

Perspective

Evolution and advances of laser hair removal technologies in India

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ABSTRACT

Laser hair removal is the treatment of choice by dermatologists to treat excessive, unwanted hair on body. A dermatologist most often invests it as the first laser in their clinical and esthetic set up. A thorough and updated knowledge of laser hair removal is required to invest in the best machine available and to provide best results to patients. This article will provide knowledge on what is the latest in terms of technological advancement in laser hair removal.

Keywords: Laser hair removal, Types of lasers, Combinations, Advancements. Alexandrite, Diode, ND: YAG, Intense pulse light

MECHANISM OF LASER HAIR REMOVAL AND THE DILEMMA IN CHOOSING THE RIGHT DEVICE

Laser hair removal works on the principle of selective photothermolysis.

All the laser devices developed till day, from ruby lasers to diode lasers work on this principle.

The catch is that though laser effectively damages the follicular bulb, it can damage the epidermis at the same time as the chromophore melanin is abundant not only in the hair shaft and follicle but also on the epidermis, particularly in Indian skin types – Fitzpatrick skin type IV–VI. Hence, the trick in laser hair removal is targeting the hair shaft without damaging the epidermis. This is the reason, there has been search for ideal lasers which can strike an ideal balance between the efficacy and the safety of lasers in dark skin types. On the contrary, laser hair removal in white skins is relatively easy as the epidermal melanin is less and hence less chances of skin burns and complications.

Today, a variety of lasers and intense pulse light (IPL) systems is available for effective long-term long hair reduction. Let us understand these various lasers so that a clinician can choose the right technology that suits their patient profile.

WHICH ARE THE VARIOUS LASERS USED FOR PERMANENT HAIR REMOVAL IN DARKER SKIN TYPES?

The selection of ideal laser for hair removal depends on the wavelength. The ideal wavelength would be a laser between 750 and 950 nm. The alexandrite laser 755 nm where the absorption of

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melanin is highest is the most powerful, but unfortunately, the epidermal melanin has higher chances of damage at that wavelength. Next in line was diode laser 810 nm which is till date the ideal laser for hair removal but the pain as well as the post-laser burns on tanned/dark skin are an issue. Another laser used on Indian skins is the Nd: YAG laser 1064 nm which is high on safety but there the efficacy is compromised. Most recent is diode in the super hair removal (SHR) mode which eliminates both pain and the skin complications. In addition to lasers, intense pulsed light sources are also used for hair removal. However, latest is the combination of alexandrite, diode, and Nd: YAG lasers (triple wavelength) that deliver effective results without compromising the safety.

HERE, WE ARE GOING TO SEE HOW LASER HAIR REMOVAL TECHNIQUES HAVE EVOLVED OVER A PERIOD OF TIME

Electrolysis

This technique aims at destroying the root of hair follicle by chemical or thermal energy. In this, a probe is inserted into each hair follicle and the dead hair is removed with the help of forceps. All the areas of the body can be treated by this technique. It showed great results that time but the technique was found to be very painful even after application of topical local anesthesia. The big advantage of this technique was that it worked for all types of hair.

Intense pulsed dye laser (515–1200 nm)

In this technique, a broad-spectrum light is focused over the area of treatment. There was no specific target for the light. The penetration depth of light was very shallow and the energy is dispersed all over the treatment area so there are more chances of burns and the deeper hair follicles are not affected. Due to these reasons, the patient compliance was very low for IPL laser.

Long-pulsed ruby laser (694 nm)

This laser uses synthetic ruby crystals as a gain medium. It works best for light and fine hair. Due to superficial placement of target chromophore in skin (melanin), this laser technology would cause many side effects on darker skin types and hence is not used anymore for epilation in India.

Long-pulsed alexandrite laser (755 nm)

This laser uses alexandrite crystals as the gain medium for laser. For long, it has been believed that alexandrite laser can mainly be used for skin type 1, 2, and 3. However with the newer lasers with short pulse duration and high peak power, alexandrite laser can be used for effective hair removal in

darker skin types as well as used for vascular and pigmentary indications.

Pulsed diode laser (810 nm)

Diode laser at 810 nm targets specifically the melanin present in the hair follicle, thus destroying the root of the hair. There are many diode technologies which have the cooling tip on the probe which will reduce the chances of skin burns. There can be a mild erythema and perifollicular erythema after treatment which subsides in no time.

Long-pulsed Nd: YAG laser (1064 nm)

Nd stands for neodymium doped; Y stands for yttrium; A for aluminum; and G for garnet laser. It is a very versatile wavelength. The 1064 nm wavelength laser penetrates deep in the dermis. It is therefore capable of reaching the follicular bulge and causing follicular damage without causing epidermal damage in pigmented skin. The long pulse 1064 nm wavelength (Nd: YAG) with contact cooling has been found to be very safe and effective method of laser hair removal in darker skin types.

Combination laser

New combination lasers of wavelength 755 nm, 810 nm, 940 nm, and 1064 nm have been around for a couple of years in India and have proven to be more successful and effective than the single wavelength. It works by targeting the hair at three levels, that is, the bulge, the hair bulb, and hair papilla. This combined effect has shown better results with hair removal as compared to use of single wavelength use. The machines have also been provided with the cooler tip which avoids burns due to heat produced by laser treatment. The main advantage of this laser is that it can be used in all types of skin. These are targeted lasers so there is no chance of damage to the surrounding area. The spot size is larger too which makes it easy to treat large areas in less time. Furthermore, the latest alexandrite and Nd: YAG combined wavelength has made room to explore this technology for wider indications: Laser hair removal, vascular, and pigmented lesions.

THE LATEST ADVANCEMENTS IN LASER HAIR REMOVAL

Advances in laser hair removal have been focused around not only improving the efficacy in terms of results but also faster treatment time, safety of the patients, and making the procedure as painless as possible.

To improve the results, the latest technology has been added to laser hair removal machines:-

Combination of different laser wavelengths

The latest laser hair removal machines provide triple wavelength and even quadruple wavelengths in a single device. Multiple wavelengths help in targeting different thickness of hair with ease. Simultaneous triple wavelengths (755 nm, 810 nm, and 1064 nm) have been found to be safe and effective hair removal modality.^[1] In clinic, experience of triple wavelength has been superior as compared to single wavelength laser, particularly in treating medium to fine hair [Figures 1 and 2].

Unique handpiece tips

The newer triple wavelength lasers also offer an attachable tip – with a curved bend and small spot size of around 6 mm. This enables the physician to treat hard to reach areas such as the glabella, nostrils, and ears. However, caution has to be taken since this detachable probe does not come with an integrated cooling device and external cooling is required [Figure 3].

Vacuum-assisted handpiece

Vacuum stretches the skin and brings the hair follicles closer to the skin. This makes it easier to target the hair follicles even at lower fluence. Drawing the skin toward the headpiece reduces competing chromophores and provides better efficacy in targeting the hair follicles. One of the techniques used by LHR companies to make the treatment pain free is pneumatic skin flattening.^[2] However, in our experience, lack of cooling in this kind of device actually



Figure 1: Before and after results of laser hair removal – triple combination technology – six sessions.



Figure 2: Before and after results of laser hair removal – triple combination technology – three sessions.

increased burns and side effects. This exited the Indian market soon after its entry.

Pain-free lasers

Pain during laser sessions can be a big deterrent for patients planning to choose the procedure. Application of local anesthetic cream was one of the earlier options before advancement of lasers. However, it was not a very practical approach. The patient would have to wait for at least 30 min before the procedure. It is not feasible to apply local anesthetic cream on full body as it can lead to lidocaine toxicity or meth hemoglobinemia. The skin had to be continuously cooled using ice packs or cold air devices. The latest technologies have integrated cooling systems making the treatment extremely comfortable and safe from burns. The temperature of the tip is 4°C before and after the laser is fired and 0°C during the lasing. This is a very practical way of keeping the



Figure 3: Unique tip.



Figure 4: Latest laser hair removal devices.

skin cool before, during, and after the procedure, reducing the need to use additional methods of cooling [Figure 4].

In motion technology (SHR mode)

This method of laser delivery involves using low fluency and high repetition rate without the risk of burns and much less pain for the patient. There is gradual rise of temperature and simultaneously cooling of the epidermis. The in motion technology allows comfort to the patient, as compared to the high cold-high heat-high cold after each shot in the static mode. This technique also ensures lesser skip areas due to its continuous movement on large areas.

Scanner optimized efficacy

Some LHR machines have scanners in which the laser energy is delivered uniformly over the area to be treated.^[3] This improves efficiency of laser treatment, especially in large areas.

Maximum peak power

One of the most important factors that determine the efficacy of any laser device is the maximum peak power. A physician must consider this before finalizing a laser technology. Anything above 4000 W is a good work horse for continuous hours of use of a laser technology.

KEY TO GET OPTIMAL RESULTS FROM ANY LHR TECHNOLOGY

The results of laser hair removal are hugely dependent on the technician performing the laser hair removal. The best technology should be in the best hands too to achieve the desired outcome. It is, therefore, important to have adequate and repeated training at regular intervals for the technician who would be performing the treatment.

Laser hair removal should be performed in the presence of a physician and the parameters should be set by the treating physician.

1. In stacking mode – there should be 10% overlap in each shot given with the laser
2. In dynamic or in motion mode, adequate energy has to be given in each area otherwise there would be suboptimal results – it can lead to thinning of hair which will be very difficult to treat in later sessions.
3. The hair should be marked and shaved properly before the session.
4. Avoid doing laser if the patient is recently tanned or has bleached the hair

5. Cooling of skin before and after treatment will be beneficial in making the treatment comfortable and avoid any chances of burns
6. Laser hair removal should be avoided if the patient has recently waxed the area
7. It is mandatory to take pictures before and after the procedure and take signed consent before each treatment.

CONCLUSION

Laser hair removal is still the bread and butter for most of dermatologists. With the large array of machines available, it can be baffling for a physician to choose. However, the right wavelengths, the high peak power, the ability to choose pulse duration independent of fluence, bigger spot size, and option of static and dynamic mode should be some of the criteria of selection of the right LHR device for your practice.

Note: The author has a 20 years' experience on many laser hair removal devices. Hence, in case, a clarification is needed, she can be contacted in person. In this article, her personal experiences have been shared.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

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