

THE EFFICACY AND SAFETY OF ABLATIVE FRACTIONAL CARBON DIOXIDE LASER FOR TREATMENT OF ACNE SCARS

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ABSTRACT

Background

Acne is a prevalent condition in every society and often results in scarring. Prevention is the optimal method to avoid these scars; however, even with the best efforts, scars will certainly arise. Ablative Fractional Carbon –dioxide laser have recently introduced a good option by using principles of Fractional Photothermolysis which produces a tiny microscopic wound surrounded by undamaged tissue.

Objective

To determine efficacy and safety of ablative fractional CO₂ laser for treatment of acne scars.

Methods

Fifteen patients with skin type III, IV, with moderate to severe facial acne scars (according to Goodman and Baron grading system of acne scarring), enrolled in this study were all treated with Ablative Fractional Carbon-dioxide Laser every 4-8 weeks for three consecutive sessions. All subjects were assessed by photographs before treatment and one month after the last session. Post treatment side effects were assessed after each session and one month after the last session.

Results

Post treatment side effects were mild to moderate and transient. Post treatment hyperpigmentation was not permanent. All patients who had moderate and severe scars before treatment changed to mild and moderate scars after completing the last session with decrease in the number and the size of the scars and these changes were statistically significant (P value = 0.002).

Conclusion

Ablative Fractional Carbon-dioxide Laser shown to be safe and effective treatment modality for moderate and severe acne scars.

Keywords: *Acne scars, Ablative Fractional Carbone-dioxide Laser*

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INTRODUCTION

Acne scarring can take several clinical forms, including atrophic saucerized, ice pick, and boxcar scars ⁽¹⁾. Histologically, these acne scars are associated with a loss of collagen ⁽²⁾. Although the deeper ice pick and boxcar scars are resistant to laser treatment and respond best to punch excision, punch elevation, tissue augmentation, and fat transplantation ⁽³⁾, atrophic scars generally respond to laser ⁽⁴⁾.

Atrophic or saucerized scars, which appear as shallow, rolling scars wider than 4 to 5 mm, are the result of an inflammatory response to an initial lesion, which terminate in collagen destruction, dermal atrophy, and fibrosis. As the scar matures and contracts, the dermal nature of the scar produces a bound –down appearance. These scars are exaggerated with aging as facial skin starts to sag and hang on the inelastic scars ⁽⁵⁾. This combination often influences patients, as they approach middle age, to seek corrective surgery for long-standing acne scars. Although carbon dioxide laser resurfacing can improve the appearance of saucerized acne scarring, it is associated with an extended recovery and significant postoperative complications ⁽⁶⁾.

A quantitative global scarring grading system was published on 2000 is used for classification of acne scars ⁽⁷⁾, table 1.

The carbon dioxide (CO₂) Laser has been proven to be effective for a wide range of dermatologic conditions including treatment of acne scars ⁽⁸⁾, but patients undergoing CO₂ facial resurfacing can expect post treatment erythema (which may last for weeks or months), edema, burning discomfort, milia and exacerbation of acne. Crusting and intermittent pruritis are among transient side effects. Significant complications such as infection, scarring or alterations in skin texture may occur. Increased likelihood of contact dermatitis to topical preparations and post inflammatory hyper pigmentation, especially in patient with darker skin photo types ⁽⁹⁾.

The introduction of Fractional Photothermolysis (FP) revolutionized laser surgery by delivering energy in a novel beam pattern ⁽¹⁰⁾ which is well-tolerated and effective modality for an expanding variety of conditions such as photo aging, peri orbital wrinkling, mild to moderate acne scarring, melasma, pigmented lesions and poikiloderma of Civatte ^(11, 12).

Table 1. Global acne scarring classification.

(Grade) type	Number of lesions: 1 (1-10)	Number of lesions: 2 (11-20)	Number of lesions: 3 (>20)
(A) Milder scarring (1point each) macular erythematous or pigmented atrophic disch-like	1 point	2 points	3 points
(B) Moderate scarring (2 points each) moderately atrophic disch like Punched out with shallow bases Small scar <5mm Shallow but broad atrophic areas	2 points	4 points	6 Points
(C) Sever scarring (3 points each) Punched out with deep but normal basis, small scar (<5mm) Punched out with deep abnormal bases, small scars (<5mm)	3 points	6 points	9 points

PATIENTS AND METHODS

This study was carried out during the period from November 2009 to April 2010, in Dermatology Laser Specialty Center in Sulaimani-Iraq.

Fifteen subjects (11 female, and 4 male, age 18-36 years, mean age 24 year) with moderate to severe facial acne scars (according to Goodman and Baron grading system of acne scarring)⁽⁷⁾, subjects had skin type III-IV (Fitzpatrick).

Informed consent was obtained from each subject before enrollment. Patients who were pregnant or lactating, who had concomitant treatment for involved skin areas or received isotretinoin for the last two months or topical therapy for the last two weeks or had laser resurfacing procedures within the preceding 12 months were excluded.

Before each treatment the face were cleaned using mild cleanser and EMLA (an eutectic mixture of local anesthetic, AstraZeneca LP, Wilmington DE), was applied for 30 min., then the area degreased and cleaned with a cleanser to obtain a completely dry skin surface. Eyes were protected with opaque goggles.

A full face, single pass treatment and for scar area two passes (overlap) with rotation of the hand piece 90 degree using multipulse CO₂ laser (Asclepion laser Technologies; Germany), wave length 106 nm, maximum output power 30 watt, multimode, method of optical output articulated.

For all patients the same parameters were applied which were 500 Mm the pick, power 25 watt, scanning dwell time 1700 msec. Smoke evacuator and air cooling system accompanied the procedure.

All subjects underwent three treatment sessions using identical techniques on an average 6 week interval (range 4-8 weeks). Oral antiviral prophylaxis (Valcyclovir 1000 mg daily) one day before and for 5 days course, cold ice bags applied immediately and for 30 min after the procedure, then moisturizing cream was applied after that.

Photographic documentation using digital camera (Model no. DSC-T 20 Sony Corp. Digital still camera, Made in Japan) were obtained as baseline, before each treatment session, and one

month after the last session. Assessment by side effects was recorded.

RESULTS

Fifteen patients with acne scars underwent three treatment sessions; all felt mild pain during the procedure which was tolerable, the pain continued for about half an hour after the laser, in all subjects mild oozing, moderate erythema and mild to moderate edema observed immediately after treatment.

The erythema persisted for one week in most patients, but in 3 patients (20%) it lasted for one month. Three patients felt dryness for one week and in one patient lasted for one month, acne form eruption observed in one patient and post inflammatory hyper pigmentation observed in 5 patients which lasted for one month (33%), Table 2.

At first evaluation nine subjects had moderate scars (11-20) lesions, 2 subjects had moderate grade, with more than 20 acne scar lesions, one subject had severe grade acne scar lesions (11-20), and the last three had severe grade with more than 20 acne scar lesions.

After one month from the last treatment all subjects are reassessed and the results were as followed: eleven patients changed to mild grade acne scars with five of them has less than 10 scars and the other six had 10-20 lesions. Four patients showed moderate scars (one patient with less 10 lesions, two patients with 10-20 scars and the last patient had more than 20 scars) and no patient had severe scars, Table 3.

So there were changes in number and shape of scars and these changes were statistically significant (P value 0.002).

Figure 1, 2 and 3 shows three patients before treatment and after one month from the last treatment. Figure 4 shows the clinical improvement, there is change in the shape, size and number of scars. All the patients saw the change in their scars and they were satisfied with the results.

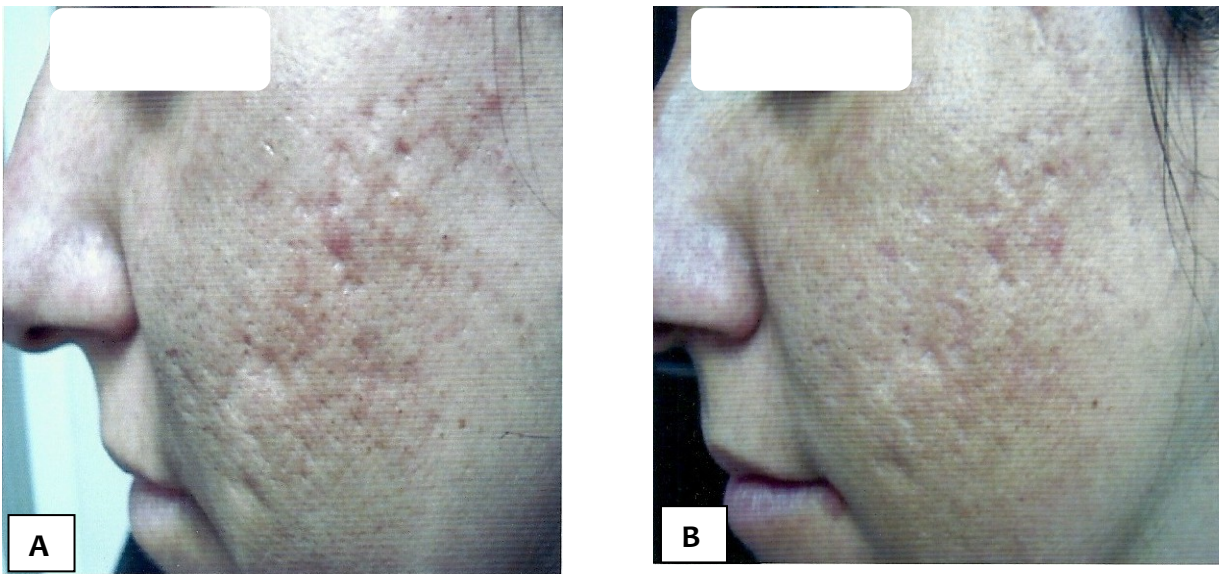


Figure 2. Efficacy of CO₂ laser in patient with moderate acne scar and more than 20 lesions; A: Pre CO₂ laser, B: Post CO₂ laser.

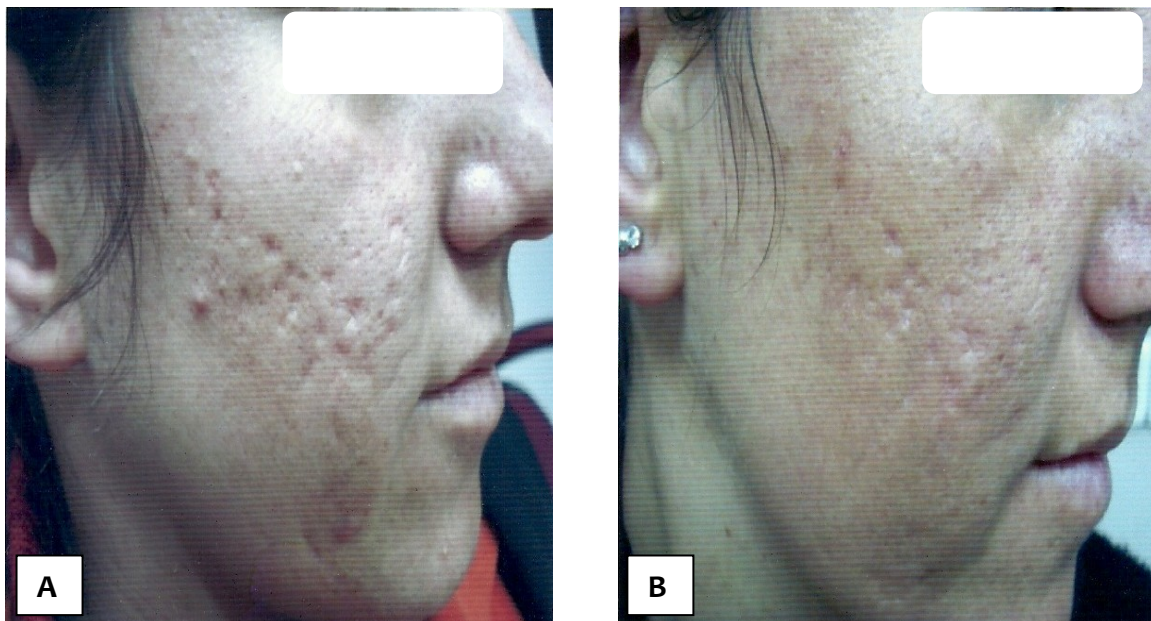


Figure 2. Efficacy of CO₂ laser in patient with moderate acne scar and more than 20 lesions; A: Pre CO₂ laser, B: Post CO₂ laser.



Figure 3. Efficacy of CO2 laser in patient with moderate acne scar and more than 20 lesions; A: Pre CO2 laser, B: Post CO2 laser



Figure 4. Efficacy of CO2 laser in patient with moderate acne scar and more than 20 lesions; A: Pre CO2 laser, B: Post CO2 laser

Table 2. Duration of post treatment side effects.

Side effects	One week	Four weeks
Erythema	15 patients (100%)	3 patients (20%)
Dryness	3 patients (20%)	1 patient
Acne form eruption	1 patient	
Post inflammatory hyperpigmentation	5 patients (33%)	

Table 3. Changes in acne scars after three sessions.

Grades	Status		P value
	Pre CO ₂ Laser N (%)	Post CO ₂ Laser N (%)	
Mild (1-10)	0(0.0)	5(33.3)	0.002
Mild (11-20)	0(0.0)	6(40.0)	
Moderate (1-10)	0(0.0)	1(6.7)	
Moderate (11-20)	9(60.0)	2(13.3)	
Moderate (more than 20)	2(13.3)	1(6.7)	
Severe (11-20)	1(6.7)	0(0.0)	
Severe (more than 20)	3(20.0)	0(0.0)	

DISCUSSION

The CO₂ Fractional Laser resurfacing is a new method for treatment of acne scars, by forming a microscopic zone of thermal damage with control of both the size and the depth of the damage in the dermis. The small pore size and the limited injury gives advantage of rapid healing and decrease the adverse effect.

With this thermal damage there will be immediate collagen shrinkage, and dermal collagen remodeling, and after the treatment there is columns of microscopic ablated epidermis and dermis and this results in macroscopic epidermal regeneration as evidenced by clinical improvement⁽¹³⁾.

This kind of treatment leaves the majority of epidermis intact, thus allowing quicker recovery periods and an improved safety profile, as we observed in this study. All patients could go back to the work after one week and no serious side effects were observed, and those who had post inflammatory hyper pigmentation took different types of bleaching agents and with photo protection, the pigmentation started to fade. So all the patients accepted the side effects because they observed a significant change in their acne scars.

This with comparison to non fractional mode of CO₂ laser which may cause hypertrophic scar and ectropion formation⁽⁹⁾.

Results from a single treatment are fully realized 3-6 months after the procedure; this is a time for collagen remodeling, Patients show changes in scars at least for 3 months after the last treatment⁽¹⁴⁾.

With this unique ability to deliver volumetric ablation and correction and encouraging safety profile with no significant post treatment complications, giving promise for additional application in future for treatment of other kinds of scars (burn scars).

Subjects were highly satisfied with the overall outcome, as well as with the reduced down time and safety profile.

In conclusion, fractional CO₂ laser source represent a new treatment paradigm by offering the ability to ablate and resurface deep dermal tissue targets, without significant risk for adverse effect. The efficacy and favorable side effects profile for this technology, with a low incidence for pigmentary changes, makes it a viable alternative for the treatment of moderate to severe acneiform scarring.

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