

## Diode laser in hair removal: A Case Report

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### Abstract

Laser hair removal has grown to be one of the popular aesthetic treatments as it is considered safe and more efficient in hair reduction compared to other methods such as plucking, shaving and waxing which are required to be done on a regular basis. Besides that, these procedures may cause unwanted effects such as post-inflammatory hyperpigmentation. Nonetheless, patients with Fitzpatrick scale V and VI have a higher risk of hypopigmentation, hyperpigmentation, scarring and keloid formation following hair removal treatment which required further adjusting of parameters.

**Keywords:** diode laser, hair removal

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When it comes to removing unwanted hair, there are options ranging from temporary methods such as plucking/epilation, waxing, depilation, shaving, bleaching, pharmacologic options to laser, intense pulse light, home-use laser/light-based devices and electrolysis [1]. This paper will discuss three common modalities for hair reduction using photoepilation therapies which utilize selective photothermolysis i.e. Neodymium-doped yttrium aluminum garnet (Nd:YAG), Diode and Intense pulsed light (IPL).

Long-pulsed Nd-YAG lasers operate in the infrared region of the spectrum with a wavelength of 1064 nm thus the side effects are related to heat. Usually, a pretreatment topical anesthetic cream and post treatment cooling cream will be provided to minimize discomfort in the patients. This treatment works well for all skin types (I to VI) especially in those with darkly pigmented skin. Other than that, it can be used in patients with pseudofolliculitis barbae in particular. The possible side effects include pain and folliculitis [2,3].

Diode lasers use a specific wavelength of light which is 810 nm and at the same time cool down the skin to protect its surface. The hair is destroyed and completely removed when the melanin within the hair bulb in the targeted tissue selectively absorbs the wavelength of laser light, causing the hair follicles to gradually shrink. It is used for those with Fitzpatrick skin types I to V and particularly good options for darker skin types. The possible side effects with diode laser treatment include pain and folliculitis [2,3,4].

IPL is less expensive and uses a broad spectrum of light with many wavelengths in the range of 500 to 1200 nm. It may not be as effective as the laser system as there is less selective absorption from the unfocused energy in the follicle hence require more regular and long-term treatments. It can be applied for individuals with Fitzpatrick skin types I to IV [2,3].

Laser or IPL therapy is the most suitable choice for those who wish to remove hair in a wide area with dense hair growth. However, total removal of hair with a single laser hair-removal system therapy is uncommon. Furthermore, successful hair removal therapy with laser is likely to be affected by the combination of skin type, anatomic location, hair color, hormonal factors, stage of follicle growth cycle, and the diameter of the hair shaft [2,5]. According to Fitzpatrick skin types, there are 7 types of skin which are type I - always burns, never tans; type II - always burns, sometimes tans; type III - sometimes burns, always tans; type IV - rarely burns, always tans; type V - moderately pigmented; type VI - darkly pigmented [2]. Side effects due to laser hair removal such as transient erythema, perifollicular edema, pain, folliculitis, hyper-pigmentation, hypopigmentation, crusting, purpura, erosions and scarring are possible [6].

### Case Presentation

A 35 years old Chinese lady with no known medical illness, came into the clinic on 20<sup>th</sup> March 2022 requesting for a hair removal procedure over the leg. Upon further inquiry, the patient has been shaving regularly for the past 20 years since teenage years. On examination, it was noted that she has hyperpigmented skin over the anterior part of both legs. Diode laser therapy over the course of 3 to 4 sessions was suggested for her. Before each session, she was advised to shave the targeted area 24 to 48 hours before treatment and avoid using any cream or lotion and sun exposure. At the end of each session, she was advised to avoid sun exposure and use sunscreen, exfoliate the treated area to avoid ingrown hair and to use gel, ice pack or aloe vera in case of discomfort caused by the heat during treatment session. Table 1 shows the laser parameter used during each session of the

Table 1 Diode laser parameter used on the patient.

Treatment sessions	Area selected	Fitzpatrick scale	Color of hair	Density of hair	Energy Density (J/cm <sup>2</sup> )	Frequency (Hz)	Pulse width (ms)
Day 0	Leg	III	Black	Medium	45	5	26
Day 30	Leg	III	Black	Medium	45	4	32
Day 60	Leg	III	Black	Medium	45	4	32
Day 90	Leg	III	Black	Medium	45	3	42

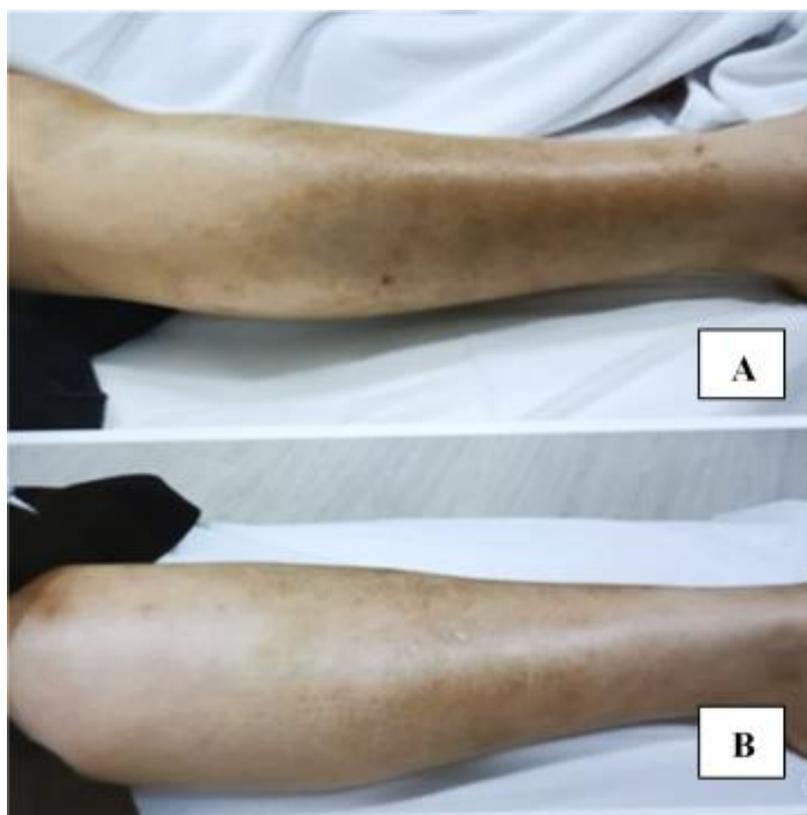


Figure 1 A: Before diode laser treatment, B: After 4 session of diode laser treatment

treatment. After all the sessions were completed (3 months), upon examination a noticeable hair reduction was found followed by depigmentation over the shin area (Figure 1).

## Discussion

Diode laser is operated based on the principle of selective photothermolysis [7]. It emits light beams with a certain wavelength which then subjects the chromophore (targets), specifically melanin that is located in the shaft of our hair follicle and hair bulb to destruction. Through this technology, diode lasers of longer wavelength (800-810nm) are absorbed by the chromophore, subsequently causing thermally mediated injury and destruction of the hair follicle and hair bulb. Permanent hair removal and prevention of future hair regrowth can be achieved with repeat sessions using diode laser [8, 9].

Based on available literature, diode laser has been the gold standard of laser hair removal in recent years due to its suitability and safety for all skin types according to Fitzpatrick skin scale [8, 10]. It is also a preferred method for hair removal due to less immediate pain compared to other lasers such as Nd:YAG [3]. Diode lasers with a wavelength of 810 have been proven to be safe and produce less side effects, hence better tolerated by darker skin types. Maximal efficacy and safety of diode laser can be achieved by maintaining low fluence and high repetition rate [8, 11]. Apart from that, diode laser is also effective in removing thick coarse hair, which is why it is a popular option among men for removing chest hair and back hair [7]. Different studies have shown that diode laser is able to provide long term hair reduction with just 3 to 4 sessions and up to 84-85% hair reduction after 12 months post-procedure [3].

Other traditional hair removal often results in pain and side effects especially to darker and tanned skin types. This is especially true for lasers involving high energy, which is often

painful and causes hypopigmentation with post-inflammatory hyperpigmentation. However, with the latest diode laser technology involving low level fluence, high repetition rate and using technique of multiple passes in constant motion, better outcome and high efficacy has been proven amongst Fitzpatrick type I-V patients with significant reduction in hair count after multiple treatment [1]. Below is the list of important things to consider before diode laser treatment [10].

- Stop plucking and waxing - Laser hair removal works by targeting the roots of the hair, so it's essential that patients don't pluck or wax the treated area at least four to six weeks prior to your first appointment.
- Shave the area - Shaving it 24 to 48 hours prior to appointment is essential. Even though hair is invisible to the naked eye, the laser is still able to target the pigment located in the hair's root as it decreases the chance of burns with the hair being below the skin's surface.
- Avoid sun exposure - For two weeks prior to laser hair removal, it's important that the skin being treated is kept out of the sun. This includes both tanning beds and self-tanners. As it may lead to skin discoloration after your laser treatment and also pain and blistering. Be sure to use sunscreen daily if the treated area can't be covered while outside.
- Put down the bleach - Bleaching should be stopped six weeks prior to laser hair removal treatment, which is enough time for the hair roots to grow back in their natural color.
- Check patient medications - Some medications can intervene with laser treatments, making them less effective while some can make the skin sensitive and more likely to burn or blister.
- Remove makeup or creams

The possible side effects of diode laser are redness, skin irritation, erythema, postoperative

hypersensitivity and possible burns and hyperpigmentation [12].

### Conclusion

Total removal of hair with a single laser hair-removal system is uncommon. Successful laser hair removal is affected by several factors such as the combination of skin type, anatomic location, hair color, hormonal factors, stage of follicle growth cycle, and the diameter of the hair shaft.

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