Best Clinical Practices in Laser Tattoo Removal

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The ability to remove tattoo ink safely, efficiently and with minimal side effects has improved significantly in the past decade. With the introduction of quality switched (Q-switched or QS) lasers, older, unsafe techniques have all but fallen by the wayside. That said, many practitioners are still unclear as to the standards that should be used when implementing a tattoo removal protocol, even with access to proper equipment. This article briefly discusses older, now obsolete methods of tattoo removal and current modalities used to resolve ink, with a strong emphasis on the importance of incorporating the recommended best standards in hopes of improving patient satisfaction and treatment outcomes.

**Previously Used Tattoo Removal Methods**

Non-laser tattoo removal techniques may still be available in some communities, although they are now nearly obsolete because of unpredictability, poor clinical outcomes and serious adverse events.

Thermal destruction of tattoo ink via fire and hot coals has been used for centuries to try to remove unwanted tattoos, usually with significant scarring. Thermal cautery, electrocautery and infrared coagulation are equally unpredictable and often result in unwanted side effects.¹

Some practitioners have attempted to use liquid for tattoo removal, but its use is very limited because the destruction leads to unpredictable results, including hypopigmentation, scarring and prolonged healing.²,³

Destruction of ink via exposure to acid, specifically phenol solution and trichloracetic acid, has been implemented, but this method also leaves hypopigmented scars and causes ink retention.⁴,⁵

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Salabrasion involves scraping the superficial dermis with coarse granules of common table salt and an abrasive pad. Salt is then reapplied to the wound surface and left under occlusion.⁶,⁷,⁸ Ink retention and textural changes after the wound heals are common.

Dermabrasion removes tattoos by sloughing off layers of skin until reaching ink. Hypertrophic scars occur frequently, postoperative pain was significant and most patients reported a result more unsightly than the original tattoo.⁸,⁹,¹⁰

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Surgical excision of skin containing tattoo pigment may result in scarring because of limitations in wound closure. However, very small tattoos located in areas of adequate skin laxity may be removed with simple excision.¹¹,¹²

Intense pulsed light devices (IPL) offer millisecond pulses that are not sufficient to destroy tattoo ink. Moreover, pigment particles in the dermis treated with IPL devices conduct heat to nearby tissue, causing unspecific tissue injuries. Intense pulsed light is not a suitable option for tattoo ink removal; treatment of tattoo ink with these devices should be avoided.¹³
Lastly, continuous wave lasers such as the carbon dioxide laser and the argon laser can effectively remove tattoo ink, but, because there is no selective light absorption, nonspecific thermal damage to adjacent dermal structures occurs, resulting in scarring and ink retention.\textsuperscript{16-18}

**Q-Switched Lasers**

Because of the impressive clinical results, predictability and safety profile when implemented properly, Q-switched laser technology is now widely considered the gold standard for tattoo removal. The three Q-switched lasers available for tattoo removal are the ruby (QSRL), the neodymium-doped:yttrium-aluminum-garnet (QS Nd:YAG) and the alexandrite (QS Alex).\textsuperscript{19-22} Laser devices that incorporate Q-switching are able to achieve selective photothermolysis due to their high energy and short pulse duration. By specifically targeting tattoo ink, Q-switched devices result in very little damage to surrounding chromophores, including hemoglobin, melanin and water. Since the surrounding tissue is largely unaffected by treatment, healing time is relatively fast and usually uncomplicated.

Following exposure to a Q-switched device, a very minimal amount of tattoo ink may be eliminated as the post-treatment crust sloughs off, but the primary mechanism of action of pigment particle removal is through engulfment via phagocytosis. Following laser treatment, tattoo pigment can be found in regional lymph nodes, so it is believed that ink is removed, at least partially, through lymphatic drainage.

Side effects from Q-switched laser treatment are typically minimal and predictable. Discomfort occurs during the procedure; minimal erythema, pruritus and edema are expected after. Minor crusting, vesicles and bulla are possible. Hyperpigmentation is relatively frequent but is nearly always transient. Hypopigmentation is usually transient as well but may be permanent in some cases. The incidence of undesired pigmented alteration (hyperpigmentation, hypopigmentation and depigmentation) is, predictably, more frequent in darker skin types. Infection, hypertrophic scars and keloids are exceedingly uncommon and, when they do present, are nearly always a result of patient non-compliance, but may also be the result of overtreatment or too frequent treatment.

**Best Clinical Practice Recommendations**

Managing patient expectations and providing proper treatment are imperative parts of any dermatological procedure. In the past, these crucial components were, unfortunately, often not given as much emphasis in the world of tattoo removal as they are today. By incorporating widely acknowledged best clinical practice recommendations, dermatologists can provide patients who desire tattoo removal a more thorough understanding of the process, proper treatment, and, ultimately, a more satisfying experience.

**A) Informed Consent:** All procedures require an informed consent, but, all too often, dermatologists use a non-specific “boiler plate” form that covers multiple, unrelated procedures. Not only is this a source of potential liability, but it also does a disservice to patients by not allowing for a true appreciation and understanding of the facts, implications and future consequences of laser tattoo removal. An informed consent is one of the most useful forms of patient education, as it sets the stage for realistic patient expectations. The authors recommend using a dedicated, detailed informed consent that, at a bare minimum, outlines alternatives to treatment, potential unwanted side effects from treatment or, because laser tattoo removal is an elective procedure, the option to forgo treatment altogether.\textsuperscript{23} This consent should be reviewed with the patient and, after he or she has had ample time to read it thoroughly, each section should be initialed and the patient should print and sign his or her name, indicating understanding and agreement to be treated.
**B) Number of Sessions Required:** One of the biggest clinical challenges faced by laser practitioners, and a frequent, significant source of patient frustration, is the estimated number of treatment sessions that are needed to effectively remove a tattoo. In the past, patients were simply informed that they might need between “five and 15 treatment sessions.” Such a large variability in the estimated number of treatments offered patients little reassurance that their tattoo ink would be resolved over the course of a predictable timeline.

In 2009, publication of the Kirby–Desai Scale offered both clinicians and patients a much more precise estimation as to the number of laser tattoo treatments they would need. This scale is now widely accepted by the dermatology community, and it is highly recommended that, during the initial visit, this scale be implemented to educate and provide a more reasonable number of treatments necessary. Once calculated, this number of predicted treatments should be clearly noted in the patient’s medical records in his or her presence.

**C) Time Requirements:** Another nearly equally common complaint was the lack of specificity in regard to the actual time it would take to remove a tattoo. Although the Kirby-Desai Scale offered a significant improvement in determining the number of treatment sessions required, practitioner recommendations about the length of time to wait between treatments varied greatly. Some told patients to return on a monthly basis, while others instructed patients to return “once the area was completely healed.”

The authors recommend a bare minimum of 7 to 8 weeks between tattoo removal sessions. The reason for this is twofold. As noted earlier, phagocytosis, which continues to take place many weeks after treatment, plays the major role in ink particle resolution, and the incidence of unwanted side effects decrease with less frequent treatment intervals. Patients also often have a hard time understanding the counterintuitive concept that increasing treatment frequency does not increase the rate of ink resolution. In fact, because of the potential for increased side effects, more frequent treatment may lead to prolonged ink retention. Thus, as noted above, the authors recommend that patients wait a bare minimum of seven to eight weeks between sessions. Moreover, in some cases where very little ink remains or adverse side effects present (tissue texture changes, hyperpigmentation, hypopigmentation), patients are asked to wait three to six months before returning for another evaluation. By explaining appropriately timed sessions to patients, clinicians will, again, be meeting industry standards, minimizing chances of adverse events while maximizing ink resolution and providing realistic expectations.

**D) Equipment Maintenance and Records:** As with any other form of advanced machinery, every Q-switched laser has a maintenance schedule that needs to be followed closely. Most device manufacturers offer a service agreement for the first year with optional extensions thereafter; as a result, most new lasers are calibrated appropriately and function in accordance with the manufacturer’s suggested protocols. Choosing to not renew a service agreement puts a laser practitioner in a precarious position, as upkeep can quickly become difficult and expensive. Poorly maintained or neglected equipment can be ineffective or dangerous. As a result, maintenance records are required by some state agencies, and all devices should have detailed notes as to when and how they were serviced. Purchasing used equipment in the secondary market is another source of concern, as the maintenance records and history of the devices may be unobtainable and manufactures may be unwilling to service used lasers.

**E) Training:** As with any procedure, proper education including, but not limited to, use, safety protocols, patient selection, side effects and treatment of adverse events, needs to be thoroughly understood before embarking on laser tattoo removal treatment. The training offered by manufactures ranges greatly and is, in many cases, sorely inadequate. Even weeklong training courses that address multiple aesthetic procedures may be insufficient. Clinicians with no previous
and/or limited laser experience who are interested in incorporating laser tattoo removal into a practice should seek out a dermatologist with significant experience in this field who also has a high patient volume (for hands-on training). Attending workshops hosted by major dermatological societies is also beneficial.

**F) Pain Management:** Discomfort is a challenging aspect of any dermatological procedure. Perception of the discomfort of laser tattoo removal varies greatly among patients, even in regard to different tattoos on the same patient. The use of forced cold air applied to the desired area just before and during the procedure makes the experience much more tolerable and should be incorporated into every laser tattoo removal treatment. Topical numbing cream applied 30 minutes prior to treatment is another means by which the pain of the procedure can be mitigated and should be offered to all patients prior to treatment. Between compressed air cooling and topical anesthetic, a more tolerable experience occurs and these two techniques nearly always offer adequate anesthesia. For patients with a true pain phobia, local anesthesia offers complete anesthesia; however, the authors have noted that the application of the laser immediately following anesthetic injections may result in increased petechia and possibly frank bleeding following such sessions. In turn, a more significant post-treatment crust may present with an increased risk of premature sloughing and, thus, tissue texture changes, dischromia and infection may be more likely to occur. So, if local anesthesia is to be incorporated, it is recommended that only the minimal amount necessary be injected and that thorough massage be performed to make sure adequate infiltration has taken place. It is also recommended that a minimum of 15 minutes elapses between the injection and the treatment.

**G) Aftercare Instructions and Follow Up:** Understandably, patient compliance with aftercare instructions occurs only when the instructions are detailed enough to provide necessary information but simple enough to comprehend. The authors recommend that a clear and concise take-home sheet be provided to patients as they leave the clinic. Additionally, a post-procedure telephone call should be placed to the patient 24 to 48 hours after the initial treatment to ensure that they are compliant with the aftercare instructions. Because treatments are spaced many weeks apart, every patient should be reminded at each subsequent session of the proper way to care for the treated area. Though proper education in person, take-home literature and consistent follow up, the chances of unwanted side effects may be mitigated.

**Conclusion**

Quality switched lasers are widely considered the gold standard for removing unwanted tattoo ink; older tattoo removal methods are now nearly nonexistent. That said, even with the proper equipment widely available, laser tattoo removal consultations and patient education and, thus, patient satisfaction, varies greatly within the industry. Through the implementation of the best clinical practice recommendations outlined in this article, healthcare practitioners performing laser tattoo removal will improve treatment outcomes and patient satisfaction.

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