

## **SharpLight Technologies: Nd:YAG Q-Switched Laser For Tattoo Removal**

### **White Paper**

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#### **Abstract**

As the popularity of tattoos continues to increase, so does the demand for tattoo removal. When a tattoo is no longer desired, Q-switched lasers provide the major means for effective clearance of tattoo pigment with minimal side-effects. We present our clinical experience using the new SharpLight Technologies (SLT) tattoo removal hand held laser, along with literature findings and the important issues practitioners should consider in the management of tattoo removals.

Prior to laser technology, tattoos were removed via techniques with a high likelihood of scarring, such as surgical excision and cryosurgery. Since the 1990's, Q-switched lasers became the gold standard for safe and effective tattoo removal. However, presence of different tattoo colors necessitates different laser wavelengths. Unfortunately, no single wavelength can remove all available ink colors.

Amateur tattoos are less dense, placed at variable depths, and composed of carbon-based ink. Professional tattoos contain a variety of densely packed, colored pigments at a uniform depth. Once implanted, the ink particles are phagocytosed by resident dermal fibroblasts, where they permanently remain in the superficial dermis. In order to selectively remove tattoo pigments placed in the dermis, pulsed lasers must meet the following criteria:

- a) The laser wavelength must be well absorbed by the targeted ink color.
- b) The heat generated should be spatially confined to the target.
- c) The energy delivered must be sufficient to cause the desired effect. Quality Factor (Q-switched) lasers (lasers with ultra-short pulses in the nanoseconds domain) with wavelengths in the visible-to-near infrared range (532nm and /or 1064nm), enable very rapid deposits of energy which result in a "photo acoustic" effect. The intense heat transients cause some particles to shatter and destroy the cells in which the pigment resides. The rupture of pigment-containing cells eventually triggers phagocytosis and the packaging of tattoo fragments for lymphatic drainage.

Amateur tattoos generally require fewer treatment sessions than professional tattoos. Brightly colored inks may necessitate more treatment sessions.

The SLT dual wavelength, Q-switched Nd:YAG laser (532nm and 1064nm) hand piece overcomes the obstacle of excessive melanin absorption and is used to remove blue and black ink tattoos even in darker skin types (using the 1064nm), or red, orange and green pigmented tattoos (using the 532nm). The clinical endpoint during Q-switched laser treatment is whitening of the inked area, with occasional mild pinpoint bleeding. The SLT laser offers a spot size range of 2, 4 and 6mm, which may be adjusted according to the tattoo pattern. The 1064nm wavelength has deeper skin penetration and carries minimal risk of hypo-pigmentation but is less effective in removing brightly colored pigments.

Of all available lasers, 1064nm is the most recommended for darker skin types. This wavelength is also useful when residual, more deeply placed ink particles remain, as well as in the treatment of thin tattoos, since it is less likely to damage the hair follicles. Literature survey indicates that about 80% of amateur black tattoos can be cleared (>75% ) after one to five treatments with the 1064nm, while 75% of professional tattoos achieve similar

clearance but require up to 11 treatments (average of 6.3 treatments). The 532nm wavelength (green light) is also absorbed by hemoglobin and as a result, purpura may last 6 to 10 days post treatment. This wavelength is most effective for red, orange, green and occasionally yellow ink. One study of this wavelength found that in 63% of red tattoos, > 75% clearance was achieved after one to five treatments, while only two of eight yellow tattoos faded.

### **Materials and Methods**

The study was designed to evaluate both safety and efficacy of a new SLT dual wavelength, Q switched Nd:YAG hand held laser in the removal of different colored tattoos. Repetition rate is 1, 2 and 3 Hz, maximum energy per pulse of 0.8 Joules. Spot sizes -available are 2, 4 and 6mm and wavelength may be set for 1064nm or both 1064nm and 532nm, using the KTP add-on tip.

Ten (10) volunteer patients, 6 males and 4 females, all between 25 and 35 years old, received 1 to 3 treatments for tattoo removal of various colors. Appropriate eye protection for both patient and practitioner was mandatory, since these lasers can be hazardous to the eyes. Photographs were taken before and one month post last treatment.

Risk analysis is important when evaluating a tattoo for removal, prior during and post treatment: Textural changes, scarring (~ 5%), hyper and hypo-pigmentation, pre-existing local allergic reaction, and immediate pigment darkening which can occur with white, pink or skin-toned tattoos. Appropriate patient education should be provided prior to treatment of any potential risk. If darkening occurs, two treatment options remain: The tattoo can be excised or ablated, or multiple additional Q-switched laser treatments can be performed to eliminate the darker pigment. The best way to anticipate such darkening is to treat a test spot and evaluate after initial skin whitening has faded.

Potential solutions: Adverse effects can be minimized using larger spot sizes and spacing the treatments 6–8 weeks apart. The healing phase can last over three weeks highest healing time reported on the chest, outer upper arm and ankle. Total healing time may be reduced using topical corticosteroids within two weeks from treatment, signs of scarring may be seen, and are frequently reversed with application of Class I topical steroids. If hyper-pigmentation occurs, use of hydroquinone – containing compounds and UVA/UVB sun block can be beneficial, as can the avoidance of sun exposure. Post treatment, urticaria or systemic allergic reaction may worsen. In such cases, Q-switched laser treatment should be used with extreme caution. It is best to either use an ablative CO<sup>2</sup> laser or Er:YAG laser to vaporize the tattoo or proceed with caution, cover with systemic corticosteroids, and consult an allergist before repeating treatment.

## Results

### Average % of removal:

1. 1st session  $\leq 40\%$
  2. 2nd session  $\leq 30\%$
  3. 3rd session  $\leq 20\%$
- Total  $\leq 80\%$  tattoo removal.
  - Treatment session time depends on tattoo's size and pattern.
  - Mild and transient edema and erythema may occur immediately after treatment and last for a few hours.
  - Cold packs and soothing creams or cold gels are recommended.
  - No severe adverse effects were noted.
  - Patient's and practitioner's satisfaction grading was an average of 9, on a scale of 1-10.

### Before and After Photos



Before and immediately after the 1<sup>st</sup> treatment session



After 2<sup>nd</sup> and 4<sup>th</sup> sessions



Before and after 3 sessions

### **Summary of the report:**

- Practitioner: Boris Leikin
- Records: Anna Danshin
- SharpLight System in use: OMNIMAX
- Nd:YAG QS hand held laser hand piece (with additional KTP crystal)
- Laser Tip size used: 2mm
- Skin types: I to V
- Tattoo colors: black / dark blue
- Tattoo types: professional, amateur
- Tattoo locations: lower leg, abdomen, arm

### **The course of treatment:**

- Shave the treatment area, where applicable
- Treatment may be accompanied by mild pain which might require an external cooling device, such as ZIMMER, in order to insure patient's comfort
- Post treatment, apply cooled gel or soothing cream and wrap treated area with a bandage for several hours

**Treatment parameters:** 0.4 to 0.8 J and 1-3 Hz.

### **Selecting parameters:**

- On dark colored tattoos (black / dark blue) start without KTP Crystal. Only after the tattoo color changes to brighter color, use the KTP to add the 532nm wavelength. Tattoos that are bright lighter can be treated with the KTP from the first treatment.
- The treatment is performed by emitting pulses without overlapping directly onto the tattoo area. Angle of the hand held laser hand piece during treatment is between 70 to 90 degrees.
- Distance adjustment may be needed, leading to an acoustic effect ("explosion" sound) and whitening of the epidermal surface above the tattoo.
- When treating with a KTP crystal, expect appearance of white foam (gas plasma).
- Treatment of a dark tattoo with a KTP crystal might lead to the creation of hemorrhages.
- Post treatment, the tattoo corium layer is formed, which peels off in two weeks.
- The interval between treatments is recommended to be 6 to 8 weeks.

### **Conclusion**

While no single wavelength holds the answer for removal of all tattoo types and colors, dual wavelength, Nd:YAG lasers can successfully fade most tattoos with minimal adverse effects. Understanding the capabilities and limits of laser technology, practitioners can set realistic goals with their patients. 100% clearance of treated tattoos is rare. At best, depending on the color, practitioners can expect 90% clearance in the cases they treat.

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