TATTOO REMOVAL: WIPING THE SLATE CLEAN

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Tattoos are becoming increasingly more prevalent in our society. In 2003, a Harris Poll estimated that 16% of the U.S. population had at least one tattoo.[1] A 2006 study survey showed that 24% of people aged 18 to 50 had tattoos.[2] This increase in tattoo placement will likely be followed by an increased interest in tattoo removal.

The ability to remove tattoo ink safely and efficiently has improved greatly in the last decade with improved laser technology. This article will discuss current modalities used for tattoo removal as well as older methods that are becoming obsolete.

Q-SWITCHED LASERS

Quality switched (Q-switched) lasers control the light output by concentrating all the energy into intense bursts or series of pulses gauged in nanoseconds. Laser devices that incorporate Q-switching are able to achieve selective photothermolysis due to their high energy and short pulse duration. By targeting specific chromophores, in this case tattoo ink, Q-switched devices deliver 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 uncomplicated.

The three lasers most commonly used in tattoo removal are the Q-switched ruby (QSRL), Q-switched neodymium: yttrium-aluminum-garnet (QS Nd:YAG), and Q-switched alexandrite (QSAlex).

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

One of clinical challenges previously faced by clinicians, and a frequent source of patient frustration, was the estimated number of treatment sessions that a specific patient would need to effectively remove a tattoo. Since multiple factors — including Fitzpatrick skin type, tattoo location, ink color, amount of ink and

presence of tissue texture changes — contribute to the number of treatment sessions needed, most patients were simply informed that they would need between "5 and 15 treatment sessions." However, in 2009 the authors published the results of a study that offered much more precise estimation. The Kirby-Desai Scale is now widely accepted by the dermatology community as an efficient means by which to estimate treatment number for ink resolution.[3]

Side effects from Q-switched laser treatment are typically minimal and predictable. Discomfort occurs during the procedure while minimal erythema, pruritus and edema are expected after the procedure. Minor crusting as well as vesicles and bulla are possible. Hyperpigmentation is relatively frequent but is nearly always transient. Hypopigmentation is usually transient but may be permanent in some cases. The incidence of hyperpigmentation, hypopigmentation and dyspigmentation is predictably more frequent in darker skin types. Infection, hypertrophic scars and keloids are very rare.

Figure 1. Before photo of a blue tattoo on the right torso.
Figure 2. Photo of blue tattoo after four treatments with a Q-switched laser.
Figure 3. After photo of the blue tattoo following seven laser treatments.

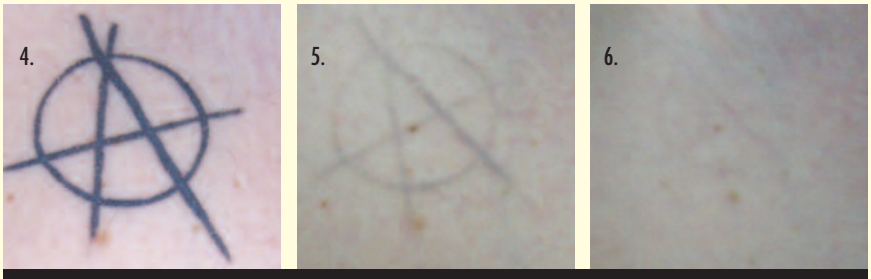

Figure 4. Before photo of a black tattoo on the right upper chest.
Figure 5. Black tattoo after three treatments with a Q-switched laser.
Figure 6. After photo of the black tattoo following six laser treatments.

Figure 7. Before photo of a black tattoo on the posterior neck.
Figure 8. Black tattoo after four treatments with a Q-switched laser.
Figure 9. After photo of the black tattoo following eight laser treatments.

PREVIOUSLY USED TATTOO REMOVAL METHODS

While the use of Q-switched laser technology is now widely considered the "gold standard" method for tattoo removal because of its impressive clinical results, predictability and safety profile, the less expensive and faster removal modalities may still be available in some communities. Serious adverse side effects often accompany the following non-laser techniques.

Dermabrasion removes tattoos by sloughing off layers of skin until reaching ink. For centuries individuals have used this method simply using any sharp object. In the 1950s and 1960s a rapidly spinning wheel or a wire brush was used to abrade the skin to remove ink. The procedure tends to be traumatic and the biological particulates that were aerosolized could carry infectious agents. Hypertrophic scars occurred frequently, postoperative pain was significant and most patients reported a more unsightly result than the original tattoo.[4,5,6]

Salabrasion involves abrading the superficial dermis with coarse granules of common table salt and a moist abrasive pad. Salt is then reapplied to the wound surface and left under occlusion for 24 to 36 hours.[7,8] Commonly, residual tattoo pigment remains and textural changes are noted after the wound heals.[9] (**See Figure 10**)

While ***liquid nitrogen*** is commonly used to destroy superficial cutaneous lesions, its role in tattoo removal is limited because the destruction leads to unpredictable results including hypopigmentation, scarring and prolonged healing.[10]

Phenol solution and trichloracetic acid have been used to treat tattoo ink but they, too, leave hypopigmented scars and ink retention.[11,12]

Thermal injury via fire, hot coals and cigarettes has been used for centuries to try to remove unwanted tattoos, usually with significant scarring. Thermal cautery, electrocautery and infrared coagulation are equally unpredictable.[11,13]

Surgical excision of skin containing tattoo pigment is still common but may result in scarring because of limitations in wound closure. However, tattoos located in areas of adequate skin laxity may be removed with simple excision.[14,15]

Continuous wave lasers, such as the carbon dioxide laser or the argon laser, can effectively remove tattoo ink, but because there is no selective light absorption, nonspecific thermal damage to adjacent dermal structures occurs. Patients treated with continuous wave lasers usually have some form of secondary scar formation, and for this reason, non-Q-switched lasers are very rarely used to treat tattoos.[16-19]

Figure 10. Scarring and ink retention after salabrasion treatment.

Intense pulsed light (IPL) ***devices*** typically offer millisecond pulses. The light intensities of these devices are normally not sufficient to destroy tattoo ink. Furthermore, instead of destruction, pigment particles in the dermis treated with IPL devices conduct heat to nearby tissue causing unspecific tissue injuries. IPL sources with millisecond pulses and low light intensities are not suitable options for tattoo ink removal, and treatment with these devices should be avoided.[20]

All of the aforementioned treatments offer unpredictable results and may result in scarring, undesired pigmentary alterations, pain and incomplete resolution of the tattoo ink as well as increased liability.

CONCLUSION

Multiple means by which to remove a tattoo are available with varying degrees of success and unwanted side effects. Previous removal modalities that left patients with incomplete results, pain, undesired pigmentary alterations, tissue texture changes and scarring have largely been replaced by the use of Q-switched lasers. Because they offer patients an effective, low-risk treatment option, Q-switched lasers are widely considered the gold standard method to remove unwanted tattoo ink. ■

Dr. Kirby is a board certified dermatologist and the Medical Director of "Dr. Tattoff." Having performed and supervised more than 30,000 laser tattoo removal procedures he is widely considered the leading authority on the art and science of laser tattoo removal.

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Table 1. CLINICAL CONSIDERATIONS

Healthcare practitioners who offer Q-switched laser tattoo removal should inform patients of the following:
The procedure is uncomfortable but tolerable.
Multiple treatment sessions are needed to remove a tattoo.
Treatment sessions are spaced at least 6 weeks apart.
Common side effects include redness, itching, swelling and possibly blisters.
Patients with colored tattoos, tattoos on distal extremities, darker skin types and "cover up" tattoos are more likely to experience adverse side effects.
Proper patient aftercare is an imperative part of the treatment process.

Table 2. CONTRAINDICATIONS TO TATTOO REMOVAL VIA Q-SWITCHED LASER TREATMENT

Uncontrolled diabetes mellitus
Significant peripheral vascular disease
Recent episode of cellulitis (MRSA)
Rheumatoid arthritis/juvenile Rheumatoid arthritis
Malignancy
Collagen vascular diseases
Immunosupression
Certain medications (isotretinoin, etc.)
Fulminate hepatitis
Renal failure (acute or chronic)

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