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### **ORIGINAL ARTICLE**

### Efficacy of Fractional CO<sub>2</sub> Laser in The Treatment of Enlarged Pores Amany Nassar<sup>1</sup>, Ahmed Said Abd-Elshafy<sup>2</sup>, Mona Abd El-Kader Shahin<sup>3\*</sup>

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#### ABSTRACT

**Background:** Enlarged facial pores are common dermatologic and aesthetic concern, and may be an early sign of skin aging. A wide variety of treatment options have been used to improve the appearance of enlarged facial pores without obvious success. The aim of this work was to evaluate the efficacy and safety of CO2 fractional laser in the treatment of enlarged facial pores **Methods**:20 patients suffering from enlarged pores recieved 3 consecutive sessions of CO2 fractional laser 4 weeks apart. Clinical and dermoscopic assessement were done to evaluate the results after each treatment session and 3 months after the last treatment.

**Results:** Treating enlarged facial pores with CO2 fractional laser led to a mean improvement of  $2.8 \pm 0.92$  corrosponding to moderate to marked improvement on quartile grading scale (0-4).

**Conclusions:** CO2 fractional laser proved to be effective and safe in treating enlarged pores with high degree of patient satisfaction.



Key words; CO2 fractional Laser, Skin aging, Enlarged Pores.

# **INTRODUCTION** condit

S kin pores are normally present in all individuals but their size and shape vary among people. The term skin pores means that the openings of pilosebaceous follicles are enlarged. They appear as empty funnel-shaped structure or as cornified cylindrical plugs corresponding to comedones<sup>[1]</sup>.

The size of pores can be evaluated as three categories 'invisible skin pores' corresponding to pores with the size of under  $0.04 \text{ mm}^2$ , 'visible skin pores' corresponding to pores with the size of 0.04- $0.07 \text{mm}^2$  and 'enlarged skin pores' corresponding to pores with the size exceeding  $0.07 \text{mm}^{2[2]}$ .

Widening of pores is affected by many exogenous and endogenous factors such as genetic predisposition, gender, hormones, aging, seborrhea, acne, chronic ultraviolet light and comedogenic xenobiotics. Aging and sebum output level were reported as the most influencing factors

for enlarged facial pores<sup>[1]</sup>.Different methods have been used to treat enlarged pores including chemical peeling, topical retinoic acid, oral isotretinoin, microdermabrasion, photorejuvenation, intradermal botulinum toxin injection, laser skin resurfacing and fractional laser treatment<sup>[3]</sup>.Fractional CO<sub>2</sub> laser is effective in the treatment of many dermatological conditions such as scars, wrinkles, enlarged pores, stretch-marks and benign growths on the skin<sup>[4]</sup>. Fractional  $CO_2$  laser mechanism of action is that it helps in rearrangement and induction of collagen production through creating hundreds to thousands of microthermal treatment zones (MTZs) and coagulated columns of tissue, that are surrounded by untreated tissue. So fractional  $CO_2$  laser helps in

improvement the texture of skin, with minimal downtime, resulting in improvement in the shape of pores<sup>[5]</sup>.

#### METHODS

This study was carried out in the period from 1<sup>st</sup> of March 2018 to 10<sup>th</sup> of September 2018, Written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Twenty patients (5 male and 15 female) with variable degrees of enlarged facial pores, their ages ranged from 20 to 50, fitzpatrick skin type from (II to IV). Full history was taken from each case including personal history, present history, family history, and sun exposure. Patients with history of keloid formation, hypertrophic scars, immunosuppression, pregnancy, oral isotretinoin use in the preceding 6 months, and laser skin resurfacing treatments in the preceding 6 months were excluded.

All subjects received a total 3 consecutive full-face treatments of  $CO_2$  fractional laser at 4-week intervals. Photographic, dermoscopic documentation using identical camera settings, lighting, and patient positioning was obtained at baseline, before each treatment session, and 3 months after the final treatment. Patients' subject assessments were performed at each visit. The full face of each patient was treated with 10,600-nm  $CO_2$  fractional laser (MX 7000 MICROXEL, Dae Shin Enterprise, Seoul, Korea).

For topical anesthesia, the face was cleansed with a mild cleanser and alcohol and a topical anesthetic cream (Pridocaine 2.5%) (mixture of 2.5%) lidocaine and 2.5% prilocaine) was applied to the whole face half an hour before laser treatment, then the cream was removed with dry gauze and the treatment site was once more cleaned with an antiseptic solution. The patients used eye goggles during all sessions. The parameters used for treatment varied according each patient condition as following: single pass, power 18 to 25 mJ, scan scale 20 x 20 mm, depth level 2  $\mu$ m, density level 3 MTZ/cm<sup>3</sup>, repeat time off, and mode selection microxel scanner. Prophylaxis with oral antiviral was prescribed for patients with the history of herpes labialis and was started one night before the treatment for a course of 3 days. For post operative care, all patients were informed to avoid sun exposure, use sunscreens (SPF +50), topical antibiotics and moisturizer many times daily for the first few days after each treatment session to help wound healing and prevent dryness. A mild topical steroid was prescriped if erythema and edema persisted.

# Visual assessment:

The photographs were taken using a digital camera (Canon EOS 750D). The images were captured with digital camera and saved in JPEG format. Images were evaluated and measured on a 0-6 scale (Figure 3)<sup>[6]</sup>, with 0 being faint and small pores and 6 being obvious and large pores by two investigators independently.

# **Clinical outcome assessment:**

Independent clinical assessment for the appearance of pores was done at the end of the study by two blinded dermatologists, and evaluation of comparative photographs using quartile grading scale with values from 0 to 4 (0 = no improvement, 1 = Minor/mild improvement 1%-25%, 2 = Moderate improvement 26%-50%, 3= Marked improvement 51%-75%, 4 Very

marked improvement 76%-100%).

During evaluation, the two evaluators were also blinded to the order of the photographs. The evaluators were then asked to perform two actions. First, they were asked to identify the photograph that showed better improvement in the appearance of pores. Second, the evaluators rated the improvement in the photographs as mentioned above. The patients were asked about their overall rates of satisfaction in each visit along a scale of very satisfied, satisfied, somewhat satisfied, and unsatisfied. Patients also were asked about the side effects and severity of pain after each treatment, then were documented on the evaluation sheet.

# **Dermoscopic assessment:**

In this study a new method was designed to assess the size of pores objectively, through high magnified images on the central areas of cheeks (each symmetrical  $4.5 \times 4.5 \text{cm}^2$  central area) that were obtained before and after the treatment using a dermatoscope (DermLite DL4) and the size of pores were measured by using the ruler of the dermatoscope on a computer program (Autocad and Foxit), and then were documented on the evaluation sheet before and after the treatment (Figure 4).

# Statistical analysis

Data analysis was performed using the software SPSS (Statistical Package for the Social Sciences) version 20. Quantitative variables were described using their means and standard deviations. Categorical variables were described using their absolute frequencies. Kolmogorov-Smirnov (distribution-type) and Levene (homogeneity of variances) tests were used to verify assumptions for use in parametric tests. To compare the same parameter among a group of patients at two points of time, paired sample t test (for normally distributed data) was used. Percent change was calculated by subtracting postoperative value from preoperative value then divided it by preoperative value\*100. The level statistical significance was set at 5% (P<0.05). Highly significant difference was present if  $p \le 0.001$ .

# RESULTS

Twenty patients (5 male and 15 female), aged from (26-43), 2 patients fitzpatrick skin type II, 17 type III and 1 type IV, completed the study (Table 1). Follow up results at 3 months after the last treatment session revealed a mean improvement of  $2.8 \pm 0.92$  corrosponding to moderate (26%-50%) to marked (51%-75%) improvement on quartile grading scale (0-4).

There was a highly statistical significance decrease in the clinical grading of pores before and after treatment according to the visual assessment grade , with a percent of improvement 58.33%(P<0.001) (Table 2). https://dx.doi.org/10.21608/zumj.2020.31095.1863 Volume 29, Issue 1, January 2023, Page (87-92) Supplement Issue Regarding the dermoscopic assessment, there was a highly statistical significance decrease in pore size after treatment comparing to before, with a percent of improvement 50.17% (p<0.001) (Table 3). The patients' degree of satisfaction revealed that 4 (20%) patients out of 20 were somewhat satisfied, 12 (60%) were satisfied, 4 (20%) were

very satisfied, and no one was unsatisfied (Table 4). The observed adverse effects were mild pain during treatment, mild erythema and crustation post treatment, which resolved within one week. Other severe adverse effects as scarring, infection and pigmentary changes were not observed.

## **Table (1):** Demographic data of the studied patients (n=20):

Variable	Fractional CO <sub>2</sub> Laser n=20 (%)
	11-20(70)
	21 5 40
Wean ± SD	$31 \pm 5.48$
Range	26 - 43
Gender:	
Male	5 (25)
Female	15 (75)
Skin type:	
II	2 (10)
III	17 (85)
IV	1 (5)

**Table (2):** Clinical grading before and after treatment with fractional laser:

	Variable		Before		After	Paired	Р
			(n=20)		(n=20)	t	
Clinical g	rading:						
	Mean $\pm$ SD		$4.8 \pm 1.23$		$2 \pm 0.67$	9.64	< 0.001
	Range		3-6		1 - 3		HS
% of	change		-58.33%				
SD: Stander	deviation	Paired t	d t : Paired t test HS:Highly significant (P≤0.001)				

### Table (3): Dermoscopic grading among the studied patients before and after treatment with fractional laser:

V	ariable	Before	After	Paired	Р
		(n=20)	(n=20)	t	
Pore size:					
	Mean ± SD	$0.19 \pm 0.03$	$0.09\pm0.02$	10.78	< 0.001
	Range	0.14 - 0.25	0.06 - 0.12		HS
% of change		-	-50.17%		
SD: Standar deviation _ Daired t : Daired t test _ US: Highly significant (D<0.001)					

SD: Stander deviation Paired t : Paired t tset HS: Highly significant ( $P \le 0.001$ )

Table (4): Distribution of the studied patients according to dermatologists' assessment based on quartile grading scale and patient satisfaction:

Variables	N=20 (%)
Quartile grading scale	
Mean ± SD	$2.8 \pm 0.92$
Median	2.8
Range	1 - 4
Patient satisfaction:	
Not satisfied	0 (0)
Somewhat satisfied	4 (20)
Satisfied	12 (60)
Very satisfied	4 (20)



**Figure (1):** Female patient (43 years old) showing marked improvement after three sessions of CO<sub>2</sub> fractional laser



**Figure (2):** Female patient (27 years old) showing moderate improvement after three sessions of CO<sub>2</sub> fractional laser.



Figure (3): Criteria of visual assessment for pore<sup>[6]</sup>



Figure (4): A dermoscopic photo on the central area of the cheek illustrating a number of pores measured by the ruler of the dermoscope on a computer program and average size was taken.

### DISCUSSION

Enlarged facial pores is an important aesthetic concern in many people, many terms such as skin pores, enlarged pores and dilated pores can be used to describe this condition.  $CO_2$  fractional laser can affect skin pores through two ways; the first way is that it causes shrinkage of collagen fibers around skin pores, which firm and strength skin tissues; the second way through the activation of fibroblasts, and this has a long term effect. In the present study, the patients were treated by 3 sessions of 10,600 CO<sub>2</sub> fractional laser 4 weeks apart with pulse energies ranging from 18 to 25 mJ based on each patient's condition, this led to a mean improvement of 2.8 ± 0.92 corrosponding to moderate to marked improvement on quartile grading scale (0-4).

The percent of improvement in the size pores to clinical grading before and after according treatment was 58.33% (P<0.001). The degree of improvement was also assessed objectively by a new method through measuring the pore size before and treatment through dermoscopic high magnified images and a computer program that accurately measure the size of the pore using the ruler of the dermoscope, the percent in reduction of pore size was 50.17% (p<0.001). These results were in agreement with kwon et al ., <sup>[7]</sup> who reported moderate to marked improvement with a mean of 2.9  $\pm$  0.4 based on quartile grading scale, after 3 sessions of low energy level CO<sub>2</sub> fractional laser with power ranging from 7.2 to 9.0 mJ. Comparing to previous studies that applied other devices to improve skin pores, Saedi et al., [8] reported mild reduction in pore size after 6 sessions of low energy non ablative fractional 1440- nm laser treatment with a mean of  $1.9 \pm 0.5$ . This proves that ablative fractional laser treatment, that was used in this study, is more effective than non ablative fractional laser treatment, with half the number of treatment sessions, when deep structures like pores are targeted. Also Roh et al.,<sup>[9]</sup> reported that various parameters of 1064-nm Nd:YAG laser is effective for reducing pore size and sebum level. Lee et al.,<sup>[10]</sup> reported mild to moderate improvement in skin pores (26% -50%) after 3 sessions of Q-switched (fluence of 6 J/cm, and pulse delay of 5ns) or long pulsed 1,064-nm Nd:YAG laser (fluence of 15 J/cm, and pulse delay of 300ns), with a mean improvement of 1.8. On the other hand, Cho et al.,<sup>[11]</sup> reported that combination treatment of the O-switched and quasi long-pulsed 1064-nm Nd:YAG laser, nonablative 1450-nm diode laser, and ablative 10,600-nm carbon dioxide fractional laser is preferable to ablative 10600-nm carbon dioxide fractional laser system alone, and could result in textural improvement and lessened prominence of pores. Suh et al.,<sup>[12]</sup> reported moderate improvement in pore size (>50%) in 93.4 % of patients after 3 sessions of 1410-nm

fractional erbium fiber laser with pulse energies ranging from 15 to 20 mJ. Cho et al., <sup>[5]</sup> reported moderate to marked improvement in enlarged skin pores with a mean of 2.67 after 3 sessions of 1550nm erbium glass fractional laser with pulse energies from 20 to 28 mJ and 400 to 900 spots/cm<sup>2</sup> for spot density. Regarding the degree of satisfaction, 60% reported that they were satisfied, 20% were very satisfied and 20% were somewhat satisfied, these findings were in agreement with **Kwon et al.**,<sup>[7]</sup> who stated marked improvement regarding the degree of patient satisfaction. None of the patients experienced severe adverse effects such as scarring, infection and pigmentary changes. Only mild erythema and crust formation were observed in most of the patients but they were completely resolved in less than 1 week with a mean side effects of  $1.1 \pm 0.32$  on a (0-3) severity scale ) (0= No, 1= mild erythema, edema, crusting, 2= moderate prolonged erythema, edema, crusting,, 3= severe as infection, scarring and pigmentation)<sup>[8]</sup>, these finding was in agreement with **Kwon et al.**,<sup>[7]</sup> who reported mild to moderate degrees of adverse effects including erythema, oozing, and edema. Regarding pain, all of the patients developed tolerable pain during all treatment sessions with mean of  $2.9 \pm 0.74$  on a (1-10) visual analogue scale (0= no pain, 10= most painful)<sup>[8]</sup>.

### CONCLUSION

As various factors cause widening of facial pores, identifying the cause before suitable treatment is necessary. High sebum secretion, decreased skin elasticity around pores due to impairment of collagen and elastin, and increased pore volume due to thick hair require different methods of treatment. In conclusion, fractional  $CO_2$  laser proved to be effective and safe in treating enlarged pores with high degree of patient satisfaction.

### Conflict of interest: No

Financial disclosure: No

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