Case Report

Treatment of a Pigmented Hypertrophic Scar by Low-Level Laser Therapy (LLLT): a Case Report

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A hypertrophic scar is defined as an excess healing response that is a dilemma for physicians. Several therapies are available: intralesional corticosteroids, topical treatments, cryotherapy, surgery, radiation, silicone gel dressing and laser therapy. Pulsed-dye, Nd-Yag and CO_2 lasers have been used for treatment of keloids and hypertrophic scars but recurrence is common. Recently Low-Level Laser Therapy (aluminum-gallium-arsenide (AlGaAs) Diode 980nm, red light (Mustung, KLO4, Helium Neon 630 nm) and blue light LED lasers have been used for closure of wounds. The aim of this report is to show the effectiveness of these lasers for the treatment of a hypertrophic scar on the forearm of a 40 year-old woman due to burning by gas explosion.

Keywords: Pigmented, hypertrophic scar, Diode 980nm laser, Low-Level Laser Therapy

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INTRODUCTION

Keloid and hypertrophic scars are healthcare problems that occur only in human. They occur more commonly in teenagers or younger adults. Characteristics of hypertrophic burn scar are as follows: surface erythema; elevation from wound surface; lack of elasticity; increased collagen; pain and itching.

Hypertrophic scar and keloid may follow local skin trauma or inflammatory skin diseases, burns or surgical procedures.

Conditions that increase the risk of hypertrophic scar are tension on the wound, excess inflammation in wound bed, inflammatory stimulus, infection, opening of wound for more than 3 weeks, lack of dermal elements and genetic predisposition.(1)

Hypertrophic scars are treated to improve pruritus, pain, movement restriction and cosmetic disfigurement. Treatment modalities for keloid and hypertrophic scars include compression, radiation, excision, intralesional injections (corticosteroids, Bleomycin, Interferon α-2b or 5-Fluorouracil), cryotherapy, silicon gel dressings and laser surgery.

There are many reports indicating that laser therapy induces thermal effect in the skin and causes improvement in the process of wound healing and it is a hopeful way to a scarless healing. CO2, Erbium YAG, PDL or Q-switched Nd:YAG laser with low fluence have been used for the treatment of keloid and hypertrophic scar with various therapeutic outcomes.

Recently, the use of far-red to near-infrared (NIR) light treatment showed that low-level laser therapy (LLLT) may be useful in wound healing. In Low-intensity light therapy, far-red to near-infrared region of the spectrum (630-1000 nm) of light modulates numerous cellular functions and this is referred to as photobiomodulation.

The aim of this report is to introduce a case of hypertrophic scar that dramatically improved after using non-ablative semiconductor aluminum-

gallium-arsenide (AlGaAs) diode 980nm, Helium Neon (630 nm) and blue light LED lasers.

CASE REPORT

A forty –year-old woman with skin type IV presented with a large hypertrophic scar extending from proximal interdigital phalanges (PIP) to the elbow with marked hyperpigmentation, pain, edema and contracture over the scared area around her finger joints. She had a history of burn injury in her right hand and forearm caused by gas explosion 8 months earlier.

MATERIAL AND METHOD

The treatment was carried out in each session by means of laser rays from an semiconductor aluminum-gallium-arsenide (AlGaAs) diode laser 980nm (LASER MED) with 6 W peak power applied on the hypertrophic scar specially on the painful area by gentle contact method(3 J/cm^2) in the first pass then by scanner device of laser apparatus with vessel program (6-10 J/cm^2)in the second pass ; for hyperpigmentation we used scanner device with pigment program (3J/cm^2) with scanning method. we used 3 passess on the whole. Then we applied red light laser (Mustang, KLO4, Helium Neon 630 nm with 25 mw power 1 J/cm^2) in the fourth pass and we applied blue light LED in bio stimulation dose (0/01 J/cm^2) with scanning method as the fifth pass. The sessions were performed every other day, each lasting 30 minutes. The treatments were done in 22 sessions, 15 sessions in 3 weeks every other day stopped for 3 weeks due to a severe pain on the wrist area and then was resumed after disappearance of the pain with the same program every day for one week as the second part of treatment.

RESULT

Using Vancouver Scar Scale (VSC) the patient responded significantly to the treatment after 4 weeks; pliability increased up to 50%, hyperpigmention decreased by 100%; the subjective sensations including pain and itching were limited significantly to the wrist area, and the height of the keloid and hypertrophic scar diminished up to 90% in marginal area and up to 50 % in central zone (fig.1-2).

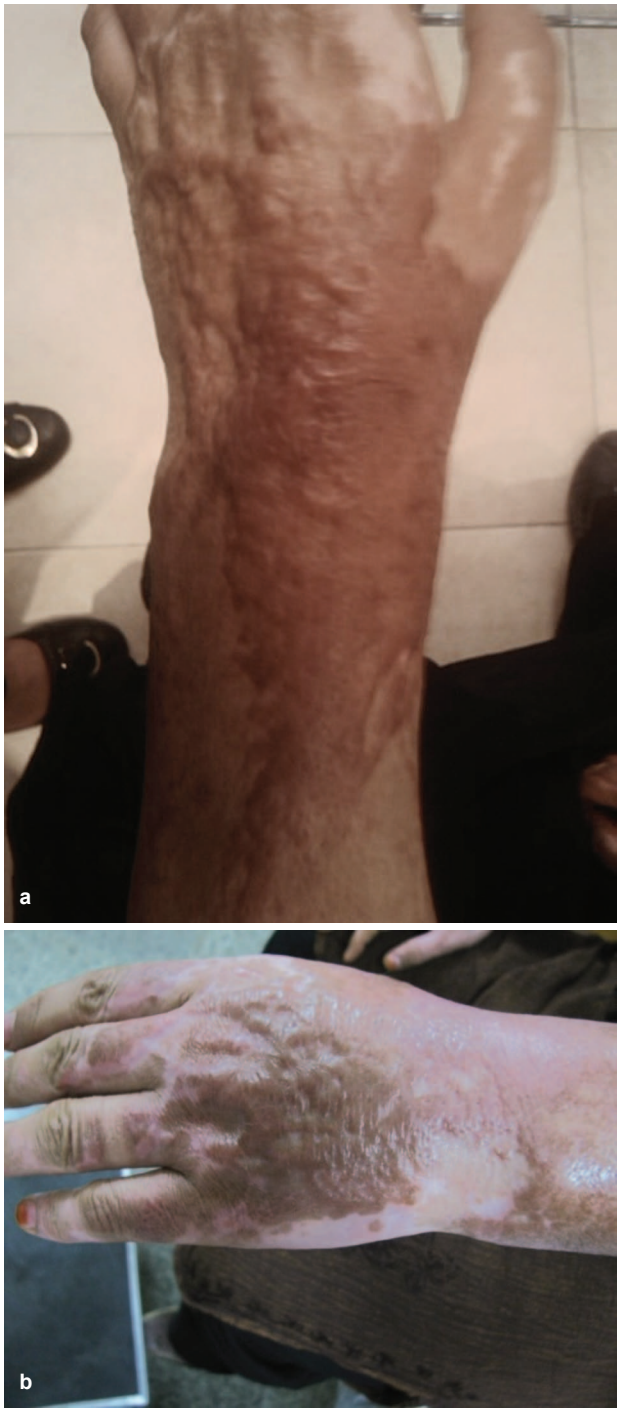

Figure 1. (a, b) First day

DISCUSSION

Laser technology has evolved over the past few decades and become the treatment of choice for many types of scars. Various types of lasers have been used for treatment of hypertrophic scars and keloids. Different monochromatic coherent sources

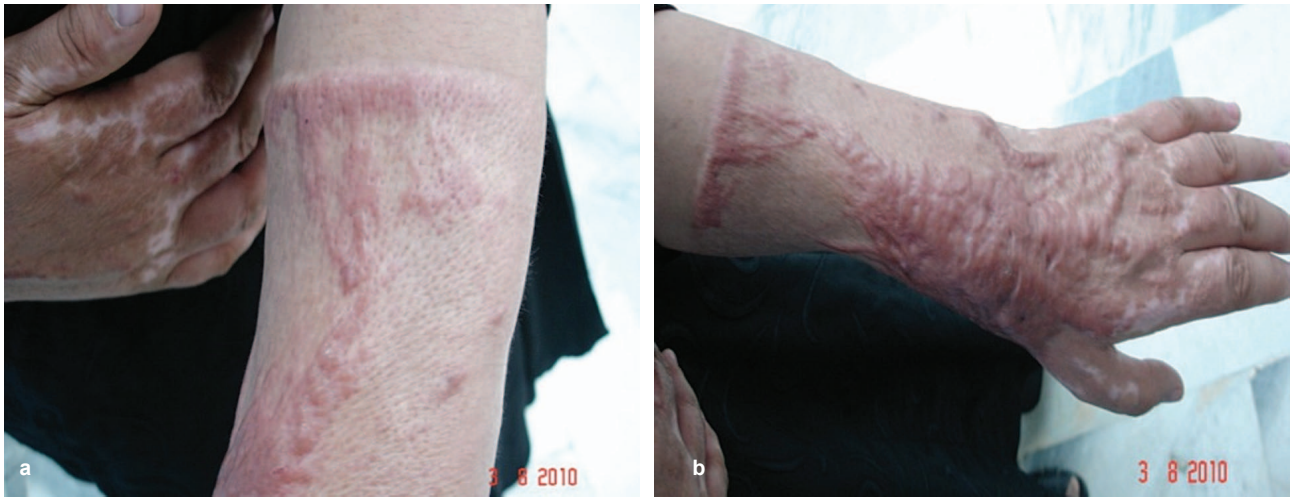

Figure 2. (a, b) Four weeks after treatment

may be used in the visible and invisible region; among them pulsed dye lasers (PDL) are currently considered the laser of choice in these settings.[2] PDL has been tried successfully for softening the lesions.[3] As the target chromophore for PDL is hemoglobin, PDL also helps to destroy the blood vessels supplying the keloid, thereby reducing its size. It has been hypothesized that PDL therapy induced tissue hypoxia leads to decreased cellular function; laser induced heating leads to disulfide bond disruption with subsequent re-modeling of collagen fibers, collagenolysis occurs following cytokine stimulation.[4] Multiple studies have shown its ability to reduce scar erythema and thickness while significantly decrease pruritus and improve the cosmetic appearance of the scar.[5]

CO2 or Erbium YAG laser have been used for ablating keloid lesions, but similar to the excision modality, the failure rate is 100%, as the laser ablation actually burns the lesion.[3]

Q-Switch Nd: YAG laser with low fluence is the other modality that has been tried in several studies. In one study that investigated the efficacy and safety of 1064-nm Q-switched (QS) Nd: YAG laser with low fluence on keloid and hypertrophic scars, pliability, vascularity, decrease in pigmentation and height was shown after the final treatment. In that study, observers concluded that QS Nd:YAG laser with low fluence may be used for the treatment of keloid and hypertrophic scars.[7] In another study the efficacy of the 532 nm frequency-doubled Nd:YAG laser was compared to the 585 nm FLPDL for treatment of pigmented hypertrophic scars and was concluded that the 532 nm Q-switched Nd:YAG laser and the 585 nm FLPDL are comparable in the treatment of pigmented hypertrophic scars, but the 532 nm Q-switched Nd:YAG laser may be preferable in dark colored scar.

There are some researches about utility of Low-level laser therapy (LLLT) in improving wound healing with positive effect of near-infra-red light emitting diode (LED) treatment with a variety of wavelengths of NIR-LED light (630-1000nm). These in vivo and in vitro studies showed that NIR-LED light treatment stimulates the photoacceptor cytochrome oxidase, resulting in increased energy metabolism and production and also stimulates mitochondrial oxidative metabolism, hence accelerating cell and tissue repair.[10] NIR-LED light which represents a novel, non-invasive therapy has been used for a wide variety of conditions, but is used most frequently for wound healing and pain control and reduction of edema directly by enhancing blood circulation to remove liquids (lymph fluid) and proteins by lymphatic draining. It also stimulates macrophages and lymphocytes to induce neo-collagensis. The analgesic effect of LLLT is another motivating factor for its application after burn induced damage on skin. Ga-As laser, one form of LLLT, reduces histological abnormalities, collagen concentration, and oxidative stress in damaged tissues. Reduction of fibrosis could be mediated by its beneficial effects on the oxidant/antioxidant.[11, 12, 13, and 14]

Due to its anti-inflammatory and analgesic effect,

reduction of edema and collagen concentration LLLT was used for the treatment of a pigmented hypertrophic scar. Laser irradiation was carried out with a gallium-aluminum-arsenate (Ga-Al-As) diode laser (980 nm, 6W energy density of 6-10J/cm ^{2}, HeNe 630nm 1 J /cm^2 and blue LED 450 nm) with satisfactory results particularly on reducing pain,edema and and hyperpigmentation It is concluded that low level laser therapy can be used for the treatment of keloids and hypertrophic scars with remarkable improvement for the abovementioned complaints.

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