

## Shifting Paradigm in Laser Tattoo Removal

Tattooing has been performed since the Neolithic era. It has undergone a sea change from being looked upon as a type of deviant behaviour to a form of expression and art over the centuries. This trend has evolved over time and tattoos have become more complex and intricate. Tattoo artists have been pushing the limits of creativity and design to create fascinating works of art making them unique and special. The classic types of tattoos such as amateur tattoos have paved way to highly complex multi-coloured professional tattoos with the current trend being 3D tattoos, optical illusion tattoos, head mandala tattoos, foot tattoos, miniature portraits, etc. The skin has become a living canvas for the artists to display their skills and creativity! Statistics show that in Australia at least 25% of people below the age of 30 years sport a tattoo. Although the craze for tattooing is on the rise, an equal number of people desire tattoo removal and many a times they are in a hurry to do so for various personal, social or occupational reasons. Dermatologists and laser surgeons have been at the forefront to innovate techniques and methods to effectively treat tattoos in the fastest and yet the safest possible way.

Traditionally Q-switched lasers have been considered the gold standard for laser tattoo removal due to their remarkable ability to selectively target the ink particles in the dermis and macrophages without damaging the surrounding skin.<sup>[1]</sup> Although the safety and efficacy of these devices have never been in doubt, certain limitations exist while aiming to clear tattoos. These include long treatment intervals between sessions, prolonged total duration for complete clearing, ink retention despite multiple sessions, inability to treat certain colours, ghosting and adverse effects in the form of blistering, scarring and dyschromias. Another problem faced with tattoo removal is the phenomenon of tattoo darkening and tattoo resistance.<sup>[2,3]</sup> In the former, cosmetic tattoos made of rust-coloured ferric oxide tend to darken after laser exposure due to its conversion to black-coloured ferrous oxide where as in the latter, tattoos made with titanium dioxide as one of the ingredient may not respond to QS lasers due to reflectance.

The choice of laser for tattoo removal depends on the skin type, level and distribution of pigment, colour of the tattoo ink and type of the tattoo to be treated. The characteristics of the laser such as spot size, pulse width and fluence are the key to successful treatments. Since tattoos can be multi-coloured, one or more wavelengths (WL) may be necessary to treat them.<sup>[1]</sup> The following is a rough guide to the WL of choice to treat different colours:

- 1064 nm QS Nd: YAG-Blue black tattoos
- 532 nm QS Nd: YAG-Red tattoo ink
- 755 nm QS Alexandrite-Purple and teal colours
- 694 nm QS Ruby-Green colour
- 755 nm PS Alexandrite-blue and green colour tattoos

To overcome the shortcomings of traditional QSL protocol, technological advancement in the form of development of picosecond lasers and modification of techniques such as R20 (repeated exposure on same day with an interval of 20 mins between sessions for 3-4 times) and R0 (repeated exposure on same day with no waiting period by applying perfluorodecalin, a perfluorocarbon compound after lasing) have been developed which are showing tremendous promise.<sup>[4,5]</sup> Blue and green pigment in tattoos is now amenable to treatment with the commercially available picosecond alexandrite laser.<sup>[6]</sup> Light scattering properties of skin act as a hindrance to laser beam penetration particularly while using shorter WL. Dermal scatter reduction by the use of optical clearing agents such as glycerol enhances the deeper penetration of laser.<sup>[7]</sup> Another improvisation is the use of combination of lasers such as the addition of fractional lasers to Q switched and picosecond lasers.<sup>[8,9]</sup> This has helped in hastening the pigment clearance and minimised the blistering and dyschromias that have sometimes plagued traditional Q switched lasing. Also, combining lasers have aided in treating tattoo complications such as granulomas.

A major issue until recently with laser tattoo removal was the inability to predict or estimate the number of sessions needed to eliminate tattoos. Patients often wish to obtain a rough estimate as to the number of sessions needed to give a significant clearing of tattoos. This indirectly has an impact on the financial implications so the patients can plan their budget for the laser sessions. To overcome this Kirby *et al.* have proposed the Kirby Desai scale to calculate the approximate number of sessions needed in a given patient.<sup>[10]</sup> This is based on the following six factors:

- Fitzpatrick skin type
- Location
- Colour

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- Amount of ink used
- Scarring and tissue damage
- Ink layering

By allotting a numeric value to each of these and totalling it, a rough estimate can be made as to the number of sessions for a given tattoo. This is a significant step forward as patient counselling becomes easier.

Newer tattoo inks are being developed that are made up of micro-encapsulated polymethylmethacrylate beads e.g. Infitink® (Freedom Ink, USA) which are highly laser responsive so that tattoos created with these inks can be cleared in one or a few sessions compared to conventional inks. This has been elaborated in the symposium by Goh and colleagues in their article titled 'Laser Tattoo Removal - A Review and Update'.<sup>[11]</sup>

Complications of tattooing and laser tattoo removal sometimes occur and one must be adept in dealing with these. Khunger *et al.* in their article on 'Complications of tattoos and tattoo removal: Stop and think before you ink' discuss these in great detail and shed light on their management.<sup>[12]</sup>

A variety of host and laser-dependant factors affect laser tattoo removal and Sardana *et al.* described these in this symposium in their article titled 'Optimizing Laser Tattoo removal: An Update'.<sup>[13]</sup>

Newer trends in laser tattoo removal such as use of imiquimod in combination with lasers, simple practical tips of using diascopy and dermal scatter reduction methods, etc. have been very nicely elucidated by Shah *et al.* in the topic titled 'Newer trends in laser tattoo removal'.<sup>[14]</sup>

These trends will be highlighted in the tattoo symposium in this issue covering the various aspects with evidence base. Though some amount of overlap is inevitable, an attempt has been made to cover the concepts in detail with the authors own experiences added to it.

As tattoo artists are getting smarter to create exquisite works of art, can we the dermatologists be left far behind? Our innovation and improvisation is proving to be a match to counter the tattoo rage. These advances have led to a paradigm shift in laser treatment of tattoos.

**Sanjeev J Aurangabadkar**

Department of Dermatology and Laser Surgery, Skin and Laser Clinic, Hyderabad, Telangana, India

**Address for correspondence:** Dr. Sanjeev J Aurangabadkar, 4-3-323, Bank Street, Koti, Hyderabad - 500 095, India.  
E-mail: Sanjeev.aurangabadkar@gmail.com

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