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Treatment of Skin Scar Using CO_2 Laser with or Without Corticosteroid

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Abstract: Background: CO_2 Laser (10600nm) is the recent method in the management of challenging skin scar resulting from trauma, burn and surgical wound. The aim of this study was to evaluate the efficacy & safety of fractional CO_2 laser (10600nm) in treatment of skin scar. **Materials and Methods:**Twenty patients with different types of scars treated with fractional CO_2 (10600nm) laser, (10 patients) were given additional intralesional Triamcinolone. **Results:** All of the twenty patients included in this study showed some sort of improvements in scar texture, height and pliability and all of the ten patients who received intralesional Triamcinolone after laser show complete satisfaction. **Conclusion:**Fractional CO_2 (10600nm) laser can be used as alternative, effective, safe and less side effects method to other conventional method in treatment of scar specially when combined with intralesional Triamcinolone.

Introduction

Scarring remains an inevitable effect of the wounding process. Scars may cause notable psychosocial morbidity secondary to poor cosmesis as well as functional impairment (Khatri, 2011).

Scar prevention and treatment have come to the forefront of dermatology within the last few years. Several recent review articles that address treatment modalities and the pathogenesis of wound healing hopefully will encourage continued research in this intriguing field (Profyris et al., 2012, Liu et al., 2011).

There are several different types of scars including:

Keloid scars are fibrous overgrowths at sites of cutaneous injury that form as a result of an abnormal wound-healing process in genetically susceptible individuals. It is benign dermal fibroproliferative tumor that never becomes malignant & grow indefinitely into large, tumorous (although benign) neoplasms. Figure 1 (Russell et al.,1988, Nirodi et al.,2000, Rockwell et al.,1989, Gauglitz et al., 2009).

Fig.(1): Keloid scar peri umbilicus.

Hypertrophic scars raised, red scars due to overproduction of collagen, which causes the scar to be raised above but not beyond the boundary of the injury. They usually occur within 4 to 8 weeks following wound infection

or wound closure with excess tension and/or other traumatic skin injuries. Figure 2. (Russell et al.,1988).

Fig. (2): Hypertrophic scar in a sternotomy incision

Atrophic scar takes the form of a sunken recess in the skin, which has a pitted appearance caused when underlying structures supporting the skin, such as fat or muscle, are lost. Figure 3. (Goodman 2000, Fabbrocini and Annunziata 2010).

Fig. (3): atrophic scar

CO_2 Laser (10600nm) is the recent method in the management of challenging skin scar resulting from trauma, burn and surgical wound.

The aim of this study is to evaluate the efficacy & safety of fractional CO_2 laser (10600nm) in treatment of skin scar.

Fractional CO_2 laser

The novel concept of fractional photothermolysis was introduced to the market by Dieter Manstein and Rox Anderson in the year 2003 (Huzaira et al., 2003).

Unlike conventional ablative and non- ablative lasers, fractional ablative and non-ablative lasers treat only a fraction of the skin, leaving up to a maximum of 95% of the skin uninvolved thus the name 'fractional', depending on the number of spots per area of treatment.

This is achieved by inducing microscopic small three dimensional zones of thermal damage or ablation, surrounded by undamaged tissue allowing for rapid epidermal repair (Inja Bogdan and Goldberg 2011, Gold 2007).

Fractional Píxel lasers will act on the water chromophore, whose absorption rate varies in accordance with the wavelength used (Gold 2007, Khan et al., 2005).

Based on the wavelength's affinity for water, fractional technologies can be divided into two main categories. Those with wavelengths that are highly absorbed by water are termed 'ablative', while those wavelengths that are less avidly absorbed by water are termed non-ablative (Inja Bogdan and Goldberg 2011).

Therefore, in every laser shot we will treat a certain percentage of the area of the skin, leaving, between every spot, unharmed zone, and these uninjured zones help the skin heal quickly. Fractional Pixel lasers "drill" the skin leaving some areas unharmed, areas which will in turn produce a fast recovery of the skin (Gold 2007), (Figure 4 and 5) (Hyeong-Seok and Jin-Sung Kim 2012).

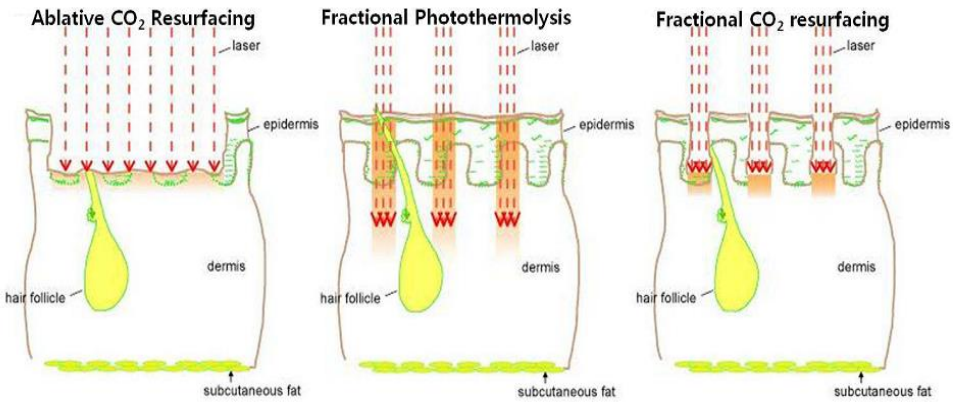


Fig.(4): Basic concept of Fractional Photothermolysis

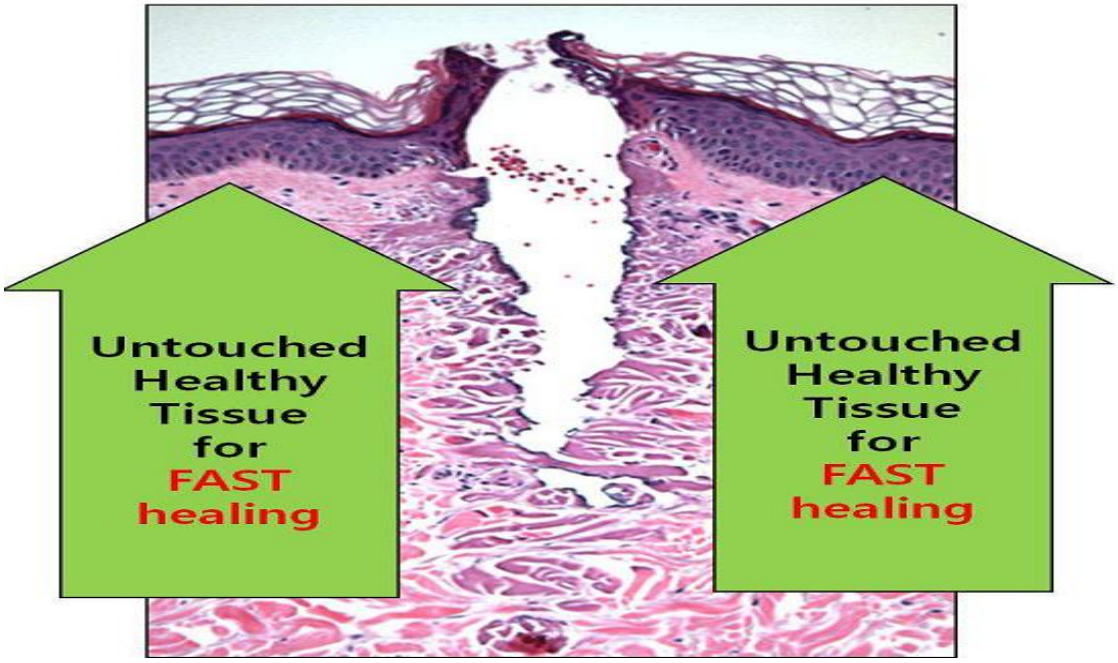


Fig.(5): Basic concept of fractional CO2 resurfacing: advantages.

The lesions damaged by CO_2 laser ablation is first filled with keratonocyte within 48 hours and replaced by dermis through the remodeling process, a process that can be continued even after three months (Hantash et al., 2007) (Figure 6) (Hyeong-Seok Oh and Jin-Sung Kim 2012).

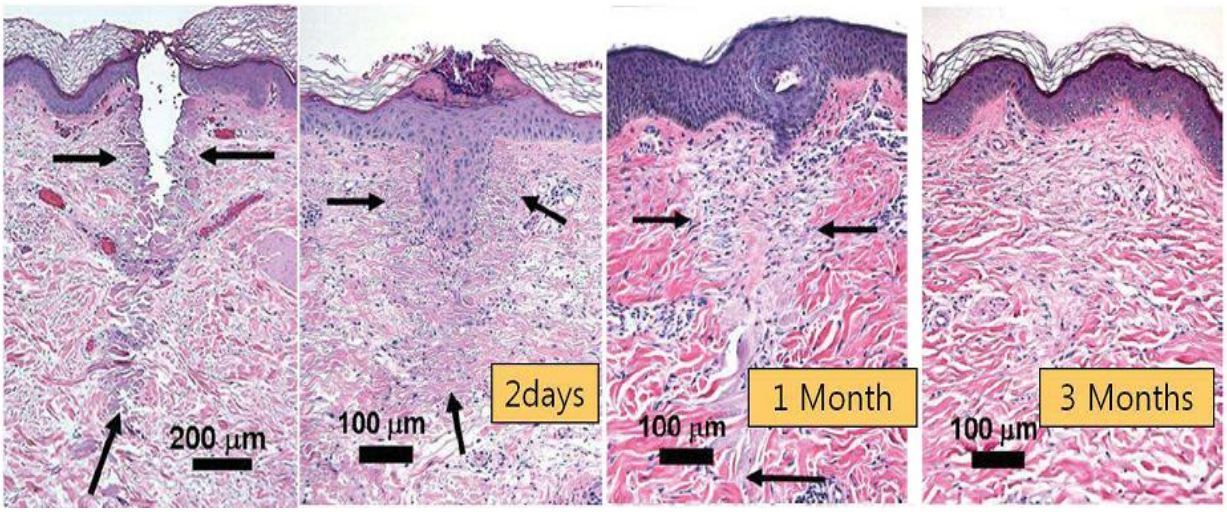


Fig. (6): The wound healing process of fractional CO2 laser treatment

Patients, Materials and Methods

This is a prospective case series including twenty patients with scars resulting from burns, surgery or traumatic injuries, age ranged from 3-53 years old. six patients were female and fourteen patients were male with different types of scars were treated with fractional CO_2 (10600nm) laser between 3-5 sessions, half (10 patients) of them given immediate post-laser topical application of intralesional triamcinolone (kenacort). (Table 1)

Table (1) : Gender, age of patient cause, duration, site of scar and type of treatment

Patient No.	Gender	Age of the patient	No. of scar	Cause of scar	Sit of scar	Duration of scar	Type of treatment
No.1	♂	28 years	4	Fire burn	Elbow joint both hands & face	10 years	Laser Laser+kenacort to face only
No.2	♀	14years	2	Boiling milk	Elbow joint and arm	7 years	Laser+kenacort
No.3	♀	34years	1	Trauma	Right hand	2 years	Laser+kenacort
No.4	♂	22years	2	Trauma	Right elbow & forearm	4 years	Laser+kenacort
No.5	♂	53years	3	Trauma	Right elbow &forearm & arm granulation tissue	2 months	Laser only
No.6	♀	14years	1	BCG scar	Left shoulder	13 years	Laser+kenacort
No.7	♂	38years	3	Trauma	Face, neck & forehead	2 months	Laser only
No.8	♂	20years	3	Trauma	Left shoulder arm & elbow	1 year	Laser+kenacort
No.9	♂	3years	2	Boiling oil	Right thigh abdomen & chest wall	2 years	Laser only
No.10	♂	27years	1	Old trauma	Left thumb	2 years	Laser+kenacort
No.11	♂	45years	2	Trauma	Face , shoulder	10 years	Laser+kenacort
No.12	♂	16years	1	Baghdad boil	Face	10 years	Laser only
No.13	♂	20years	1	Trauma	face	15 years	Laser only
No.14	♂	12years	2	Boiling water	Left Forearm, arm	2 years	Laser+kenacort
No.15	♂	18years	1	Surgical wound	Right inguinal region	15 years	Laser+kenacort
No.16	♀	3years	2	congenetal infection	Both foot	3 years	Laser only
No.17	♂	28years	3	Trauma	Left leg, left hand, forearm	3 months	Laser only
No.18	♀	28years	1	Fire burn	face	20 years	Laser only
No.19	♂	10years	1	Trauma	foot	1 years	Laser only
No.20	♀	29years	2	Baghdad boil	face	10 years	Laser only

Procedure

Before laser treatment, A written informed consent was obtained from each patient and Questionnaire sheat was put for the patient to help to assess and follow up the patient:

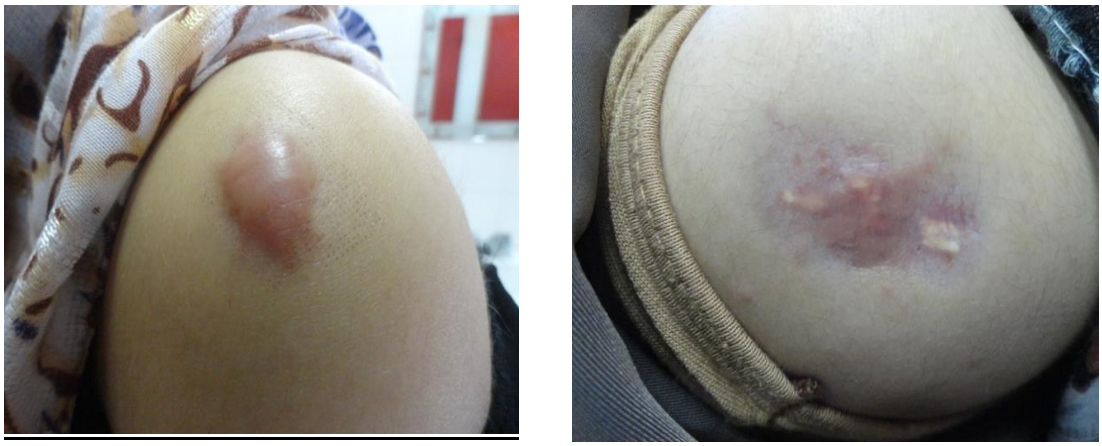
1. Name, age, sex, cause of scar, sit of scar, duration of scar. As shown in table 1.
2. Determine type of the scar.
3. Taking photograph by digital camera to each patient (Sony, 16.1 megapixels, Japan) before, immediately after session and at weekly interval.

The sessions were repeated every 15 days for at least two sessions and maximum 5 sessions. The procedures for all the patients were done without anesthesia. All the patients (10 patients) who received kenacot intraregional had at least 2 session fractional CO_2 laser therapy before receiving the injection, this injection was given immediately after laser therapy after dilution with 10ml distilled water. Only one case

(No.11) was received twice intralesional kenacort at weekly interval with laser therapy. The laser hand piece was applied in perpendicular manner to the scarred area then give shoot after determining the energy which is ranged between 20-22 mj with density of 3 and array mode of operation while size of square is determined according to size of the lesion. The patient is advised to put topical sun-block cream (SPF 50) to the treated area which is directly exposed to sun light for one week.

Results

All of the twenty patients included in this study show some sort of improvements in scar texture, height and pliability and all of the ten patients who received intralesional Triamcinolone (kenacort) immediately after laser show complete satisfaction. Treatments were well tolerated by all patients and no significant adverse effects were reported. All patients experienced mild tolerable pain and burning sensation throughout the procedure and last 24 hours after it. Mild erythema and edema is observed in all patients immediately post-treatment and last for two days only but in only one case the erythema remaining seven days after the procedure and later on subsided. No infection and no changes in the color (pigmentation) of the skin are noticed during this study.



A **B**

Fig. (7): 14 years old girl with scar due to BCG at left shoulder treated with 4 sessions of 2weeks interval in dose of 20mj density 3 with array is the scanning mode , Immediately after the 5th session she receive intralesional corticosteroid after dilution with distilled water .
A before any treatment while **B** one month after the 5th session.

A **B**

Fig. (8) : 14 years old girl with scar in the right elbow of 7 years duration due boiling milk received 4 session of 2 weeks interval of 22 mj of density 3 and array mode of action with slowly improvement in the 5th session followed immediately with intralesional triamiconolon (diluted with 10 ml distilled water) after one week only the patient was happy because she feel there is good change in contour &

consistency. **A** before any treatment , **B** one month after laser & intralesional corticosteroid.

A **B**

Fig. (9) : 38 years old men presented with multiple scars in the forehead ,face & neck due to 2 months history of car accident. **A** before and **B** after laser therapy with 3 sessions of fractional CO_2 laser with 20mj ,density 3 array is the scanning mode. with good satisfactory result within 3 months follow up.

Discussion

The process of wound repair and restructuring is complicated, and various factors contribute to the creation of various types of scars such as hypertrophic, keloid and atrophic (Wollina 2003). Proper scar classification is important because differences in clinical scar characteristics determine the treatment protocol (Alster and Tanzi 2003, Lupton and Alster 2002, Groover and Alster 2000).

Table (2): Scar types and their clinical characteristics

Scar type	Clinical characteristic
Hypertrophic	Raised, pink-red, limited to site of original trauma
Keloid	Raised, deep-red-purple, extend beyond original traumatic border
Atrophic	Saucer-like or ice-pink indentation

Excision alone of keloids results in a high rate of recurrence (45% to 100%). Hypertrophic scars, on the other hand, rarely recur after surgical excision (Wollina 2003).

The application of laser in general surgery and Dermatology has advanced rapidly within the last 30 years. The side effects of laser were minimal and had mostly resolved by 3 months, and no patient is suffered from obvious side effects (Wollina 2003). Progress in laser technology and refinements in technique have made laser therapy a preferred treatment choice for hypertrophic scars and keloids While Atrophic scar resurfacing with a CO_2 laser has effected scar improvements of 50% - 80% (Alster 2003, Bernstein et al., 1998, Alster 1999).

Current study did not distinguish between keloid and hypertrophic scars results because these require different therapeutic approaches and often confused because of an apparent lack of morphologic differences (Ehrlich et al., 1994). According to a recent study, the treatment with laser appears to be more effective in younger patients with thin skin. as we noticed in this study (Naouri et al.,2011).

For the treatment of atrophic scars The short-pulsed Er:YAG laser was developed as a less aggressive alternative to CO_2 laser skin resurfacing(Alster 1999, Tanzi and Alster 2002).

Since the mid-1960s intralesional steroid injections (10 to 40 mg/mL) have gained popularity as one of the most common

approaches to attenuate hypertrophic scar and keloid formation (Jalali and Bayat A 2007).

Since the introduction of laser treatment for keloids in the mid-1980s, the most encouraging results have been obtained with the 585-nm pulsed-dye laser (PDL), which has been recognized as an excellent therapeutic option for the treatment of younger hypertrophic scars and primarily keloids(Alster and Handrick C 2000).

Within the last 10 years (from 2003) the introduction of fractional selective photothermolysis progress rapidly as an effective procedure for the treatment of dermatological problems including scars with less recurrent rates and less side effect in comparism to other methods in treating scars.

In this research using ablative fractional CO_2 laser with and without intralesional corticosteroid (Triamcinolone acetonide 40mg/ml) after dilution by 10 ml distilled water show excellent result within one week after the procedure (laser immediately followed by intralesional Triamcinolone) and all the 20 patients treated with laser with or without corticosteroid are comfortable and satisfied about the result at least in this short period of follow up.

In comparism with study done by (Waibel, et al., 2013) Using topical Triamcinolone in 15 patients show overall improvement of 11 patients only with the follow up period of 6 months, while in this research with follow up of less than three months show overall improvement of all the 10 patients who received intralesional Triamcinolone injection.

Conclusion

Fractional CO_2 laser can be used to treat different types of scars and should be considered as important alternative method of treatment to other more traditional methods with fewer side effects. It gives encouraging result when combined with intralesional injection of Triamcinolone although the period of follow up is short in this research. This current study finds that the shorter the history of scar & the younger the patient is accompanied with good result of healing after Fractional CO_2 laser therapy.

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علاج الندب الجلدية بأستخدام ليزر ثاني أكسيد الكربون مع او بدون استخدام الحقن الموضعي لمادة الكورتزون

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الخلاصة : ليزر ثنائي اوكسيد الكربون ذو الطول الموجي 10600 نانومتر يعتبر الطريقة الحديثة لعلاج الندب الجلدية الاكثر تحديا الناتجة من اصابات حوادث الحروق وجروح العمليات الجراحية .ان الهدف من هذه الدراسة هو لتقيم فعالية وأمان استخدام ليزر ثنائي اوكسيد الكربون التجزيئي ذو الطول الموجي 10600 نانومتر في علاج التليفات الجلدية. **طريقة البحث:** عشرون مريضا بمختلف انواع التليفات الجلدية لأسباب مختلفة عولجت باستخدام ليزر ثنائي اوكسيد الكربون التجزيئي ذو الطول الموجي 10600 نانومتر في عدة جلسات مع او بدون استخدام الحقن الموضعي لمادة الكورتزون (تراي اميسنولون). **النتيجة:** كل المرضى الذين خضعوا للمعالجة بهذه الطريقة شعروا بنوع من التغير في الملمس و الارتفاع للتليفات الجلدية التي يعانون منها علما ان الذين خضعوا للعلاج بالحقن الموضعي بالتراي اميسنلون مسبوقا بجلسة او جلستين من ليزر ثنائي اوكسيد الكربون التجزيئي ذو الطول الموجي 10600 نانومتر ابدو ارتياح كامل للنتيجة. **الاستنتاج:** يمكن استخدام ليزر ثنائي اوكسيد الكربون التجزيئي ذو الطول الموجي 10600 نانومتر كبديل فعال وأمين مع قلة الاعراض الجانبية مقارنة بالطرق التقليدية الاخرى في معالجة التليفات الجلدية وخاصة اذا كان مقترنا باستخدام الحقن الموضعي للتراي اميسنيلون.