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RESEARCH ARTICLE

Laser treatment for post chickenpox scars in Fitzpatrick skin type IV and V.

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Abstract

Post chickenpox scars are usually more common in adults and its treatment represents a major challenge for cosmetic dermatologists. This study evaluates the efficiency of a nonablative, submillisecond, 1064-nm Nd:YAG laser used in combination with microdermabrasion (MDA) therapy over 6 months to treat post chickenpox facial scars in 12 males and 7 females with Fitzpatrick skin type IV and V. all patients are treated at a fluence of 14-16J/cm^2 and a pulse duration of 0.4 milliseconds with a repetition rate of 5hz. Each patient was treated with 5-6 laser treatments for 3-4 weeks. MDA treatments were carried simultaneously with allowable intervals of time. The Mean follow-up time after the final laser session was 8.94 months. Results of the participant assessment revealed mean scores in scarring, skin texture, and Post inflammatory hyperpigmentation (PIH) of 4.5, 4.5, and 4.6 respectively. Physician evaluation of improvement revealed mean scores of 4.5, 4.5 and 4.6 respectively (5=marked improvement; 3=mild improvement). Participants and physician evaluation did not reveal scores of no change or worsening for the 3 parameters. Clinically significant improvements in scarring, skin texture, and PIH were evaluated. Results of the present study suggests that a nonablative, sub millisecond, 1064-nm Nd:YAG laser used in combination with MDA treatment is an effective treatment method for atrophic chickenpox scarring in patients with Fitzpatrick skin type IV and V.

INTRODUCTION

Chickenpox is an airborne disease, also known as varicella, is often a contagious disease caused by the initial infection with varicella zoster virus(VZV).[1] The disease results in a characteristic skin rash that forms small, itchy blisters, which eventually scab over.[2] It usually starts on the face, chest, and back and then spreads to the rest of the body, which spreads easily through the coughs and sneezes of an infected person.

The use of lasers to treat atrophic scarring conditions in darker skin types presents a significant challenge to laser practitioners. Treatment options are limited due to increased risks of pigmentary complications including hypo- and hyper-pigmentation. This is especially true when attempting to treat large areas with atrophic scarring. Post chickenpox scars are usually more common in adults and its treatment represents a major challenge for cosmetic dermatologists.

People with skin type IV have dark hair and light Mediterranean, olive looking skin beige with light brown tint. It can be prone to an over production of melanin following to sun exposure which result in uneven pigmentation of melisma. Skin type IV can be prone to an over production of melanin following certain light and laser skin rejuvenation treatments or laser hair removal and thus proper preparation of the skin and sun avoidance is recommended prior to aesthetic treatments such as laser/ light and peels. It can help in prevent permanent discoloration or scarring of skin.

People with skin type V has an olive or dark skin tone and includes light skinned African Americans, Indians and those of Middle Eastern decent. They tan easily and rarely burn. Skin type V reacts more severely to common conditions such as acne, eczema, dermatitis, psoriasis and seborrheic dermatitis (dandruff) which can lead

to potential problem with pigmentation as the formation of melanin. Thus the skin is more reactive to an insult leads to dark marks called post inflammatory hyperpigmentation PIH.

The CO2 laser is the workhorse of cosmetic dermatology and the platform technology to which all optical therapies should be compared. CO2 laser skin resurfacing remains very valuable, can remove bulk amounts of tissue in a bloodless fashion, and correct contour irregularities/facets at the periphery of lesions. CO2 lasers emit light at 10,600 nm that is preferentially absorbed by water (its principal chromophore) leading to superficial ablation of tissue by vaporization, provided pulse energy is adequate to heat water past its phase transition at 100°C. Although the majority of the energy is absorbed by the first 20 to 30 μm of the skin, the zone of thermal damage can be as much as 1 mm deep, depending upon the pulse duration of the laser.

When the 1064 nm neodymium-doped yttrium aluminum garnet (Nd:YAG) laser with the option of sub-millisecond pulse width is used with 300-500 micro second pulse durations, a 5 mm spot size and repetition rates of 5-10 Hz, it offers the ability to focus heat in the papillary and upper reticular dermis. The sub-millisecond 1064 nm Nd: YAG laser has been proven to stimulate new collagen synthesis [3]. It is therefore feasible that deliberate sub-millisecond 1064 nm Nd: YAG laser treatments could result in substantial reduction in scarring by stimulating collagen formation resulting in smoothing of the skin. [4-9]

As the post chickenpox scars are representing a clinical and therapeutic challenge especially in dark skin so we also wanted to evaluate the safety and efficacy of using Microdermabrasion (MDA) and the sub-millisecond 1064 nm Nd: YAG laser in facial chickenpox scarring cases in adult men and women with Fitzpatrick skin type IV and V.

MATERIALS AND METHODS

This study was conducted at Department of Dermatology, MNR medical college& hospital, Sangareddy, on 12 male and 7 female patients aged 29 to 45 years with Fitzpatrick skin type IV and V, presented with a history of chickenpox infection 2.5 – 4.5 months earlier which left numerous scars over the face and forehead. Patients reported after getting fever got leisions over the skin, followed by formation of scab over the skin lesions which started to fall off within 9-11 days of the onset of their appearance which resulted in scars. Gentian violet lotion or topical antibiotic ointment was applied topically over the skin lesions and antibiotic was administered orally for 1 week. No other intervention had been administered before the patients presented to us. Exclusion criteria included any prior trial for treatment of the scars, any concomitant systemic disease, and any active skin infection. No prophylactic therapy was used before or after treatment and Treatments were performed without topical anesthesia.

The treatment was started with MDA utilizing aluminum oxide crystals, followed by the session with the sub-millisecond 1064-nm Nd: YAG laser. The MDA sessions were repeated every 7 days for 8 sessions and the laser session was repeated every 3-4 weeks for 5-6 sessions. A minimum of 3 days was allowed between MDA and laser treatments. Treatment was performed without topical anesthesia and no prophylactic therapy was administered before or after treatment to control post inflammatory hyperpigmentation (PIH) resulting from laser treatments. Treatment was performed over 6 months.

The following parameters used during laser treatments: 5-mm spot size, 14 J/cm2, and 0.4- millisecond pulse width with a repetition rate of 5 Hz. The face was divided into squares of 5 x 5 cm and laser pulses were delivered with a continuous motion. The hand piece was moved to the adjacent treatment area when erythema developed. Erythema was seen after an average of 500 pulses per treatment square. The laser treatment was conducted with no pre or post cooling of the skin while defocusing the hand piece 1 to 2 cm above the skin using multiple passes of the treatment area.

The patients were followed up for a period ranging between 3 and 12 months after the last laser session. There was no downtime or any incidence of adverse effects such as pigmentary changes or scab formation after the procedure. The post treatment erythema persisted for 20 to 30 minutes immediately after each laser session and completely faded away afterwards. The patients were asked to utilize sun block with at least SPF 30 in between the sessions.

A questionnaire was administered to all participants 4 weeks after the last laser session regarding changes in scarring and skin texture as well as PIH. These 3 parameters were graded on a 4-point scale (2=marked improvement; 1=mild improvement; 0=no change; - 1=worsening). The same questionnaire also was administered to the treating physicians to grade changes observed in each participant.

Photographs were taken before treatment and 3 months (or more) after the last laser session. Blinded assessments were performed by different physicians using before and after photographs No statistical analysis was performed.

RESULTS

All 19 participants were included in the analysis. The mean length of follow-up after the final laser session was 8.94 months. Results demonstrated marked improvement in scarring, skin texture, and PIH as observed by participant and physician. Results of the participant assessment revealed mean scores in scarring, skin texture, and PIH of 4.5, 4.5 and 4.6 respectively. Patients and Physician evaluation of improvement revealed mean scores of 4.5, 4.5 and 4.6 respectively (5=marked improvement; 3=mild improvement). Participant and physician evaluation did not reveal scores of no change or worsening for the 3 parameters.

Transient mild edema and erythema were observed in all participants and resolved within a maximum of 2 hours after treatment. No transient or permanent complications such as blistering, crusting, purpura, scarring, or transient or permanent hyperpigmentation or hypopigmentation were noted at 2 or 4 weeks. None of the participants reported any adverse effects during or after the treatment sessions through the end of the follow-up period.

Fig: 1. before treatment

Figure: 2. after treatment

Table: 1. showing the details of the participants and sessions in the treatment.

S.NO	Age	Skin Type	No of MDA Sessions	No of Laser Sessions	Follow-up Period in months
1	34	IV	8	6	8
2	38	IV	8	6	9
3	44	IV	8	5	7
4	30	V	8	5	10
5	41	IV	8	6	11
6	47	IV	8	5	7
7	42	V	8	6	8
8	29	V	8	5	11
9	45	V	8	5	12
10	34	IV	8	5	9
11	41	V	8	6	7
12	32	IV	8	6	10
13	30	IV	8	5	8
14	43	IV	8	6	8
15	29	V	8	6	8

16	31	IV	8	6	9
17	39	IV	8	6	11
18	35	V	8	6	9
19	30	IV	8	5	8

DISCUSSSION

In the present study 19 cases of post chickenpox scars indeed shows that sub-millisecond 1064 nm Nd: YAG laser may be a viable treatment modality capable of generating improvement in texture, scarring and PIH secondary to the acne condition in darker skin types. Blinded photo assessments by physicians indicated that six treatments performed, on average, 24.5 days apart resulted in clinically and statistically significant improvement in atrophic scarring, texture and PIH in patients with skin types III-VI.

It is noteworthy to state that the non-invasive treatments with the sub-millisecond 1064 nm Nd: YAG laser: (10) improved the existing PIH from acne scarring; (11) did not induce additional PIH; (12) did not require pre- or post-treatment agents to control PIH in dark skin patients; (13) did not require anesthetic.

The percentage of subjects with skin types IV and V included in studies for the treatment of atrophic scarring are very limited compared to lighter skin types due to pigmentation concerns [10-12]. Even with the use of hydroquinone pre- and post-treatment, a recently published prospective study of 15 subjects with skin types IV-VI and acne scarring using Er:YAG laser showed a 50% rate of the PIH [14]. In the same study, the pain levels were reported to increase as the skin type went from IV to VI and as the number of passes went from 1 to 8.

The theory behind combining MDA treatments with laser treatments was to reduce the thickness of the stratum corneum thereby allowing greater light penetration to the papillary dermis. Thus, MDA treatments performed before the laser treatments were mild in intensity to prevent discomfort or complications from deep dermal abrasions [15]. The conservative MDA settings used in this study were not considered effective to treat acne scarring and PIH and were unlikely to have had an effect on the observed improvement [16-19]. Nonetheless, randomized split face studies would be required to definitely determine whether MDA is necessary or has an additional benefit when used in combination with laser treatments.

In previous studies, the sub-millisecond 1064 nm Nd: YAG laser therapy has been shown to stimulate collagen [3] and to improve scar severity [20]. However, no assessment has been performed on secondary improvement to texture and pigment. We hypothesize that the sub millisecond Nd: YAG laser works through two parallel actions to safely stimulate collagen and

Improve discoloration. The first mechanism involves discrete cellular damage caused by direct absorption in hemoglobin, melanin and water during each pulse and bulk heating from cumulative pulsing in a region. As a result, damage created through direct absorption and through sustained time at elevated temperature initiates a healing response, prompting collagen stimulation [21, 22].

Nd: YAG is absorbed by melanin and hemoglobin and is subsequently used for vascular and hair reduction treatments. Pulse durations in these treatments are in the 10-100ms range, roughly 30-300 times longer than the pulse durations used in this study. The short pulse durations used in sub-millisecond treatment does not change the characteristics of chromophore absorption. At these short pulse durations, the laser energy is heating fine structures during each pulse, thus more selectively targeting the microvasculature in the papillary dermis and melanocytes within the epidermis without actually damaging the epidermis or larger vessels in the dermis.

The second mechanism of action occurs through bulk heating. The laser uses a 5 mm spot. Pulsing at 5-10 Hz to deliver large amounts of energy in relatively short bursts to a finite area of tissue. Heat conducts to surrounding tissue over time to create bulk heating in each treatment. The degree of bulk heating is a function of total energy delivered per unit area per unit time. The goal during treatment is to deliver energy to an area of tissue faster than the body can extract the heat. For this reason, skin cooling is not desired during treatment. This bulk heating occurs gradually and non-selectively through heat conduction, so no structures are specifically targeted. This allows for safe treatment, even on type VI skin.

SUMMARY

Preliminary data collected in our study suggest that sub-millisecond 1064 nm Nd: YAG laser treatments are safe and effective for treating atrophic scarring in patients with darker skin types, delivering clinically and statistically significant results with reduced risk of pigment complications. This offers a new standard of care or first treatment

option for patients with a high risk of pigmentary complications. Prospective studies with the sub millisecond Nd: YAG laser alone are required to further assess treatment outcomes considering the effect of number treatments as well as to determine targeted treatment parameters for improved effects on scars of various severity and type. Further, randomized split face studies are needed to show the treatment effect and the incidence of PIH compared to non-treated and treated controls with alternative treatments.

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