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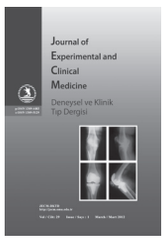

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Unusual complication caused by laser hair removal: skin burns

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ABSTRACT

The complications of laser hair removal system are uncommon. We will present a case of burn on upper extremity caused by Alexandrite laser (AL). This report indicates that it is essential for the laser operator to be well educated upon the potential risks of photoepilation. The circumstances of this injury and preventive measures are discussed in this case report.
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1. Introduction

The development of various laser systems with many ranges of wavelengths have made effective hair removal possible. Different types of laser are available for different skin types. The Alexandrite laser (AL) is one of the most widely used laser hair removal system being used currently, with a shorter wavelength with a specific energy of 755 nm light (Nanni and Alster, 1999). The mechanism of hair removal is to damage the stem cells in the bulge of the hair follicle. AL provide a significant opportunity for epidermal and dermal injury during the epilation process (Nanni and Alster, 1999). AL hair removal systems are traditionally highly effective for white-skinned, dark-haired patients.

AL may produce adverse effects such as pigmentary changes (lightening or darkening of the skin), pain, perifollicular edema, purpura, blistering, crusting and scarring. Complication rates also vary according to the anatomic location treated (Raulin et al., 2000; Topping et al., 2001). Despite widespread use of AL epilation, only a few burn case have been reported in the literature (Bouzari et al., 2004; Goldberg, 2007).

2. Case

We would like to report a case of 18 year old girl with darker skin who suffered second and third degree burn areas on her right forearm in a new aesthetic centre. Due to application of AL hair removal (18 mm spot shot, 755 nm wave length, 30 j/cm^2 fluence), the patient had sustained full thickness burn area with circle shape on the dorsal side of her forearm (Fig. 1).

We investigated the etiological factors, symptoms, signs and medical history of the patient. She was using tetracycline for acne treatment which sensitizes skin to the damaging effects of photoepilation. Burn areas were dressed every day and antibiotic therapy was begun. The burn area was treated consevatively within four weeks.

Fig. 1. Circle shape burns on the dorsal side of forearm due to hair removal treatment with Alexandrite laser

Textural skin pigmentation and slight scarring of the burn areas had not completely resolved at 4 months follow-up.

3. Discussion

Laser assisted hair removal has recently become popular because of its speed and efficacy. However, the ideal laser hair removal system including the appropriate approaches for different skin types and body areas have not yet been optimized.

Different types of laser are available for hair removal and their various treatment protocols have created much confusion. The fact is that all laser hair removal systems target follicular melanin pigment. When an appropriate energy source is directed at the skin, laser light is primarily absorbed in the hair shaft melanin. Heat is generated and diffuses to the surrounding follicular epithelium. Therefore, all hair removal devices provide a significant opportunity for epidermal and dermal injury during the epilation process (Nanni and Alster, 1999).

Laser hair removal is based on the principles of selective photothermolysis: a combination of the appropriate laser wavelength, pulse duration, and fluence. Wavelengths between approximately 700 and 1000 nanometers (nm) are selectively absorbed by melanin. Therefore, any light source that operates between 700 and 1000 nm is appropriate for targeting melanin in the hair shaft. In addition, pulse duration have to be equal to or shorter than the thermal relaxation time of the target to confine thermal damage (Eremia et al., 2001).

By studying hair color and skin type it is easy to determine which patients will have the best results with laser hair removal. Patients with red, gray, or blond hair may be advised that they should not expect permanent hair reduction. In addition, it is important to shave hairs before beginning the treatment. If the external hair shaft is present the laser will burn skin (Christine and Dierickx, 2011). Hair color and skin color determine the best fluence to remove hair. Darker skin types IV to VI may be treated between 10 and 20 J/cm. Fair skin types I to III may take the highest fluences, from 25 to 40 J/cm^2 (Table 1). Each skin type has its own threshold fluence. For this reason, multiple pulsing are not recommended. If hypo or hyperpigmentation occurs, it is transient. The duration of these pigment changes, however, depends on the anatomic area. If epidermal damage is present, the fluence has to be lowered by 5 to 10 J/cm^2 (Christine and Dierickx, 2011).

Table 1. Fitzpatrick classification of skin types.

Skin type	Typical features	Tanning ability
I	Pale white skin, blue/hazel eyes, blond/red hair	Always burns, does not tan
II	Fair skin, blue eyes	Burns easily, tans poorly
III	Darker white skin	Tans after initial burn
IV	Light brown skin	Burns minimally, tans easily
V	Brown skin	Rarely burns, tans darkly easily
VI	Dark brown or black skin	Never burns, always tans darkly

Despite all efforts to protect the epidermis from damage, photoepilation may result in clinically significant adverse reactions such as hyperpigmentation, hypopigmentation, perifollicular edema, purpura, blistering, crusting, burn and scarring although laser technology today offer the potential for fast, safe, and effective treatment of unwanted hair. Complication rates also vary according to the anatomic location treated. The most important factors affecting adverse reactions from laser assisted hair removal relate to melanocyte activation (dark skin type, tanned skin, chronically sun-exposed body areas) (Chernoff, 1997; Nanni and Alster, 1999). In addition, photosensitive medication such as tetracycline increases the effect of laser hair removal system. Factors affecting the severity of phototoxic reactions are as follows: the nature and concentration of the photosensitive drug and agents, the duration of exposure to AL, the intensity of AL, and light absorption in the skin. These drugs allow the deeply penetrating laser light to skin. More absorption will occur in darker skin types and tanned skin. In addition, laser wavelength is another key factor influencing treatment efficacy and complication rates because different lasers produce unique adverse reactions based on specific absorption properties (Anderson and Parrish, 1983).

Treatment discomfort, postoperative erythema, and perifollicular edema are considered as side effects of laser surgery. These signs are clinical end points that guide the laser operator. Hyperpigmentation is usually reversible and results from a stimulation of melanin production from epidermal melanocytes (Nanni and Alster, 1999; Raulin et al., 2000). Hypopigmentation may be permanent and results from thermally induced destruction of melanocytes. The incidence of burn after laser hair removal appears to be low and transient; this side effect may be more common when laser hair removal is carried out by untrained people. Eremia et al (2001) reported postinflammatory hyperpigmentation in 10%, burn with blister in 1%, and postinflammatory hypopigmentation in 2%. The incidence of these complications would be expected to be minimized by using lower energy densities and by avoiding treatment of tanned skin.
This case report is to summarize the potential adverse effects of laser hair removal systems. These adverse reactions are preventable and therefore, some basic measures may reduce the incidence of these reactions such as burn due to laser epilation.

1. The laser hair removal system manufacturers have to post warnings in their owner's manuals of the danger of potential phototoxic reactions. Various laser manufacturers have used different approaches to reduce complications. These include variations in wavelength, spot size, pulse width, and adjunct skin cooling system. The patients with darker skin types should be treated cautiously to minimize adverse reactions. Alexandrite laser (755 nm), capable of delivering relatively high fluences at a 12 - 15 mm spot size, is a safe and highly effective for hair removal in skin type I - IV patients. To limit epidermal damage in dark skin types, the treatment fluence below 40 J/cm^2 was often necessary, which also reduces efficacy and requires a higher number of treatments.

2. The laser hair removal system devices have to be tested at regular intervals to increase their safety by manufacturer and laser operators.

3. Medical history and skin assessment for first laser appointment have to evaluate by solarium operator. The laser program has to be created according skin colour.

4. Patients who receive photosensitive drug and agents have to take care to avoid exposure to laser light.

We hope that this letter will succeed raising awareness of the dangers of laser hair removal.

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