

The Efficacy of Fractional Co2 Laser in Treatment of Post Acne Scars

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Abstract

One of the most common dermatological diseases is acne. Acne scars and pigmentation may have a dramatic psychological effect on people who suffer from severe breakouts. Laser, radiofrequency, chemical, surgical, microneedling, fillers, and/or fat injections are all current therapeutic methods. With less reported downtime than lasers or chemical peels, fractional radiofrequency-based treatments have lately been utilised to reduce acne scars with less risk of scarring or hyperpigmentation. Fractional Co2 Laser therapy of acne scars is the focus of this study. There were 15 individuals with post-acne scars who participated in this research. Fractional Co2 Laser was used on the right side of the patients. They had three monthly sessions of treatment. The sessions were completed in all instances. The mean pain score for the first session of fractional CO2 laser treatment was 60. Within two sessions, it dropped to 57.3 and then to 52.7, indicating a substantial reduction in discomfort with time ($p=0.039$). Mean improvement scores increased significantly over time ($p<0.001$), according to the findings of this investigation. It was shown that there was a significant difference in the improvement grades across sessions when the improvement score was stratified into grades of moderate and outstanding. Erythema (100 percent) and edoema (20 percent) were the most common side effects of fractional CO2 laser treatment. There aren't any hyperpigmentation or scars to be seen here. Conclusion: Fractional Co2 improved the patient's score greatly, but it was also related with more severe pain and more erythema than usual.

Key words: Fractional Co2 Laser, Treatment, Post Acne Scars.

1. Introduction

Dermatologists encounter a lot of patients with acne, which is one of the most common skin problems. Acne scars and pigmentation may have a dramatic psychological effect on people who suffer from severe breakouts. Laser, radiofrequency, chemical, surgical, microneedling, fillers, and/or fat injections are all current therapeutic methods. More recently, fractional radiofrequency-based treatments have been utilised to relieve acne scars with less reported downtime than lasers or chemical peels and the capacity to treat darker or sensitive skin types with less risk of scarring or hyperpigmentation and [1].

It was established by Manstein and colleagues in 2004 as a way to bridge the gap between ablative and nonablative laser treatments, which are both effective. Resurfacing with fractional resurfacing uses a matrix of energy beams to create an array of small thermal wounds (microscopic treatment zones) in the dermis to induce a therapeutic response in the skin [2]. Tissue ablation induced by a brief, high-energy exposure is quick enough to minimise extracutaneous skin damage. Injuries caused by lasers may be quickly repaired because to the reservoir of skin that is saved [3]. Fractional resurfacing, although not as effective as complete ablative laser skin resurfacing, has fast become more popular than the latter due to the reduced side effects, dangers, and downtime of treatment, as well as the acceptable improvement in appearance [4].

Radiofrequency (RF) has seen a substantial rise in popularity in the last several years. It is possible to simulate skin regeneration processes with the application of high-frequency current, which causes oscillating migration of ions and causes an increase in temperature [5]. Their low risk of consequences and relatively high efficacy, their applicability for the face

and body, painlessness, and the ability to conduct them at any time of the year and on any skin phototype are some of the features of these procedures [6].

Fractional Co2 Laser therapy of acne scars is the focus of this study.

2. Patients and Methods

This was an observational study conducted from August 2021 to November 2021. This study was carried out on 15 patients with Fitzpatrick skin types III-IV aged between 18-50 years who were presented with mild-to-severe atrophic facial acne scars. Their mean age was 30.5 years (\pm SD). They were 5 males (33.3%) and 10 females (66.7%). All patients were informed about the nature of the procedure and were requested to sign a written informed consent that was approved by the Ethics Committee of Human Research, Benha University. They were treated with fractional co2 on the right side and 4 plus on the left side at one month interval for 3 sessions.

2.1. Inclusion criteria:

Male or female patients with age 18-50 years, with post acne scars and skin type III-IV.

2.2. Exclusion criteria:

All patients presenting with any of the following conditions were excluded from the study:

- Previous treatment with oral retinoids within six months prior to study.
- Previous treatment of face with ablative laser.
- Hypertrophic scars or keloids.
- Pregnancy or breastfeeding.
- Photosensitivity.

Included patients underwent a detailed history and full clinical examination to determine the affected sites, Fitzpatrick skin type, and type of acne scar as proposed by Jacob *et al.* [7] (Table 1). Severity of acne scar was

assessed using qualitative scarring grading system, which was developed by Goodman and Baron's [8] qualitative global acne scarring grading system, 2006a in (Table 2). Those with mild-to-severe atrophic facial acne scars are included in this study.

The patients informed to stop topical creams one week before the session and to stop any cosmetic in between the sessions. Patients were explained about the outcome, side effects, and complications of the procedure. Before any procedure, the treatment area was cleansed of sebum and debris (including dirt, makeup, and powder) using a mild cleanser and 70% alcohol. A thick layer of anesthetic cream (Pridocaine) was then applied to the treatment site for 1 hour prior under occlusion. Before starting the procedure, the cream was removed with dry gauze and the treatment site was once more cleaned with an antiseptic solution. Both the patients and the operators wore safety goggles during the laser session. At each visit the severity of acne scars, patient satisfaction scores, visual analyze scores and side effects were assessed.

BX 300 is the fractional CO₂ laser device used in this study. This fractional laser delivers a fine laser beam to minimize the damage done to the skin by heat and to shorten the recovery period this laser beam vaporizes the epidermis and part of the dermis promoting collagen contraction via its thermal effects, thereby inducing skin remodeling. Different settings were used according to each individual case regarding the type of scar, severity and skin type fluence ranging from 36 to 42 j/cm² was used and pulse duration 1.8 ms. In an attempt to avoid common side effects that occur with fractional laser treatment, a lower fluence was used in the first session and depending on the results, the fluence was increased per treatment session.

Acne scar classification [7]

Acne scars subtype	Clinical features
Ice-pick	Ice-pick scars are narrow (<2 mm), deep, sharply demarcated tracts that extend vertically to the deep dermis or subcutaneous tissue
Rolling	Rolling scars may reach ≥5 mm in diameter. They have a rolling or undulating appearance that occurs from fibrous tethering of the dermis to the subcutis
Boxcar	Boxcar scars are oval depressions with sharply demarcated vertical edges. They are wider at the surface than ice-pick scars and do not taper to a point at the base

3. Results

The present study was conducted on 15 cases with moderate-to-severe post acne scars on face. Their mean age was 30.5 years (± SD). They were 5 males (33.3%) and 10 females (66.7%).

Table (1) Age and gender distribution among all studied cases.

		Cases N=15	
Age (years)	mean±SD	30.5	±5.9
Male	N, %	5	33.3%
Female	N, %	10	66.7%

SD, standard deviation.

Among all studied cases, 26.7% were smokers, and 26.7% had positive family history of scar (Table 2).

4 PLUS ITALY is the quadripolar radiofrequency device used in this study. The dynamic quadripolar radiofrequency emission focus energy on the layer of the tissue that needs treating, reducing both power needed and risks dramatically fluence ranging from 20 to 35 j/cm² was used. The tissue is treated in a natural, safe, comfortable and effective way.

Postoperative care, sun protection 50 SPF was prescribed as well as topical anti-inflammatory cream twice daily for the next week after each session. All patients were strictly advised to avoid direct sunlight for 4-5 days post laser treatment.

Patients were treated with a total of three sessions at 1-month intervals. Follow up occurred one month after each treatment session. Post-treatment changes in erythema and pigmentation as well as improvements in texture, atrophy, and overall appearance were graded by the investigator on a quartile scale (mild, ≤25%; 26–50% = moderate improvement; good, 51–75% = marked improvement; and excellent, >75% = near-total improvement). Two blinded dermatologists assessed the treatment response by comparing pre treatment and post-treatment clinical images using the same quartile grading scale.

A subjective assessment was also performed by the patients in terms of their overall satisfaction with appearance using a five-point scale (grade 0, no improvement = dissatisfied; grade 1, 1–25% = slightly satisfied; grade 2, 26–50% = satisfied; grade 3, 51–75% = very satisfied; grade 4, 76–100% improvement = extremely satisfied). Patients were also asked to grade pain during the procedure on a four-point scale (0 = no pain; 1 = mild pain; 2 = moderate pain; and 3 = severe pain).

Table (2) Relevant history of all studied cases.

	Cases N=15	
	N	%
History of smoking	4	26.7%
Positive family history of scar	4	26.7%

Most of studied cases (80%) were received previous treatment, all of them received topical treatment and 5 cases (33.3%) were received systemic treatment (Table 3).

Table (3) Previous treatment among all studied cases.

	Cases N=15	
	N	%
Not receiving any treatment	3	20%
Using topical and systemic	12	80%

Face was affected in all studied cases. Mean (\pm SD) disease duration was 7.7 (\pm 2.2) years. Grade I was found in 26.7%, grade II in 40% and grade III in 33.3%. (Table 4).

Table (4) Features of AV scars in all studied cases.

		Cases N=15	
		N	%
Duration (years)	mean\pmSD	7.7	\pm 2.2
Grades	I	4	26.7%
	II	6	40%
	III	5	33.3%

Regarding fractional CO₂ laser, mean pain score at the first session was 60. It decreased by the 2nd session to 57.3 and by the 3rd session to 52.7, with significant decrease in pain score across time ($p=0.039$) (table 5).

Table (5) Comparison of pain grades after fractional laser throughout 3 sessions.

		Fractional CO ₂						<i>p</i>
		1 st session		2 nd session		3 rd session		
		mean	\pm SD	mean	\pm SD	mean	\pm SD	
Pain score		60	12.4	57.3	13.9	52.7	14.4	0.039
		N	%	N	%	N	%	
Pain grades	No pain	0	0%	0	0%	0	0%	0.276
	Mild	5	33.3%	6	40%	8	53.3%	
	Moderate	9	60%	7	46.7%	6	40%	
	Severe	1	6.7%	2	13.3%	1	6.7%	

Regarding fractional CO₂ laser, mean improvement score at the first session was 32.3. It increased by the 2nd session to 45 and by the 3rd session to 63.3, with significant increase in improvement score across time ($p<0.001$) (Table 6).

Table (6) Comparison of improvement grades after fractional laser throughout 3 sessions.

		Fractional CO ₂						<i>p</i>
		1 st session		2 nd session		3 rd session		
		Mean	\pm SD	mean	\pm SD	Mean	\pm SD	
improvement score		32.3	8.6	45.0	10.4	63.3	12.5	<0.0·1
		N	%	N	%	N	%	
Improvement grades	No	3	20%	1	6.7%	0	0%	<0.0·1
	Mild	12	80%	11	73.3%	4	26.7%	
	Moderate	0	0%	3	20%	8	53.3%	
	Excellent	0	0%	0	0%	3	20%	

Regarding fractional CO₂ laser, all cases had erythema (100%, while 20% has edema. None had hyperpigmentation or scarring (Table 7).

Table (7) Frequency of side effects after fractional laser.

	Fractional CO ₂	
	N	%
Edema	3	20%
Hyperpigmentation	0	0%
Erythema	15	100%
Scarring	0	0%

4. Discussion

The mean pain score for the first session of fractional CO₂ laser in this research was 60. Within two sessions, it dropped to 57.3 and then to 52.7, indicating a substantial reduction in discomfort with time ($p=0.039$).

Previous investigations, such as those by Bjrn et al. [9] and Manuskiatti et al. [10] have demonstrated that the average pain score decreases with each therapy session. Our findings support these earlier research. Tolerability to pain increased with consecutive laser treatments, according to Ochi et al. [11]. Similarly, each subsequent laser treatment reduced the amount of time patients had to deal with erythema afterward.

After the second and third treatments, Chapas et al. [12] found that stimulating the wound healing response resulted in quicker recovery and better tolerability. It's also possible that patients' pain was reduced because they were more accustomed with the therapy process [9].

Xu and Deng [13], showed that patients who received treatment with a greater density or higher fluence of lasers felt more discomfort or pain that lasted longer.

Mean improvement scores increased significantly over time ($p<0.001$), according to the findings of this investigation.

It was shown that there was a significant difference in the improvement grades across sessions when the improvement score was stratified into grades of moderate and outstanding.

The findings of this research were consistent with those of previous investigations. There was a clinical improvement in all of the patients investigated by El-Taweel et al., Majid and Imran. [15], and Hedelund et al. [16] who used fractional CO₂ lasers to treat atrophic scars, according to the evaluation of the investigator and the two blinded dermatologists. After each treatment session, the skin texture of the acne scar and depressed scar group improved. Both scar groups had a statistically significant improvement in skin texture between the three sessions of therapy, according to all dermatologists.

An ablative 10,600-nm wavelength is combined with the notion of fractional photothermolysis in the fractionated carbon dioxide (CO₂) laser. Thermal ablation removes just a small portion of the skin, leaving behind healthy skin that quickly replaces the ablated areas. Histological signs of wound healing and new collagen synthesis may be seen [11]. When compared to standard laser resurfacing, fractionating

the CO₂ laser improves skin regeneration and scarring while requiring less downtime and having a far lower risk of adverse effects [17].

Erythema (100 percent) and edoema (20 percent) were the most common side effects of fractional CO₂ laser treatment. With no scars or hyperpigmentation.

Majid and Imran [15] also found that the treatment regimen's side effects, such as erythema that lasted an average of 3-4 days, superficial crusting that lasted 4-6 days, and moderate transitory edoema, were all temporary. Some 6 people had transient acneiform lesions, and 2 needed oral therapy. In our research, only three patients had post-inflammatory hyperpigmentation, which was the only significant adverse impact. Over the course of two to three months, a course of topical medication cleared up the hyperpigmentation.

According to Hedelund et al. [16], all of the patients in their study had short-term side effects that resolved on their own, and none of them went on to have long-term or irreversible side effects.

Three patients in the research by Arsiwala et al., [18] had hyperpigmentation, while two patients each had discomfort, erythema, and acne, and one had secondary infection, while one patient had a secondary infection.

Adverse events occur more often as the number of therapy sessions rises, according to Ochi et al. [11]. Blistering (4.0 percent), crusting (2.9 percent), worsening of inflamed acne lesions (1.7 percent), and scarring are among the side effects, with 6.4% of patients reporting hyperpigmentation (0.6 percent). Hypopigmentation, bacterial or viral infection were not observed to have any negative side effects in this study. The most prevalent side effect of laser therapy, postinflammatory hyperpigmentation (PIH), was restricted to the regions that had been treated. It was brief, lasting anywhere from seven to fourteen days on average, until finally dissipating after 13.5 days.

5. Conclusion

Improvement scores increased considerably, but so did the incidence of higher pain grades and more erythema associated with fractional CO₂.

References

- [1] L.kroepfl and J.Jason, *J Drugs Dermatol*.vol.15(11),pp.1413-1419,2016 .
- [2] M.Lapidoth, S.Halachmi, S.Cohen and DB.Amitai, Fractional CO₂ laser in the treatment of facial scars in children. *Lasers Med Sci*.vol.29(2),pp.855-7,2014 .

- [3] Park, SE.Chang , S.Bang , KH.Won and CH.Won, Usefulness of Skin Explants for Histologic Analysis after fractional Photothermolysis. *Ann Dermatol*.vol.27(3),pp.283-90,2015. .
- [4] M.Naouri , M.Atlan , E.Perrodeau , G.Georgesco and R.Khallouf, High-resolution ultrasound imaging to demonstrate and predict efficacy of carbon dioxide fractional resurfacing laser treatment. *Dermatol surg*.vol.37(5),pp.596-603,2011.
- [5] W.Thanasarnaksorn, V.Siramangkhalanon, DI.Duncan and I.Belenky, Fractional ablative and non-ablative radiofrequency for skin resurfacing and rejuvating of Thai patients. *J cosmet Dermatol*.vol.17(2),pp.184-192,2018.
- [6] M.Eلمان and Y.Harth, Novel multi source phase controlled radiofrequency technology for non-ablative and micro-ablative treatment of wrinkles, lax skin and acne scars. *Laser Therapy*.vol.20(2),pp.139-144,2011.
- [7] CI.Jacob, JS.Dover, MS.Kaminer, Acne scarring A classification system and review of treatment options. *J Am Acad Dermatol*.vol.45,pp.109-17,2001 .
- [8] GJ. Goodman, Postacne scarring A review of its pathophysiology and treatment. *Dermatol Surg*.vol.26,pp.857-71,2000.
- [9] M.Bjørn, B.Stausbøl-Grøn, A.Braae Olesen, and L.Hedelund, "Treatment of acne scars with fractional CO2 laser at 1-month versus 3-month intervals: An intra-individual randomized controlled trial", *Lasers in Surgery and Medicine*, Wiley Online Library.vol.46 ,pp.89–93,2014.
- [10] Fitzpatrick, Richard. Effect of Pulse Width of a 595-nm Flashlamp-Pumped Pulsed Dye Laser on the Treatment Response of Keloidal and Hypertrophic Sternotomy Scars. *Dermatologic surgery* : official publication for American Society for Dermatologic Surgery .vol.33,pp.152-61,2007.
- [11] H.Ochi, L.Tan, W.P.Tan, and C.L. Goh, "Treatment of facial acne scarring with fractional carbon dioxide laser in Asians, a retrospective analysis of efficacy and complications", *Dermatologic Surgery*, LWW.vol.43 ,pp.1137–1143,2017.
- [12] A.M.Chapas, L.Brightman, S.Sukal, E.Hale, D.Daniel, L.J.Bernstein, and R.G.Geronemus, "Successful treatment of acneiform scarring with CO2 ablative fractional resurfacing", *Lasers in Surgery and Medicine: The Official Journal of the American Society for Laser Medicine and Surgery*, Wiley Online Library.vol.40, pp.381–386,2008.
- [13] Y.Xu, and Y.Deng, "Ablative fractional CO2 laser for facial atrophic acne scars", *Facial Plastic Surgery*, Thieme Medical Publishers.vol.34 , pp.205–219,2018.
- [14] A.E.-A.I.El -Taweel, Abdel S.H.Rahman, and A.T.Rihan, "Fractional CO2 laser in the treatment of atrophic scars", *Scientific Journal of October 6 University*, October 6 University.vol.3 ,pp.13–20,2016.
- [15] I. Majid, and S. Imran, "Fractional CO2 laser resurfacing as monotherapy in the treatment of atrophic facial acne scars", *Journal of Cutaneous and Aesthetic Surgery*, Wolters Kluwer--Medknow Publications.vol.7, pp. 87,2014.
- [16] L.Hedelund, C.S.Haak, K..Togsverd-Bo, M.K.Bogh, P.Bjerring, and M.Hædersdal, "Fractional CO2 laser resurfacing for atrophic acne scars: a randomized controlled trial with blinded response evaluation", *Lasers in Surgery and Medicine*, Wiley Online Library.vol.44, pp.447–452,2012.
- [17] Z.Husain, and T.S.Alster, "The role of lasers and intense pulsed light technology in dermatology", *Clinical, Cosmetic and Investigational Dermatology*, Dove Press.vol.9,pp. 29,2016.
- [18] N.Z.Arsiwala, A.C.Inamadar, and Adya, K.A. "A comparative study to assess the efficacy of fractional carbon dioxide laser and combination of fractional carbon dioxide laser with topical autologous platelet-rich plasma in post-acne atrophic scars", *Journal of Cutaneous and Aesthetic Surgery*, Wolters Kluwer--Medknow Publications.vol.13,pp.11,2020.