

## Carbon Dioxide Laser Efficiency in Treatment of Atrophic Facial Post Acne Scarring

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### Abstract

Scarring occurs during the healing of active acne and can be caused by all types of acne. Acne scars impair quality of life and have been described as a risk factor for suicide, depression, low academic performance, and unemployment. In this study, we aimed at evaluating the efficiency and safety of fractional carbon dioxide laser in the treatment of atrophic post acne scars. This study was carried out in Benha University and Kobbary El-Kobba Dermatology, Venereology & Andrology Departments and included 20 patients having moderate to severe facial post acne scars. All patients were Fitzpatrick skin types III- V. Four treatment sessions with 4-week intervals were done for all patients. Twenty subjects [100%] completed four treatment sessions. The clinical types of acne scars were determined prior to treatment and classified according to the predominant type into Boxcar scars in six patients [30%], ice pick scars in 10 patients [50%] and rolling scars in four patients [20%]. Acne scars showed great improvement after treatment. 30% and 50% of patients were highly satisfied and satisfied respectively after the end of treatment. Facial erythema, as an adverse effect was evaluated one week after each session through applying Clinician Erythema Assessment scale [CEA]. The erythema was cleared of three [15%]. Post inflammatory hyperpigmentation did not occur to any patients. Acneiform eruption was observed after treatment in 1 patient out of 20 [5%]. Other side effects like petechiae, infections, milia, scarring, and post inflammatory hypopigmentation did not occur. Conclusion: Fractional carbon dioxide laser is effective in the improvement of atrophic facial acne scars with no recorded side effects.

**Keywords:** Acne scars, Carbon dioxide laser.

### 1. Introduction

Acne is a common disease affecting 80% of individuals between 11-30 years old and 5% of elderly people. Acne is caused and characterized by multiple factors: including cutibacterium acnes activity; increased sebum production; androgenic stimulation; follicular hypercornification and lymphocyte; macrophage and neutrophil inflammatory response [1].

Acne vulgaris is characterized by comedones, papules, nodules, and often scars. Scar is a common complication in scar-prone patient. Close inspection of acne skin under a bright light can reveal some scarring in up to 90% of patients who attend to dermatology clinics, but significant scarring occur in about 22% of sufferers. Types of post acne scars are superficial macular scars, ice picks scars, rolling scars, boxcar scars, hypertrophic scars and keloid [2].

Treatment of the scars resulting from acne must reflect several considerations by the physician. Cost of treatment, severity of the lesions, physician goals, patient expectations, side-effect profiles, physiological or emotional effect to the patient and prevention measures should all play a role [3].

Acne scars can be corrected through a variety of modalities, including soft tissue augmentation, deep chemical peels, microneedling, surgical treatment, dermabrasion, ablative and non-ablative laser resurfacing [4].

Ablative laser such as carbon dioxide laser [10600nm] and Erbium: Yttrium Aluminium Garnet laser [Er:YAG] [2940nm] and non-ablative laser such as Er: glass laser [1540nm], diode laser [1450nm], Pulsed Dye Laser [585nm], KTP [532nm] and Q-switched Nd:YAG laser [1064 nm] are used on treatment of acne scars. Carbon dioxide laser achieve total ablation of epidermis and apporation of the dermis. In addition to the destructive

nature, there may also be stimulation of collagen by the procedure [5-6].

### 2. Subjects and methods

This study was carried out in Benha University and Kobbary El-Kobba Dermatology, Venereology and Andrology Departments. This study was approved by Ethic Committee of Benha University. The nature of the study was clearly explained to each patient. Informed written consents were obtained for participation in the study. All data obtained from patients were used for scientific purposes only.

Twenty patients with different types of atrophic acne scars were enrolled in this study. Exclusion criteria included: History of keloidal scar formation, any active inflammation or infection, oral isotretinoin use within the preceding 6 months, diabetes mellitus, pregnancy and lactation, photosensitivity or current use of photosensitive drugs, melasma, known allergy to lidocaine. Radiofrequency, or laser treatment should be stopped six months before the study.

All patients were subjected to the following:

- Written informed consent was obtained from each patient before enrollment in the study.
- History was taken including patient's age, duration of acne scars, recent systemic therapy with isotretinoin or previous procedures to repair acne scars. Systemic prophylactic antiviral therapy [Acyclovir] was given to patients with known history of recurrent herpes simplex.
- Clinical examinations of post acne scars with a magnifying lens, under good illumination, while the patient is sitting in upright position to detect the type of each lesion and grading the scars.
- **Treatment protocol:** All subjects received four sessions of fractional CO<sub>2</sub> laser treatment with four weeks-interval between the sessions.

- **Preoperative care:** Local anesthetic [EMLA] cream was applied to the treated area under occlusion for 60 minutes before the procedures. Then the whole face was cleansed using mild cleanser and dried with sterile gauze. Patients and doctor on the laser room used special protective eye goggles for their safety.
- **Laser treatment:** Treatments were performed by using fractional CO2 laser [Deka Smartxide DOT laser].
- **Postoperative care:** During first week post treatment, all patients were instructed to use mild facial antiseptic every 4 hours followed by emollient application. Direct sun exposure, heat and friction was avoided. Sun screen was applied daily.
- **Outcome assessments:** Standardized high-resolution digital photographs using identical camera settings, patient positioning and lighting conditions were obtained prior and after the end of treatment. The photographs were presented for comparison with the known baseline photograph by a non-treating blinded physician. The degree of facial erythema was evaluated one week after the session though the Clinician Erythema Assessment Scale [CEA] which was graded as clear, almost clear, mild and moderate [8]. Adverse effects including post inflammatory hyper or hypopigmentation, oedema, acneiform eruption, bleeding, blistering, petechiae, infection and scarring were recorded as absent or present. The

patients also filled out a questionnaire for subjective assessment of their improvement and expressed their satisfaction as highly satisfied, satisfied, neutral and dissatisfied [10].

**3. Results**

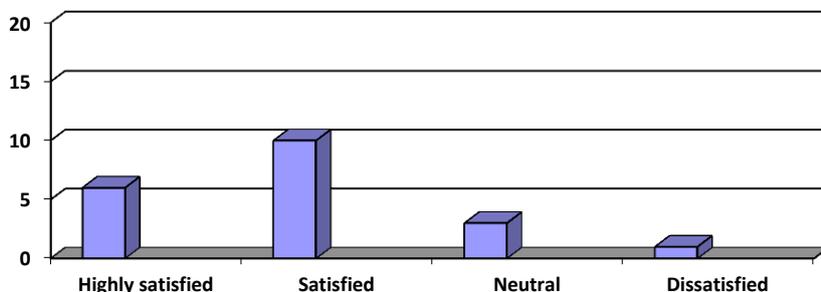
This study included 20 patients suffering from post-acne scars. Their age range was 18-32 years. The duration of their post acne scars ranged between 2-10 years. According to Fitzpatrick classification of skin photo types, the skin phototypes were III - V. The clinical types of acne scars were determined prior to treatment and classified according to the predominant type into Boxcar scars in six patients [30%], ice pick scars in 10 patients [50%] and rolling scars in four patients [20%]. The severity of acne scars before treatment was graded. Acne scars showed great improvement after treatment Table (1) and Fig (1). The degrees of patients satisfaction is displayed in Fig (2).

Facial erythema, as an adverse effect was evaluated one week after each session through applying Clinician Erythema Assessment scale [CEA]. The erythema was cleared of three [15%]. Post inflammatory hyperpigmentation did not occur to any patients. Acneiform eruption was observed after treatment in 1 patient out of 20 [5%]. Other side effects like petechiae, infections, milia, scarring, and post inflammatory hypopigmentation did not occur.

**Table (1)** Comparison of acne scars severity degrees before and after treatment.

Degree of severity of acne scars	Before treatment		After treatment	
	Number	%	Number	%
Macular	0	0	10	50
Mild	6	30	6	30
Moderate	12	60	3	15
Severe	2	10	1	5
Total	20	100	20	100
P- value	<0.05*			

\*Significant



**Fig (1)** Patient satisfaction after treatment.



**Fig (2)** Great improvement of post acne scars after the 4<sup>th</sup> treatment session. Further improvement during the follow up sessions despite the stoppage of treatment sessions.

#### 4. Discussion

Acne scars cause cosmetic and psychological problems and still lacking standardized treatment option. Various therapeutic options have been described with variable outcomes as well as complications [6]. Fractional CO<sub>2</sub> laser therapy is based on the theory of fractional photothermolysis which creates microscopic zones of thermal injury and sparing normal healthy zones in between that helps in rapid re-epithelization, tissue tightening and new collagen formation that improves the appearance of wrinkles and atrophic acne scars [7]. Despite the documented efficacy of fractional CO<sub>2</sub> laser resurfacing in the treatment of acne scars, its drawbacks such as long periods of erythema and edema may cause discomfort and hinder patients' daily lives, limiting its use [6].

[9] reported 46.6% improvement in atrophic acne scars treated with the fractional CO<sub>2</sub> laser. Most of their patients were females. Females' patients showed better result when treated with laser [10]. treated 30 patients with CO<sub>2</sub> laser for 3 sessions at 6 weeks interval then followed the patients up for 6 months. They found that the improvement is excellent in 8%, good in 38.5%, fair in 38.5% and slight improvement in 15%.

M.Bjorn [11] treated 13 patients with 2 sessions of fractional CO<sub>2</sub> laser. The patients were classified into two groups, one group received the second session after 1 month while the other group received it after 3 months. They found that before treatment, acne scars appeared with moderate to severe atrophy [ $5.8 \pm 1.87$ ]. After treatment, acne scars appeared with significantly less atrophy on treated sides 1 month postoperatively [1-month interval  $1.96 \pm 1.23$ ,  $P < 0.0001$ ; 3-months interval  $1.82 \pm 1.08$ ,  $P = 0.0006$ ] and 6 months postoperatively [1-month interval  $1.56 \pm 1.24$ ,  $P = 0.0021$ ; 3-months interval  $1.33 \pm 1.66$ ,  $P = 0.0002$ ]. They found that Fractional CO<sub>2</sub> laser resurfacing improves atrophic acne scars and a treatment interval of either 1 month or 3-months does not seem to

influence the improvement of scar atrophy nor the occurrence of postoperative adverse effects.

As regard the treatment safety, patient reported that 15% of the patients suffer from erythema for 7 days. No recorded post inflammatory hyperpigmentation. While Acneiform eruption was observed after treatment in 1 patients out of 20 [5%].

W.Manuskiatti [10] evaluated the efficacy and safety of carbon-dioxide ablative fractional resurfacing on atrophic acne scars in 13 Asian individuals. Of the subjects, 62% rated themselves as having at least 50% improvement in their scars. Mild post-inflammatory hyperpigmentation was the most common adverse effect observed in 92% of the subjects, and was completely resolved in an average of 5 weeks.

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