Standard guidelines of care: Lasers for tattoos and pigmented lesions

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ABSTRACT

Introduction: Lasers have revolutionized the treatment of pigmentary disorders and have become the mainstay of therapy for many of them. Machines: Though different laser machines are used, Quality-switched (QS) lasers are considered as the gold standard for treatment of pigmented lesions. Proper knowledge of the physics of laser machine, methodology, dosage schedules, etc., is mandatory. Physician Qualification: Laser may be administered by a dermatologist, who has received adequate background training in lasers during postgraduation or later at a center that provides education and training in lasers, or in focused workshops which provide such trainings. He should have adequate knowledge of the machines, parameters, cooling systems, and aftercare. Facility: The procedure may be performed in the physician’s minor procedure room. Indications: Epidermal lesions: Café au lait macules (CALM), lentigines, freckles, solar lentigo, nevus spilus, pigmented seborrhoeic keratosis, dermatosis papulosa nigra (DPN), Dermal lesions: Nevus of Ota, Blue nevus, Hori’s nevus (acquired bilateral nevus of Ota-like macules). Tattoos: Amateur, professional, cosmetic, medicinal, and traumatic. Mixed epidermal and dermal lesions: Postinflammatory hyperpigmentation (PIH), nevus spilus, periorbital and perioral pigmentation, acquired melanocytic nevi (moles), melasma and Becker’s Nevus. Contraindications: Absolute: Active local infection, photo-aggravated skin diseases and medical conditions, tattoo granuloma, allergic reactions to tattoo pigment, unstable vitiligo and psoriasis. Relative: Keloid and keloidal tendencies, patient on isotretinoin, history of herpes simplex, patient who is not co-operative or has unrealistic expectation. Patient selection: Proper patient selection is important. Investigations to identify any underlying cause for pigmentation are important; concurrent topical and systemic drug therapy may be needed. History of scarring, response to previous injuries, degree of tanning needs to be considered. Detailed counseling about the need for multiple sessions is required. Informed consent should be taken in all cases. Treatment sessions: Epidermal lesions need an average of 1–6 sessions, while dermal lesions need average of 4–10. Some tattoos may need up to 20 sessions. All lesions may not clear completely and only lightening may be achieved even after multiple sessions in many cases. Future maintenance treatments may be needed. Hence, a realistic expectation and proper counseling is very important. Epidermal lesions are likely to recur even after complete clearing. Therefore, there is a need for continued sun protection. Dermal lesions and tattoos tend to remain clear after treatment (except conditions as dermal melasma). Laser parameters: Laser parameters vary with area, type of pigmentation and machine used. Complications and their management: Postinflammatory pigmentation changes are common in dark skin patients. Textural changes and scarring occur rarely.

Key words: Laser, Pigmented lesion, Tattoos
INTRODUCTION, RATIONALE, AND SCOPE

Light Amplification by Stimulated Emission of Radiation (LASER) uses the principle of selective photothermolysis. Significant advancements have been made in laser technology for pigmented lesions with new and better equipment being introduced every year. Most of the data on the use of these devices are on Fitzpatrick skin types 1 to 3. Treatment of darker skin types (skin photo types 4, 5, and 6) is a challenge due to the risk of complications. Quality-switching (Q-switching) is a means of creating very short pulses (5–100 ns) with extremely high peak powers. The QS lasers also produce an additional photoacoustic effect, which results from the generation of shock waves following laser irradiation. Such waves then cause vibrational damage to cellular structures and rupture membranes, thereby disrupting melanosomes and tattoo ink particles. The QS lasers have changed the way the dermatologists approach these conditions and have become the mainstay of treatment. QS laser treatment is a safe and effective procedure.\(^{1-6}\)

Long-term data on the safety and efficacy of these devices in darker patients needs to be quantified to allow consistent treatment outcomes. Considerable variations exist in results due to availability of a variety of lasers of different wavelengths, peak powers, and spot sizes. Hence, minimum uniform recommendations are necessary. These guidelines outline the indications and treatment of the following: benign pigmented lesions and tattoos, various procedures, methodology, associated complications, and expected outcome.

EVIDENCE: LEVEL B


INSTRUMENTATION AND TECHNICAL INFORMATION

Melanin absorbs light in the ultraviolet up to the range of 1200 nm. At longer wavelength, absorption is lower and penetration deeper compared to shorter wavelength. Different laser systems such as QS lasers (QS Ruby laser 694 nm, QS Alexandrite laser 755 nm, QS Nd:YAG laser 1064 nm, and frequency doubled at 532 nm), intense pulsed light (IPL), Millisecond lasers (Alexandrite 755 nm, Diode 810 nm, 1064 nm, and 532 nm Nd:YAG, etc.) have been used for treating pigmented skin lesions [Table 1]. QS lasers target melanin (and ink particles) in the dermis allowing removal or lightening of benign pigmented lesions and tattoos, respectively. QS lasers produce ultra-short bursts of light in the nanosecond range and are the current gold standard of treatment for tattoos and benign pigmented lesions.\(^{1-4}\)

QS Neodymium: yttrium-aluminum-garnet (Nd:YAG) laser 1064 nm emits light that penetrates 2–3 mm into dermis and hence is suitable for deeper dermal pigmentation such as found in nevus of Ota. By passing the beam through the potassium-titanyl-phosphate (KTP) crystal, the frequency is doubled and the wavelength is halved (532 nm). A shorter wavelength penetrates less deeply and therefore is more useful for removal of epidermal pigment such as in ephelids. The ruby laser (694 nm) penetrates less than 1 mm into skin and is used for treating superficial lesions such as freckles or CALM. However, because of its high affinity for melanin and the possible risk of hypopigmentation, the QS ruby laser is not recommended for use in patients of darker skin types. The QS alexandrite laser (755 nm) penetrates deeper than the ruby laser due to its longer wavelength and hence can be used in both epidermal and dermal pigmented lesions and tattoos.\(^{1-4}\)
Besides the QS lasers, Long-pulsed (millisecond) lasers such as the Diode 810 nm, long-pulsed alexandrite laser 755 nm, etc., can also be used for treatment of certain pigmented lesions. Intense pulse light (IPL) systems have also been used for the treatment of superficial pigmented lesions such as freckles, lentigines, etc. IPL systems are polychromatic light sources that use cut-off filters to block shorter wavelengths thus producing a broad band of IPL. These systems use wavelengths from 530 nm and above, and can be used to treat superficial pigmented lesions but are not recommended for dermal lesions or tattoo removal.[1-4]

Different laser systems and their details are listed in Table 1. It is beyond the scope of these guidelines to make specific recommendations on different brands. Proper patient selection and tailoring of the fluences appropriate to the patient’s skin type remain the most important factor for effective and safe laser treatment. The treating dermatologist should always refer manufacturer’s/marketing company’s specifications.

**EVIDENCE: LEVEL B**


**PHYSICIAN QUALIFICATION**

1. Any qualified dermatologist (DVD or MD) may perform the procedure.[1,2]
2. The Physician should have knowledge of basic anatomy and physiology of the skin and its variations.
3. To ensure successful cosmetic outcome, the physician should have basic knowledge and training about laser physics.
4. Proper hands-on training may be obtained either during postgraduation, if the postgraduate center provides such training; it may also be obtained from equipment supplier’s medical experts or from a dermatologist/plastic surgeon experienced in regularly performing the procedure. Dedicated hands on workshops are also adequate to provide training in the use of lasers.
5. The physician should be familiar with early recognition, prevention and treatment of postlaser (postprocedure) complications such as hyper or hypopigmentation, scarring, burns, etc.
EVIDENCE: LEVEL A


FACILITY

Laser is a simple procedure requiring only minor facilities. It may be performed in the dermatologist’s clinic/minor procedure room/or day care theater.[1-9]

- Presence of a nurse assistant is desirable; A female nurse assistant is mandatory while treating female patients.
- Proper lighting, operating table/cosmetic chair, comfortable seating for the treating physician are essential.
- Room should not have mirrors.
- The cosmetic chair without metallic surface (which may reflect laser/light beams accidentally) and of washable material should preferably be used.
- Cooling system should be available, as needed for each individual machine, as per manufacturer’s recommendation. Emergency hazard switch should be in place (for shutting of all systems) in case of any accidental happenings viz., fire or entry of any unauthorized persons. For further details, the reader is referred to the taskforce guidelines on laser room specifications.

EVIDENCE: LEVEL A


INDICATIONS

Pigmented dermatological conditions which can be treated by lasers are listed in Table 2.[1-3]

CONTRAINDICATIONS

Absolute

a. Associated photoaggravated skin diseases and medical illness for example, SLE.

b. Treatment area with active cutaneous infections for example, herpes labialis, staphylococcal infections, etc.

c. Unstable vitiligo and psoriasis: for risk of koebnerization of treated area.

d. Tattoo granuloma

e. Localized allergic reactions can occur with almost any color ink and result in urticaria and granulomatous reactions. If a patient exhibits

<table>
<thead>
<tr>
<th>Table 2: Pigmented lesions amenable to treatment by lasers</th>
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<tr>
<td><strong>Epidermal lesions</strong></td>
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<td><strong>Dermal lesions</strong></td>
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<td><strong>Epidermal-dermal lesions</strong></td>
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a cutaneous reaction within a tattoo, QS laser treatment should be used with caution. After QS laser treatment, the ink particles are mobilized, potentially triggering an allergic response. Systemic allergic reactions are more common in patients exhibiting a localized allergic response.

Relative
In the following indications, laser has to be used cautiously, and after proper counseling of the patient; use of laser in these situations depends on individual situation and on treating Dermatologist’s judgment.

a. Keloid and keloidal tendencies
b. Patient on isotretinoin
c. History of herpes simplex/history of herpes for increased risk of reactivation, this risk should be seriously considered prior to performing the procedure; if the treating physician decides to perform the procedure, the risk and benefit should be explained to the patient and the procedure should be performed after proper informed consent and only after a course of acyclovir. Active herpes labialis is included under absolute contraindication (see above).
d. Patient who is not co-operative or has unrealistic expectation.

EVIDENCE: LEVEL C


PREOPERATIVE PREPARATION

Tanning: It is very important to ensure that the patient is not tanned. Epidermal melanin produced by UV Light exposure may interfere with laser treatment and increase the risks for scarring, hypopigmentation, or hyperpigmentation.[1-6] To ensure a tan is not present, it is wise to compare the color of the potential treatment site to that of a nonexposed skin site, similar to the buttock or axilla. If a tan is present, treatment should be delayed until the tan has faded as much as possible in the treatment area. Use of sun protection, protective clothing, and bleaching creams can be useful in treating the tan. Patients with darker skin types and tanned patients are advised to apply hydroquinone-containing compounds (2−4%) preoperatively to minimize the risk of post inflammatory hyperpigmentation (PIH).

Systemic retinoids: It has been recommended that patients on oral retinoid therapy should not undergo laser treatment of pigmented lesions and tattoos for 6-12 months following discontinuation of the medication, as they have an increased risk of keloidal...
scar formation. However, proper evidence to support such a recommendation in Indian patients, particularly for epidermal lesions is lacking. However, caution is advised while treating all patients with history of recent administration of isotretinoin.

**Test patch:** A test patch helps to determine the treatment parameter for an individual. It is also helpful in medico legal situations. In particular, it is advisable for all beginning practitioners to perform laser test spots in all patients prior to treating an entire lesion, since skin type and color do not always perfectly predict the response to treatment. Even seasoned experts may need to perform small test spots, particularly where response to treatment cannot be judged properly. Always evaluate the patient 4-8 weeks after the test spots.

**EVIDENCE: LEVEL B**


**Anesthesia**

QS laser treatment usually does not require anesthesia, but, if a large area is treated then topical eutectic mixture of local anesthetics (EMLA), 1-2 hours before procedure under occlusion are recommended.

**EVIDENCE: LEVEL B**


**Eye protection**

QS laser light can cause permanent retinal damage and vision loss. Eye protection in the form of optically coated glasses or goggles for the specific laser being used is necessary. All persons present in the room during laser treatment must also wear appropriate eye protection. The eye wear should block the wavelength being used and the lens should provide an optical density (OD) of at least four. Laser protective eye shields (anodized external metal eye cup) must be used when treating periocular lesions. When treating eyelids, a metal corneal eye shield should be placed on the eye using topical anesthesia to protect the globe.

QS lasers produce ultra-short pulse durations that produce significant tissue splatter. Precautions include protective clothing, goggles, masks, and laser cone containment devices which should be used with every patient.

**EVIDENCE: LEVEL B**


**INTRAOPERATIVE TECHNIQUE**

Selecting the appropriate laser parameters

- **Fluence:** It is always preferable to begin with the lowest energy fluence that produces a visible response. Fluence may be increased if response is suboptimal. If epidermal debris is significant, the fluence should be lowered.
• **Spot size:** For epidermal lesions, the spot size which is just large enough to accommodate the treated lesion should be selected. It is important in epidermal lesions, especially in darker individuals, to avoid treating surrounding unaffected area to avoid pigmentary alterations. For dermal lesions, the spot size that elicits immediate, brisk whitening on laser irradiation should be selected. Larger spot sizes allow deeper penetration and produce less tissue splatter.

• **Treatment end point:** With the QS laser, the end-point of treatment is immediate whitening of the lesion. With an IPL, the end point is only erythema. Higher fluences may produce pin-point bleeding and blistering.

• **Repetition rate:** Choose higher frequency i.e., 5–10 Hz while doing large area. For smaller discreet lesions a frequency of 2–3 Hz gives better control.

**Laser procedure**

After choosing the correct spot size and the energy fluence (J/cm²), laser treatment is performed with the hand piece held perpendicular to the lesion and the entire area is covered with minimal overlap (up to 10% overlap). QS laser treatment will produce an immediate whitening of the lesion. Pin-point bleeding may occur if very high fluences are used. The entire lesion is covered in one pass. A popping sound is heard with each laser shot as the cells containing melanin or ink particles explode. Laser pulses are placed close to each other with minimum overlap. Keep cooling the area with ice packs/air cooling (for example, Zimmer) just before and after laser pulses to avoid heat buildup.

**Number of sessions**

Epidermal lesions require one to two treatments, dermal lesions may need anywhere between four to six or even more sessions. Tattoos may need five to twenty sessions for successful lightening. Professional tattoos require more treatment session for eradication. Amateur tattoos are less dense and are often made up of carbon-based ink that responds more readily to QS laser treatment. Traumatic tattoos are more superficial with minimal pigment and clear with one or two treatments. Gunpowder and firework tattoos need more care while treating as the implanted material has the potential to ignite and pox-like scars have developed after treatment.

**Interval between sessions**

Treatments should be done at least six to eight weeks apart. Treatment intervals can be longer when treating nevus of Ota (up to six months interval has been suggested). While treating tattoos also longer intervals are advisable. Continued clearance of the lesion occurs due to removal of pigment by macrophages and lymphatics, between treatments. Optimal interval between treatments therefore needs to be determined on an individual basis. [1-7]

**EVIDENCE: LEVEL B**


**POSTOPERATIVE CARE**

• Broad spectrum sunscreens with good UVA/UVB coverage are recommended before and throughout the treatment period. [1,2]

• Immediately after laser treatment, the treated area appears abraded, and inflamed. Apply ice packs till burning sensation subsides, then apply a layer of antibiotic such as mupirocin and cover with gauze. Patient is instructed to clean the area with copious amount of water and apply the ointment twice daily till lesions heal which can take around 5–10 days.

• Oral antibiotics may be used, if considered essential, by the treating physician, but are not
mandatory. Anti-inflammatory agents may be needed while treating large lesions. Patient should be instructed to avoid sun exposure and cosmetics on the treated area. Treatments are scheduled at an interval of 6–8 weeks.

- Patients are instructed to apply an antibiotic ointment or petrolatum ointment for about a week after procedure. Strict sun protection is advised for darker patients. Ice packs may be used after the procedure to minimize discomfort.
- Postprocedure bleaching agents may be used, but only after the crust subsides.\(^\text{[1,2]}\)

**EVIDENCE: LEVEL C**


**COMPLICATIONS AND THEIR MANAGEMENT**

1. PIH resolves with time; some patients may need bleaching agents such as hydroquinone along with sunscreens.\(^\text{[1-14]}\)
2. Postinflammatory hypopigmentation may persist for several weeks to months and may be difficult to treat. Phototherapy may be used to treat the hypopigmentation.
3. Textural changes and scarring
4. Darkening of tattoo pigment, especially flesh colored cosmetic tattoos. Red tattoos can turn black. If it occurs, it is difficult to treat.
5. Thermal injury and burns.
6. Localized allergic reactions can occur with almost any color ink and can result in urticaria and granulomatous reactions. Mercury-containing red ink is the commonest cause for allergic tattoo reactions. Other reactions reported include lichenoid and photodermatitis reactions. Cadmium in the yellow ink is known to cause photodermatitis reactions. After QS laser treatment, the ink particles may get further mobilized and trigger a severe allergic response. Systemic allergic reactions may also occur in such patients. Hence, if a patient exhibits a cutaneous reaction within a tattoo, QS laser treatment should be used with caution, only after treating the reaction with steroid creams. A test patch is always recommended. Patients with persistent allergic reactions in tattoos, may be treated with CO2 or Er:YAG laser ablation.
7. Scarring: May occur if very high fluence is used which results in a burn which if gets infected may pose a high risk for scar formation.
8. Acute compartment syndrome of the upper extremity has been reported following Q-switched 1064-nm Nd:YAG laser treatment of a decorative tattoo.
9. Infection; An antibiotic ointment and a nonadherent dressing should be applied upon completion of treatment. Patients should be instructed in the proper local wound care.\(^\text{[1-14]}\)

**EVIDENCE: LEVEL C**

10. Ashinoff R, Levine VJ, Soter NA. Allergic reactions


GUIDELINES FOR USE OF LASER FOR INDIVIDUAL PIGMENTED LESIONS [TABLE 3]

Epidermal lesions

Epidermal lesions respond readily to QS laser treatment. The wavelength used is 532 nm using the frequency doubled QS Nd:YAG laser. QS Ruby (694 nm) and QS alexandrite laser (755 nm) also can be used. Epidermal lesions require 1–6 sessions for clearing. These lesions are prone to recurrences and adequate sun protection is recommended to maintain clearance.

1) Café au lait macules (CALM): CALM are difficult to treat and usually require multiple treatments over months to years and recurrences are common, occurring in up to 50% of patients within a year of clearance. Risk of pigmentary alteration is higher in darker individuals and laser treatment may result in partial or incomplete clearance, with a speckled pattern of hyperpigmentation.[1-3]

EVIDENCE: LEVEL B


Lentigines/solar lentigo: Lentigines can usually be removed completely in one to three treatments. The treatment of the lentigines found on the mucosal surface in Peutz-Jeghers syndrome may produce equally good results as those found on the skin surface. Treatment with Q-switched lasers is more effective than with other modalities such as liquid nitrogen, 35% trichloroacetic acid, and glycolic acid peels.[1-8]

EVIDENCE: LEVEL B


Table 3: Guidelines for treating pigmented lesions by lasers

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<table>
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<tbody>
<tr>
<td>A</td>
<td>Confirm the diagnosis (biopsy if uncertain)</td>
</tr>
<tr>
<td>B</td>
<td>Avoid a tanned patient</td>
</tr>
<tr>
<td>C</td>
<td>Choose appropriate QS laser and do a test area if necessary</td>
</tr>
<tr>
<td>D</td>
<td>Epidermal lesions, for example, Lentigines use 532 nm QS Nd:YAG</td>
</tr>
<tr>
<td>E</td>
<td>Dermal Lesions, for example, Nevus of Ota use 1064 nm QS Nd:YAG</td>
</tr>
<tr>
<td>F</td>
<td>Evaluate test spots after 4–8 weeks</td>
</tr>
<tr>
<td>G</td>
<td>If lesion clears well proceed for rest of area</td>
</tr>
<tr>
<td>H</td>
<td>If marginal improvement with Laser, test the area again at eight weekly intervals and only after significant pigment dilution is produced, proceed for rest of the area.</td>
</tr>
<tr>
<td>I</td>
<td>If any worsening/scarring stop further treatments</td>
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2) Freckles: Since freckles are known to recur after treatment, maintenance treatments may be necessary and adequate sun protection should be emphasized during counseling. They respond very well to QS lasers with most lesions clearing in 1-2 sessions.[1-3]

EVIDENCE: LEVEL B


3) Nevus Spilus: Since nevus spilus has a dual component of pigmentation, the entire lesion may not respond uniformly to the laser treatment. The darker macular lesions (junctional or compound melanocytic nevus component) tend to respond better than the lighter component (CALM) to the laser treatment. Partial or complete clearance has been reported with the use of Q-switched lasers, long-pulsed lasers and IPLs.[1-4]

EVIDENCE: LEVEL C


4) Dermatosis papulosa nigra (DPN) and pigmented seborrheic keratoses: These lesions have significant epidermal proliferation with normal to slightly increased number of melanocytes and increased melanization of keratinocytes. These lesions can be readily treated by non-specific ablation with ultrapulsed carbon dioxide laser, erbium: YAG laser, radio frequency (RF) devices, etc. The QS lasers and long-pulsed lasers that target melanin can also be used to treat these lesions more specifically. Laser spot size should be limited to just below the size of the lesion. The non-specific ablative methods are preferred means of treatment due to the cost-effectiveness and good results obtained with them.[1-3]

EVIDENCE: LEVEL C


Dermal lesions

1) Nevus of Ota: Nevus of Ota is extremely satisfying to treat and it readily responds to QS laser treatment. The longer wavelength 1064 nm QS Nd:YAG laser is the most widely used laser to treat, especially in darker skin types. The longer wavelength along with a large spot size allows deep penetration of photons and is ideally suited to treat this dermal condition. Multiple treatments are necessary (typically 6 – 8 sessions) with an interval of at least two months between treatments. Intervals of even six months between treatments are recommended and lesions continue to clear between sessions. Purpura and pinpoint bleeding may occur.
if very high fluences are used or if smaller spot sizes are employed. Postinflammatory hyper and hypo pigmentation is a common problem in Indian skin and good pre and postoperative care is necessary to minimize side effects. The PIH usually clears within a few weeks, without scarring.[1-16]

EVIDENCE: LEVEL B

4. Kunachak S, Leelaudomlipi P. Q-switched Nd:YAG laser treatment for acquired bilateral nevus of Ota-like macules: acquired bilateral nevus of Ota-like macules or Hori’s macules can mimic nevus of Ota. The differentiating features are late age of onset, lesions are bilateral and symmetrical and absence of mucosal involvement. It is amenable to treatment by longer wavelength QS lasers.[1-4]

EVIDENCE: LEVEL B


3) Blue nevus: The melanocytes in blue nevi are located deep within the dermis and their blue-black color results from the tyndall effect of the over lying tissues. Like the nevus of Ota and Ito, the blue nevi...
respond readily to QS laser treatment. Lesions that extend into the subcutaneous fat are more difficult to treat.[1-2]

EVIDENCE: LEVEL C


Tattoos

Tattoos may be classified as decorative, cosmetic, traumatic, medical and iatrogenic. Decorative tattoos are most commonly encountered and are further subdivided into amateur and professional. Amateur tattoos are made of carbon based ink and tend to be blue-black in color. Professional tattoos are denser, placed deeper in the dermis and can be multi-colored. Professional tattoos generally contain larger quantity of ink and are more variable in their composition. Decorative tattoo pigments contain both inorganic and organic compounds. The common inorganic elements used are iron, titanium, cobalt, cinnabar, cadmium, mercury, copper, chlorine, bromine, aluminum, silica, and magnesium and carbon ink. The organic compounds used in tattoos include both dyes (azo or non-azo dyes), and polycyclic compounds. QS lasers are very effective for dark-blue, black and green tattoos, whereas red and yellow tattoos are more difficult to treat. Pigments which contain iron oxide tend to darken on exposure to laser; hence a test patch is desirable. While amateur tattoos can be removed in fewer sessions, professional tattoos which are intricate and multi-colored may need larger number of sittings. Some professional tattoos may not clear completely, despite repeated treatments, and a ghost image of the design may be left behind.[1-14] Guidelines for lasers for tattoo have been summarized in Table 4.

<table>
<thead>
<tr>
<th>Table 4: Guidelines for use of lasers for treatment of tattoo</th>
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<tbody>
<tr>
<td>A. Avoid a tanned patient</td>
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<tr>
<td>B. Choose appropriate QS laser and do a test area</td>
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<tr>
<td>C. Red Tattoo: use: 532 nm QS Nd:YAG</td>
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<tr>
<td>D. Dark blue and black Tattoo: use 1064 nm QS Nd:YAG</td>
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<tr>
<td>E. Green Tattoo: use 694 nm QS Ruby</td>
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<tr>
<td>F. Evaluate test spots after 4–8 weeks</td>
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<td>G. If lesion clears well proceed for rest of area</td>
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EVIDENCE: LEVEL B


1) Traumatic tattoos: These occur after road traffic accidents where asphalt granules may be deposited in the skin. Usually a small amount pigment as deposited
superficially in the skin and often clears with one or two treatments with Q-switched lasers.[1-2]

EVIDENCE: LEVEL C


2) Cosmetic tattoos: Cosmetic tattoos are usually red, white or flesh colored and is placed to create areolae after breast reconstruction surgery or is in the form of lip liner tattoos. Pigment darkening may occur after laser therapy of these tattoos, hence test patches are recommended. The patients are followed up for 6-8 weeks after a test patch and if no darkening occurs (and the tattoo lightens/fades) then treatment can be undertaken for the rest of the tattoo. It’s best to avoid further treatments if the tattoo darkens.[1,2]

EVIDENCE: LEVEL C


3) Gunpowder and firework tattoos: Care should be taken while treating them, as the implanted material has the potential to ignite, and pox-like scars can develop. A test spot is mandatory in such cases and only after evaluating the patient after 6-8 weeks, further treatments should to be taken up.[1,2]

EVIDENCE: LEVEL C


MIXED EPIDERMAL AND DERMAL PIGMENTATION

1) Melasma: Melasma is best treated medically. Lasers have a limited role in the treatment of melasma. Though successful use of QS lasers, fractional lasers, IPL and combination lasers have all been reported, response to treatment is unpredictable, and pigmentation frequently recurs. Also, postinflammatory pigmentation is common in Indian patients. For these reasons, lasers are not routinely recommended as the treatment of choice for treating melasma in Indian patients. It may be used in selected resistant cases, at the discretion of the treating physician, after proper counseling. A test patch may be performed prior to treating the lesion.[1-5]

EVIDENCE: LEVEL C


2) Becker's nevus: Becker's nevus is a hamartomatous pigmented hairy lesion that occurs in adolescence and young adulthood. The condition is difficult to treat and uniform results are difficult to obtain. These lesions require long-pulsed lasers for the removal of hairs and the use of QS laser treatment for pigment reduction. However, pigment reduction is variable and use of test spots with different pigment specific lasers is recommended to determine the laser (or combination of lasers) best suited to treat an individual lesion. However, it should be emphasized that the outcome of laser treatment in these conditions may be suboptimal and unpredictable. Proper counseling is essential before treatment about the possible suboptimal outcome.[1-4]
EVIDENCE: LEVEL C


3) Nevocellular nevi: Nevocellular nevi may be congenital or acquired.[1-7] Acquired nevi are further subdivided into junctional, compound, and intradermal types. Any of the currently available QS lasers can be used to treat nevi. Frequency-doubled Nd:YAG at 532 nm are considered suitable for superficial junctional nevi; however, longer-pulsed pigment specific lasers, with pulse duration of up to 3 ms, may also be used for the treatment of nevi. Compound and intradermal nevi are best treated by radiofrequency surgery or surgical excision. In Junctional nevi, the response to treatment is variable. These superficial lesions may lighten or clear only partially and lesions may recur. The QS lasers at 532 nm, 755 nm are more effective than the 1064 nm wavelength due to better melanin absorption of these wavelengths, though the latter is safer in darker skin types. On an average, 1–3 sessions are required for clearing. The risk of dyschromia and atrophic scarring is high in darker individuals. Due to these reasons laser treatment should be used with caution and test treatments are recommended.[1-7]

Congenital melanocytic nevi, which are generally very dark and bulky, with a deep dermal component, are difficult to treat and need a combination of different approaches such as excision, grafting, and lasers. Combination of QS and subsequent longer-pulsed lasers have been reported to be effective, but the lesion may clear only partially and the response is unpredictable. Multiple treatments, generally between three and five are usually needed. Patients should be followed-up regularly to check for recurrences, as nonpigmented deep nests of nevus cells may remain.[1-7]

EVIDENCE: LEVEL C


4) Postinflammatory hyperpigmentation (PIH): PIH may have epidermal and dermal components.[6] Although the epidermal component can be targeted with QS lasers and IPL systems, the dermal component is often refractory to treatment and the pigmentation may worsen on treatment. Hence, lasers are of limited value. If the treating physician feels the need to use QS lasers for such lesions, test patches are always recommended when attempting laser therapy. Strict sun protection and topical bleaching agents remains the mainstay of therapy.[6]

EVIDENCE: LEVEL C

1. Taylor CR, Anderson RR. Ineffective treatment...
A summary of the different benign pigmented lesions and tattoos and their treatment with lasers is listed in the Table 5.

**CONCLUSION**

Laser treatment of pigmented lesions and tattoos is a safe and effective procedure. Adequate knowledge of the machine, the parameters to be used and laser-tissue interaction are essential before undertaking laser treatment. Proper patient selection, counseling and choosing the correct wavelength allow safe laser treatment even in darker individuals with excellent outcomes.

**ACKNOWLEDGMENTS**

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CONSENT FORM FOR LASER FOR PIGMENTED LESIONS

Mr./Mrs./Miss ___________________________________________________
Age ___________________________________________________
Address ____________________________________________________
________________________________________________________________ City ________________________
Phone Numbers _______________, _________________, Mobile ________________
Name of procedure and machine used ______________________________
I undersigned Mr/Miss/Ms________________________________________ have been explained regarding above said procedure in
my regional language, I am fully aware of the possible side effects and risks involved in this procedure. I am also aware that this
particular procedure may not always be successful and no guarantee can be made for successful outcome of such procedure.
I have been explained that multiple sessions may be needed for satisfactory results and even after final results, maintenance
treatments may be essential
I also know that this procedure will be performed by _____ . I also give my consent that during this procedure if any complication
arises, I may be given any emergency treatment best suitable to me without asking my prior permission.
I further state that I have carefully read and understood all the information provided in this form and under fully conscious mind I
hereby give my written consent for the said procedure with its risks involved.
Signature of Patient/thumb impression
Signature of Parents/Guardian (For Minors) DATE: ___________________
________________________________________________________________
Name and Relationship if Signed other than Parent DATE: ________________
WITNESS:
NAME __________________________ Signature ________________________
DATE: ________________________
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