adverse effects and clear pigment particles more effectively than Q-switch¹⁰. However, Q-switch lasers remain the first option for tattoo removal in general¹. The therapeutic endpoint is an immediate ash-white color caused by rapid heating of the particles resulting in gas bubbles and steam. This phenomenon spontaneously resolves within 30 minutes after procedure^{11,12}. Pinpoint bleeding may also occur and is considered a therapeutic endpoint¹². It is important to use the lowest possible fluence to achieve the endpoint without causing surrounding epidermal damage, which may result in hemorrhage or blisters¹¹.

In the case of a non-responsive laser tattoo removal treatment, the recommendation is to increase the spot size rather than the dose because a larger spot size gives better penetration due to less scattering of the laser beam^{2,6,12,13}. While increasing fluences is necessary to achieve optimal tattoo removal with each subsequential treatment, a too-high fluence, especially during the initial treatment sessions when the tattoo is darkest, can injure the treated skin, consequently resulting in scar formation^{6,14}. In contrary to Q-Switch and picosecond lasers, ablative lasers like CO₂ or Erbium YAG lasers remove tattoo pigments non-selectively which means it also affects the surrounding skin and potentially leads to unwanted scar formation⁹.

Table 1. Summarization of the factors affecting laser tattoo removal ⁶.

Factors		Details
Tattoo	Type	Professional/cosmetic/amateur/traumatic
	Duration	The longer the duration, the more difficult the removal as the size, depth, and shape of the tattoo granules change
	Depth	The deeper the tattoo, more the sessions required
	Surface	A large area requires more sessions
	Color	Multicolored, especially green tattoos are more difficult to remove
	Allergic reactions	Ablative lasers are required for the removal of pigment
	Layering	Double tattoos required more sessions
Laser	Type	It has been shown that picosecond laser is superior to Q-Switch
	Energy	Fluence should be increased with successive sessions
	Beam profile	Larger spot size enables deeper penetration
Individual factor	Age	Poor response in old age
	Site	Poor response in the distal anatomical region
	Pigmented skin	Bleaching agents should be used before attempting tattoo removal
	Host removal of tattoo pigment	Depends on macrophage activity, which in turn depends on the host's immune response
Reference: Serup J, Bäuml W. Guide to Treatment of Tattoo Complications and Tattoo Removal. <i>Curr Probl Dermatol</i> . 2017;52:132-138.		

Combined selective thermolysis with ablative fractional resurfacing has been utilized in tattoo removal to facilitate trans-epidermal elimination of tattoo pigments^{13,15,16}. The combination of pulsed Erbium: YAG or ultra-pulsed CO2 with Q-Switch Nd: YAG is known as the rapid tattoo removal technique (RTR)¹¹. It presumably requires fewer treatment sessions and minimizes side effects in tattoo removal compared to Q-Switch Nd: YAG laser monotherapy^{16,17}. The area treated with ablative fractional lasers increases Q-Switch laser penetration and fluid clearance in the dermis, resulting in a

lower incidence of edema and an increase in effectiveness¹¹.

FACTORS AFFECTING THE RESULT OF LASER TATTOO REMOVAL

Factors that should be taken into consideration in laser tattoo removal include the characteristics of tattoos, lasers used, and individuals, summarized in **Table 1**^{1,18}.

Different types of tattoos differ in how the tattoo pigments are placed into the dermis. In professional tattoos, pigments are densely

deposited, and they require more treatment sessions^{1,6,8,13}. Cosmetic tattoos are even harder to remove as they usually contain uniquely blended colors, the mixture is unknown. Sometimes, additional layers of pigment are deposited on the original ones for correction, making it impossible to identify the right compositions and ensure the proper laser selection^{1,8,13}. For traumatic tattoos, the materials can be difficult to remove if they are deposited too deep in the dermis or contain explosive materials; this affects how a physician chooses laser treatment modality^{1,6,11}. Other tattoo factors that should be considered include the duration, depth, surface area, color of tattoos, allergic reaction, and layering¹⁸.

With the same parameters, picosecond lasers appear to be superior to Q-Switch lasers¹⁵. However, the parameters and which lasers to utilize should be individualized to different types of tattoos and patients' skin types⁸. For instance, the use of Q-switch Nd:YAG with a long wavelength, 1064 nm, in patients with darker skin types reduces the energy absorbed by epidermal melanin; therefore, reducing the risk of complications¹⁹. Inappropriate types of lasers or intense pulse light systems are less likely to achieve satisfactory results and may be seen as a failure²⁰. Inappropriate parameters like overdosing on laser light can cause vesicles and hemorrhagic blisters—patients could be left with scars²⁰. Recommendations are provided to initiate treatment from the lowest fluence that is effective to achieve the therapeutic endpoint—immediate whitening. In later sessions, fluence can be increased as the ink density decreases^{6,11}. Once the fluence is increased, physicians should be aware of pinpoint bleeding which commonly occurs¹³. It is safer to do one pass with minimal overlap on the treated areas¹.

An individual factor is one of the major concerns that should be taken into consideration. It is of important vital to communicate with the patients before the laser treatment about the complications, and expected results and that tattoo removal takes several sessions. The Kirby Desai Scale, as summarized in **Table 2**, has been widely used to predict the number of laser tattoo removal sessions²¹. All patients should be informed regarding the possibility of developing scarring, textural changes of the skin, dyspigmentation, allergic reactions, and paradoxical darkening or hyperpigmentation after laser treatment for the removal²². Two special groups of the population that must never undergo laser tattoo removal are pregnant women and lactating women because, theoretically, fragmented ink particles after laser treatment spread systemically⁶.

In patients whose tattoos are located close to areas with inactive intermittent herpes infection, e.g. the mouth, herpes prophylaxis must be considered to avoid reactivation^{6,10,20}. For tattoos with active inflammation e.g., eczema or psoriasis, infection e.g., verrucae, herpes simplex, or concomitant disease e.g., sarcoid, laser treatment must be avoided at all costs as these conditions will be worsened, have slow healing, and cause scarring in laser-treated tattoos postoperatively^{2,10,23}. Some conditions like psoriasis, lichen planus, and vitiligo can be exacerbated by tattooing (Koebner phenomenon) and potentially also by the procedure, laser tattoo removal^{2,20}.

Physicians should immensely be aware if the to-be-treated tattoo areas have a suspicion of a malignant lesion, e.g. melanoma, as this can obscure the detection post-laser therapy and is considered as one of the contraindications^{1,2,20}. Other contraindications for laser treatment include

Table 2. The Kirby-Desai Scale for predicting the number of sessions needed for laser tattoo removal.

Kirby Desai scale for estimating the number of sessions needed for laser tattoo removal						
Point	Skin Phototype	Location	color	Ink amount	scarring	layering
0	-	-	-	-	No scar	none
1	I	Head and neck	Black only	amateur	Minimal	-
2	II	Upper trunk	Mostly black with some red	minimal	-	layering
3	III	Lower trunk	Mostly black and red with some other colors	moderate	moderate	-
4	IV	Proximal extremity	Multiple colors	significant	-	-
5	V	Distal extremity	-	-	significant	-
6	VI	-	-	-	-	-

The estimated number of sessions for each tattoo on the first evaluation is the sum of points from each column +/- 2.5 sessions

a history of deep chemical peeling, dermabrasion, or radiation in the last six months, a history of keloid, blood clotting abnormalities, and a history of sunburn in the past two weeks¹. Though not an absolute contraindication, patients with severe diabetes are not encouraged to undergo laser treatment due to poor wound healing and a higher risk of developing infections⁶.

LASERS OF CHOICE IN NON-REACTING TATTOOS TO AVOID PITFALLS^{10,11,13}

Summarization of Q-switch laser treatment according to tattoo colors in **Table 3**.

Dark Blue and Black-Colored Tattoos

For Fitzpatrick skin types I to III, both Q-Switch and Picosecond lasers with 694, 755, and 1064 nm wavelengths are effective. For patients with darker skin types, Fitzpatrick skin type IV to VI, Q-Switch or Picosecond lasers with 1064 nm, are recommended due to a lower risk of epidermal injury compared to shorter wavelengths. Physicians should make sure that the dark blue or black colored tattoos are not due to traumatic tattoos that contain explosive materials like gunpowder as this can subsequently cause scarring from micro-explosions.

Red-Colored Tattoos

The optimal wavelength for red tattoos is 532 nm; however, this wavelength is not recommended in patients with Fitzpatrick

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Table 3. A summary of tattoo pigment response to different wavelengths of Q-Switch.

QS Laser	Black	Blue	Green	Red	Orange	Purple
Ruby 694 nm	+	+	+	-	-	+
Alexandrite 755 nm	+	+	+	-	-	-
Nd: YAG 1,064 nm	+	+	-	-	-	-
Nd: YAG 532 nm	-	-	-	+	+	-
+ indicates response						

skin type IV to VI due to the high risk of dyspigmentation. Red-colored tattoos are known to cause allergic reactions during the tattooing process and may also occur during laser tattoo removal. Systemic corticosteroids and/or antihistamines can be administered before the procedure if a Q-switch or picosecond laser is opted for the removal. Other options are ablative lasers like CO2 or Er: YAG lasers.

Green-Colored Tattoos

It is wise to be cautious when using QS Ruby 694 nm because of the higher risk of transient and permanent dyspigmentation due to shorter wavelengths. Some studies found that QS Ruby 694 nm and Q-Switch Alexandrite 755 nm resulted in the most significant improvement.

Multiple Colored Tattoos

Various colors of tattoos are composed of different substances that may require the use of more than one wavelength. In such cases, areas with black or dark colors are advised to be treated first with Q-switched Nd: YAG 1064 nm before specifically targeting other areas with more specific wavelengths.

PITFALLS

Paradoxical Darkening

Paradoxical darkening of tattoos can occur, particularly with the light-colored pink, tan, nude, or white-colored pigment tattoos, which are often used for permanent makeup in cosmetic tattoos^{13,19,24}.

Cosmetic tattoos or pale-colored tattoos contain white compounds of ferric oxide and/or titanium dioxide^{7,8,20}. Laser tattoo removal with pulsed lasers, Q-switch, or picosecond lasers, has a high risk of darkening¹⁰. They paradoxically darken due to the reduction of titanium dioxide and/or iron oxide of the pigment compounds by pulsed laser treatment (which could either be a Q-Switch or a picosecond laser). Ferric oxide (Fe₂O₃) is reduced to ferrous oxide (FeO) which is black, while titanium dioxide (Ti⁴⁺) is reduced to titanium cation (Ti³⁺) which is dark violet^{7,8}.

When removing such tattoos, thoroughly inform the patient about this potential complication. A test spot is highly recommended before treating the whole area to assess the therapeutic response^{11,13}. Once darkened, numerous additional laser treatments are necessary to remove the residual pigments. Such paradoxical darkening has been successfully treated with further Q-Switch laser treatments, Q-Switch

Nd: YAG 1064 nm, but may require up to 20 sessions^{8,11}. Repetitive treatment sessions not only cost time and money but also pose an increased risk of tissue fibrosis and skin textural changes which may also decrease the efficacy of any future laser therapy⁸. Therefore, some recommend that cosmetic tattoos are best removed successfully with an ablative laser system (e.g. CO2 or Er: YAG)^{8,10,12,16}.

Ablative lasers, pulsed CO2, and Er: YAG lasers do not require specific pigment identification, thus, not posing the risk of paradoxical darkening of metallic compounds. Instead, ablative lasers work to vaporize unwanted pigments, regardless of the pigment color and composition, of the epidermis and dermis^{8,10}. The benefits lie that they effectively treat multicolored or white tattoos and accelerate tattoo pigment elimination from the body.

A combination of lasers, RTR, has been proposed for optimal removal, the ablative lasers aid in reducing paradoxical darkening as well as allergic tattoo reactions^{11,16}. For paradoxical darkening lesions that are highly resistant to further laser surgery, surgical removal is an alternative¹¹.

Scarring

Scarring can exist before laser tattoo removal caused by needle trauma, amateurism, and infected ink²⁰. Attempts to remove tattoos with inappropriate lasers or parameters can result in scarring all the same. Burns and keloids may occur if laser hair removal is performed on tattoo areas. Intense pulsed light (IPL) is also not recommended. With its long pulse duration, pigmented particles and surrounding tissues are heated excessively causing tissue damage leading to scarring¹⁸.

Body sites involved in normal daily physical activities, such as the neck, waist, and wrist are at an increased risk of developing scarring²². Questioning about earlier scarring history is important to predict whether a patient has a likelihood of developing hypertrophic scars or keloids and advise accordingly as a precaution⁶. A cooling device, corticosteroid ointment, and/or silicon dressing can be applied after each laser procedure in scar-prone patients or in cases of exaggerated post-laser inflammation⁶.

A study by Kirby W. et al. using Q-Switch Nd: YAG for tattoo removal shows that the incidence of hypertrophic scars was relatively low (0.28%) and no keloids were reported²⁵. A study by Zhang L. et al. demonstrated similar results and reported the textural skin changes post-laser removal²². They found tattoos that had been raised above the skin before the laser treatment all developed textural skin changes or hypertrophic scars at the end of the follow-up period²². The assumption lies that the deep penetration of the pigments causes a granulomatous reaction in the skin, collagen hyperplasia, and eventually scar formation. When the tattoos are removed, the scars are visible and more obvious^{6,13,22}.

Using too-high energy fluence increases the risk of deeper thermal injury with potential burns and scarring, particularly in dark or tanned skin in which the epidermal melanin absorbs most of the laser radiation^{2,13}. If there is a need to penetrate deeper, physicians should try a larger spot size first, instead of increasing the fluence. With multiple laser sessions, not only does the risk of scarring/fibrosis rise but also the risk of hypopigmentation or post-inflammatory hyperpigmentation^{6,14}.

When treating tattoo removal with ablative lasers, caution must be exercised. The eyelid

is one of the common areas where cosmetic tattoos are done, it lacks adequate pilosebaceous units, unlike cosmetic tattoos located on other facial sites where pilosebaceous units are abundant and aid in healing and moisturizing suitable for ablative laser treatment⁸. The use of excessive energy or stacking of laser pulse in the area may result in excessive thermal damage, too-deep cutaneous penetration, and permanent scarring.

The treatment interval must be at least 6–8 weeks apart to allow adequate healing; shorter treatment intervals can interfere with immune cell activity in the healing process⁶. Patients on short- and long-term immunosuppression, either from drugs like immunosuppressive agents or medical conditions, can have poor wound healing which further leads to pigment retention following laser treatments²⁶.

Traumatic Tattoos

A common cause of traumatic tattoos is accidental explosions from fireworks and gunpowder. Q-switched or picosecond laser treatment of traumatic tattoos can cause micro-explosions upon laser irradiation resulting in cavitation and subsequently atrophic scars and is, therefore, contraindicated for this indication^{6,10}. Ablative lasers are more appropriate in this circumstance as they do not ignite the incendiary fragments¹⁰.

Deeply embedded materials may not be completely eradicated, and patients should be informed before laser treatment. Harder materials, such as asphalt and car paint, require more treatments, while softer materials like dirt and mascara require fewer treatments⁶. Large particulate materials also necessitate the use of ablative lasers, such as Erbium: YAG or CO₂ lasers because

pulsed lasers are not sufficient to target them⁶.

Dyspigmentation

The most common complication is pigmentary changes, either hypopigmentation or hyperpigmentation; they are more common than scarring. These occur 4-6 weeks after laser treatment and usually are not permanent^{13,17}. In darker or tanned skin, these pigmentary changes can last longer than normal.

It is recommended to conduct a test spot and evaluate after four to six weeks to assess the risk of hypo- and hyperpigmentation and efficacy^{1,18}.

Hyperpigmentation, either permanent or transient, develops after inflammation or numerous laser treatments. It occurs as a result of increased ultraviolet (UV) sensitivity of the skin after laser treatment. This symptom is predominant amongst darker skin types and inadequate UV protection following laser treatment².

The laser should be chosen wisely per tattoo pigment colors and the skin types. Generally, Q-switched 1064nm Nd: YAG laser is safer in darker skin types V-VI¹⁹. Non-ablative fractional lasers have been used to treat post-inflammatory hyperpigmentation successfully¹².

Patients who take or have taken gold salts, such as gold injection for arthritis, even if the gold was given years ago, can have uneven hyperpigmentation, also known as chrysiasis, when treated with Q-switched lasers^{1,6,12}. This complication can be treated with a long-pulsed ruby laser²⁷.

Hypopigmentation especially occurs with ruby or 532 nm Nd: YAG lasers and possibly

lasts for 6 months but is less frequently seen with 1064 nm Nd: YAG laser as this wavelength is not absorbed by melanin¹². The risk of hypopigmentation increases with high fluences, number of treatments, inflammation, and the use of shorter wavelengths⁶. When hypopigmented develops, avoid repeated treatment on the same area and cease further laser treatment for the residual tattoo until the skin has recovered from hypopigmentation; the recovery time ranges from months to years²². To avoid hypopigmentation in dark-skinned patients, longer wavelengths and lower fluences are preferable. For persistent hypopigmentation, an excimer laser can be considered to induce re-pigmentation; multiple sessions may be required²⁴.

Other than skin, leukotrichia, permanent whitening of the eyelashes, has been reported following laser tattoo removal of permanent eyeliner¹³.

Allergic Reaction

Allergic reactions resulting from tattoos can present with plaque elevation or plaque-like pattern, extensive hyperkeratosis, or ulcer necrotic reaction. The reaction is seen primarily in red tattoos but can also be seen in other colors. Black and white tattoos rarely develop allergies²⁰. Colored pigments induce allergic reactions during tattoo making and this reaction may recur during laser tattoo removal.

Tattoo allergic reactions can be type I hypersensitivity or type IV hypersensitivity to tattoo ingredients like nickel and paraben, a preservative²⁰. Laser treatment is concerning, especially for type I tattoo allergic reactions including anaphylaxis. There is a potential risk of a systemic reaction or a flare-up of chronic allergic reaction from the breakdown of pigment particles after

exposure to laser treatment, and activation of ongoing allergy in the tattoos^{15,18,23}. The consequences can be hematogenous contact dermatitis, urticarial reactions, or anaphylactic shock^{2,3,23}. Some allergic reactions may be early or delayed after several months or years following tattoo removal^{13,20}.

Subsequent laser treatments must not be performed to prevent the further spread of allergens within the body and avoid a systemic reaction if an allergic reaction occurs following a laser treatment¹². If Q-Switch and picosecond lasers are to be used, prophylactic systemic corticosteroid and antihistamine as pretreatment, and proceed with extra caution^{2,11,18}. However, pretreatment cannot possibly get rid of the risks entirely. Always be aware that laser clinics are not prepared to handle severe allergic reactions with potential acute cardiovascular collapse¹⁸.

An alternative, ablative fractional laser treatment (a CO₂ or Erbium: YAG) to eliminate the allergic ink portion of a multi-colored tattoo, is safer and recommended before Q-Switch lasers on this occasion^{6,12}. Thus, the use of ablative CO₂ and Er: YAG lasers is preferable¹¹. Some even advocate against the use of Q-Switch lasers in tattoos that show signs of allergic reaction¹⁵. Dermatome shaving is also an option, removing the concentrated pigments in the superficial dermis^{12,29}.

Due to the numerous substances and unknown components in the tattoo inks, proving allergic reactions to a specific tattoo color remains challenging¹³. Patient history and objective findings are the main tools to differentiate allergic reactions from non-allergic tattoo reactions. Patch testing of tattoos and pigments is not reliable and produces false negative outcomes^{12,13,20}.

Difficulty in identifying the culprit component is one of the reasons⁷. However, no reaction is evident in patch testing even if the culprit ink is used. It is hypothesized that the antigens, the pigments, must be haptenized in the dermis first at a certain period or undergo alteration from UV exposure before they become immunogenic^{7,12,29}.

Non-Allergic Reaction

Black tattoos commonly cause non-allergic reactions. Severity depends on the density of black pigments in the dermis and the tendency to spontaneously aggregate and form pigment foreign bodies resulting in inflammation or granuloma^{7,18}. Removing the granuloma reaction can be done by surgical excision or laser⁷. Reactions in black tattoos can be treated with lasers without concerns of developing allergic reactions²³. Additionally, with either treatment with Q-Switch, nanosecond lasers or picosecond lasers, partial removal of pigment can exterminate the problem.

Patients can present with pseudo-lymphomatous tattoo reactions characterized by asymptomatic or pruritic papules, plaques, or nodule nodules occurring months to years after tattooing. Pseudo-lymphomatous reaction usually arises on tattooed skin; however, it is not always confined to the tattoo^{7,30,31}. Laser surgery with Q-Switch Nd:YAG has been reported as an effective treatment for pseudo lymphomatous tattoo reaction, but there is a risk of triggering systemic hypersensitivity response and treatment should be exercised with caution^{32,33}. Other than lasers, treatment options include super potent topical steroids or intralesional corticosteroids, and surgical excision in case of conservative measure failure^{7,23}.

For sarcoidosis reactions in black tattoos, lasers have a limited role in the treatment because of the risk of scar in the treated areas²³.

The last tattoo non-allergic reaction is the dermal urticarial response in the treated skin due to traumatic histamine release or light-induced urticaria, not in the sense of allergic reaction to pigments¹². Pretreatment with a small spot and then observing for the cutaneous reaction is strongly advised before approaching the entire tattoo¹⁸.

Pigmented Skin Lesions

A thorough skin examination should be performed as much as possible for hidden pigmented lesions like nevi or tumors on tattooed skin³⁴. There is a diagnostic problem of pigmented lesions within tattoos and the danger of treating them by laser; pigmented cells can lose pigmentation, hindering the assessment of melanocytic lesions^{13,34}. Withholding laser tattoo removal treatment is recommended until the excision of the tumor is done with the pathological report. Dermoscopic assessment regularly is recommended while a tattoo is undergoing removal by laser although there is no evidence suggesting that laser treatment converts benign nevi into melanoma³⁴.

Compartment Syndrome

A rare complication report is a severe compartment syndrome requiring emergency decompression on the forearm. It was revealed that the patient received more than twice as many pulses as were recommended. As a result, excessive edema arose leading to compression syndrome².

CONCLUSION

Which lasers to be used in laser tattoo removal and with what parameters should be individualized regarding many factors. Patients should be thoroughly counseled on the tattoo removal process and receive enough information to set realistic expectations and obtain a satisfactory clinical outcome. Risks of treatment, complications, and expected post-treatment side effects should always be reviewed and discussed with patients. An estimation of the number of laser sessions needed should be made during the initial confrontation; otherwise, there will be a risk of poor treatment adherence, with the patient underestimating the effort and time required to clear a tattoo.

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Corresponding Author:

Nattanicha Chairsrimaneepan
3601 4th St, Lubbock, TX 79430
Phone: 806-999-3691
Email: nattanicha5.13@gmail.com

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