

Assessment of Safety and Efficacy: Fractional CO₂ Laser Treatment for Acne Scars

Dr. Sachin Goyal¹, Dr. Mukesh Bansal², Dr. Rohit Gupta³

¹Junior Resident, Department of Skin and VD, Career Institute of Medical Sciences and Hospital Lucknow, India (Corresponding author)

²Professor and Head, Department of Skin and VD, Career Institute of Medical Sciences and Hospital Lucknow, India

³Assistant Professor, Department of Skin and VD, Career Institute of Medical Sciences and Hospital Lucknow, India

Abstract: ***Objective:** This study aimed to evaluate the safety and efficacy of fractional CO₂ laser in the treatment of acne scars. **Methods:** A prospective interventional study was conducted on 50 patients with atrophic acne scars. The study tool used is Goodman's Qualitative acne scar grading system. **Results:** The patients showed improvements in scar grades, visual score and skin texture. Adverse effects were minimal. **Conclusion:** Fractional CO₂ is a safe and effective choice for acne-scarring patients with minimal discomfort and shorter downtime as compared to traditional CO₂ laser therapy.*

Keywords: Fractional CO₂ laser, acne scars, safety, efficacy, atrophic scars

1. Introduction

Acne scar is a chronic disease that evolves from acne, which is an inflammatory skin disease of the pilosebaceous units characterized by the formation of seborrhea, comedones, erythematous papules and pustules and, less frequently, nodules, deep pustules, or pseudocysts. [1] In order to standardize the language used in the description of acne scars, Jacob et al. divide these into 3 general categories: icepick scars, rolling scars, and boxcar scars. [2]

Ice pick scars are narrow (2mm), dotted and deep scars, with a wide opening and a deep infundibulum in the form of the letter V. Rolling scars are wider (up to 5mm) and they reach to the subcutaneous adipose tissue. They give a distorted appearance to the skin, in the form of the letter M. Boxcar scars have clearly visible vertical edges; they are wider than ice pick scars and take U shape with a broad and visible base. [3]

It occurs in boys with the age of 16 years-17 years up to 95.0%-100.0% and in girls of these ages; the recurrence percent is 83.0%-85.0%. [4] Acne usually clears itself between the ages of 23 and 25; however, it can last up to 40 years in 1.0% of men and 5.0% of women.[5]

The Goodman and Baron Quantitative Global Acne Scarring Grading System (GBGS), which ranges from 0 to 84 points, is a clinically useful and straightforward system for grading the severity of acne scars. It is based on scar count (1-10, 11-20, >20), scar shape (atrophic, macular, boxcar, hypertrophic, keloidal), and scar severity (mild, moderate, severe). [6] Facial resurfacing with fractional lasers is currently claimed to be one of the most effective treatment options for facial scars. [7] The current application of fractional 10,600 nm CO₂ laser is an effective method which is widely used in the treatment of acne scars. [5]

2. Material and methods

The present prospective interventional study was conducted on over 50 patients with acne scars attending the outpatient department of skin and STD, Career Institute of Medical Sciences and Hospital, Lucknow, U.P during the study period for the period of January 2021 to June 2022. The study tool used is Goodman's Qualitative acne scar grading system [8] Patients who provided written consent, were older than 18 years and met the inclusion criteria were included in the study.

Exclusion criteria encompassed patients who had taken systemic retinoids or immunosuppressive drugs in the past three months, individuals with coagulation defect or bleeding disorder, those with a history or evidence of keloid scars, active or recurrent herpes, pregnancy and lactation, and those with unrealistic expectations.

Simple random sampling using computer generated random numbers was employed to select the participants.

Local and English language was preferred to ask for each patient's history and it was taken using a confidential questionnaire formulated by the staff members. The questionnaire included questions providing information on personal data, which were next properly encoded. The clinical data given by patients were then complemented with information on the diagnosis of the disease, the treatment administered (present and/or past), and adverse effects reported.

2.1. Objective assessment

A baseline objective grading was done for each patient using Goodman's Qualitative acne scar grading system. Acne grade was assessed 4 weeks after 1st sitting and a percentage of improvement in size and depth of the scar was noted, and photographs were taken. Similarly, 4 weeks after the last sitting of laser treatment grade of the scar is assessed.

Table 1: Subjective assessment

Grade	Remarks
Nil	No improvement
Poor	26 – 50% improvement
Good	51 – 75% improvement
Excellent	> 76% improvement

Table 2: Subjective assessment was done using a self-evaluation scale

Score	Remarks
0	No improvement
Less than 4	Poor
4-6	Good
More than 6	Excellent

3.Observations/ Results

The distribution of the studied patients based on age and it was observed that the majority 28 (56.0%) patients belonged to the ≤19 age group followed by 13 (26.0%), 8 (16.0%), and 1 (2.0%) patient belonged to 31-40, 41-50 and ≥51 age group respectively. The mean age of the studied patients was 31.86±8.58 Years. the male patients i.e. 30 (60.0%) dominant over female patients i.e. 20 (40.0%).

The distribution of the studied patients based on Occupation and it was found that the majority 13 (26.0%) patients were Field workers followed by 11 (22.0%), 10 (20.0%), 6 (12.0%), and 5 (10.0%) patients were Housewife, belonged to the Agriculture, service sector and labour respectively.

Table 3: Physician's Evaluation at various sitting

Evaluation at the end of sitting		Physician's Evaluation after 1st sitting		Physician's Evaluation after 3rd sitting		P value
		Frequency (n=50)	Percentage (%)	Frequency (n=50)	Percentage (%)	
Score	Excellent	5	10.0	13	26.0	0.067
	Good	28	56.0	27	54.0	
	Poor	17	34.0	10	20.0	
Grade of acne Scar	1	11	22.0	28	56.0	0.002
	2	17	34.0	9	18.0	
	3	15	30.0	12	24.0	
	4	7	14.0	1	2.0	
Self Evaluation at the end of sitting	3	18	36.0	4	8.0	0.001
	5	13	26.0	29	58.0	
	6	19	38.0	17	34.0	

The above table shows the Physician's evaluation at various sitting and it was found that improvement was seen in the Physician's Evaluation after 3rd sitting group but the association of Score and the Physician's evaluation after 1st 3rd sitting was found to be statistically insignificant ($p>0.05$).

The association of (Grade of acne Scar & Self-evaluation at the end of sitting) and the Physician's evaluation after 1st 3rd sitting was found to be statistically significant ($p<0.05$).

In the present study, it was found that 100.0% of patients were taking Exposure to sunlight. Based on the duration of exposure to sunlight 26 (52.0%) patients were taking 2-4 (hrs) sunlight, 18 (36.0%) patients were taking 5-7 (hrs) and 6 (12.0%) patients were taking 8-10 (hrs).

Based on the type of exposure, the majority 21 (42.0%) had seasonal exposure to sunlight followed by 16 (32.0%) and 13 (26.0%) patients had continuous and Intermittent exposure to sunlight respectively.

In the present study the distribution of the studied patients based on Acne scars. Based on the type of Scar, the majority 24 (48.0%) patients had Ice pick Scars followed by 14 (28.0%) and 12 (24.0%) patients had Rolling Scar and Box Scar respectively.

Based on Grade scar majority of patients had grade 2, grade 3 and grade 4 and based on the Site of scar mostly 24 (48.0%) patients had Scars on Cheeks followed by 11 (22.0%), 8 (16.0%) and 7 (14.0%) patients had Scar at the forehead, chin and Temporal region.

The distribution of the studied patients based on Immediate Post-treatment and it was found that the majority 9 (18.0%) patients faced Burning sensation and Itching followed by 4 (8.0%) and 3 (6.0%) patients faced Erythema and Edema respectively.

The distribution of the studied patients based on the Physician's Evaluation after 1st sitting and it was found that only 5 (10.0%) patients had Excellent scores, 28 (56.0%) patients had Good scores and 17 (34.0%) patients had Poor scores.

Based on the Grade of acne Scar majority of 17 (34.0%) patients had Grade 2 followed by 15 (30.0%), 11 (22.0%) and 7 (14.0%) patients had 3, 1 and 4 grades respectively.

Also, based on Self-evaluation at the end of 1st sitting it was found that the majority of 19 (38.0%) patients belonged to 6 grade followed by 18 (36.0%) and 13 (26.0%) patients belonging to Grade 3 and Grade 5 respectively.

4.Discussion

Acne is a common condition with a prevalence as high as 80.0% among adolescents. All body areas with high concentrations of pilosebaceous glands may be involved, but the most commonly affected areas include the face, back, and chest. Acne lesions can result in permanent scarring with a marked impact on quality of life. Genetic factors, disease severity, and delay in treatment are the main factors influencing scar formation. [vi]

Fractional photothermolysis or fractional CO₂ laser is a newer technology in which only a fraction of the skin is removed instead of wiping away the entire skin. [9]. A typical patient has scars of different morphological types and grades, and it is difficult to treat all these scar types satisfactorily with a single treatment option assessing the efficacy of any therapeutic option difficult to judge.[xiv] Fractional CO₂ laser evades a significant number of unwanted results as just a fraction of the skin is dealt with, without disrupting the integrity of the epidermis.[10] Of the treatment options available to treat post-acne scars, fractional photothermolysis may offer the highest degree of scar amelioration and patient satisfaction. Against this backdrop, this study attempts to throw light on the efficacy and safety of fractional CO₂ laser in the treatment of post-acne scars.

In the present study, the majority of studied cases were in the age below 30 years (56.0%) followed by 31 to 40 years (26.0%) with mean age 31.86±8.58 years and male predominance (60.0%) living in urban areas (62.0%). 34.0% were graduates and 36.0% studied till intermediate. 60.0% were vegetarian and 68.0% were having adequate sleep. This was in concurrence with the study by Saeed AHM et al [11]

In the present study, the distribution of the skin type was done based on Fitzpatrick skin type and it was found that the majority of the cases were of grade III (44.0%) followed by grade I (26.0%) and grade II (20.0%). Saeed AHM et al [11]

In the present study, the majority of the studied cases were having ice pic scar (48.0%) followed by rolling scar (28.0%) and grade 2 scar (34.0%), grade 3 scar in 32.0% of cases. Cheeks were affected in 48.0% of cases followed by the forehead (22.0%) and chin (16.0%). Pooja T et al [12]

In the present study, the distribution of the studied patients was based on the Physician's Evaluation after 1st sitting and it was observed that a good score was reported by 56.0% of physicians followed by a poor score (34.0%) and excellent was in 10.0% cases. Based on the grade of scars grade 2 was 34.0% followed by grade 3 (30.0%) and grade I (22.0%). Based on self-evaluation 38.0% of cases reported grade 6 scar followed by grade 3 (36.0%) and grade 5 (26.0%). Whereas in the 3rd setting, the excellent score increases to 26.0% and the grade of score and self-evaluation at the end of sitting improved significantly as compared to the first sitting (p<0.05). Our findings were consistent with the findings of Sundaram G et al [13]

5. Recommendations and Limitations of the Study

The sample size was relatively small. The number of laser sessions was limited to 3. Limited duration of follow-up (only 3 months) as the time for maximum benefit takes at least 6 months.

6. Conclusion

There is a multitude of options for the management of acne scars and treatment needs to be individualized. There is no

magic wand or one-stop quick solution to tackle acne scars. Usually, multiple sittings of multiple modalities are required to produce the best results. FCO₂ has shown efficacy and safety in the management of acne scars and may be used alone or in combination with other therapies. It is a safe and effective choice for acne-scarring patients with minimal discomfort and shorter downtime as compared to traditional CO₂ laser therapy. It is likely to see even more post-treatment improvement with an increase in observation time.

References

- [1] Rathi SK. Acne vulgaris treatment: the current scenario. *Indian J Dermatol* 2011;56(1):7-13.
- [2] Jacob CI, Dover JS, Kaminer MS. Acne scarring: a classification system and review of treatment options. *J Am Acad Dermatol* 2001;45(1):109-17.
- [3] Fabbrocini G, Annunziata MC, D'arco V, Vita VD, Lodi G, Mauriello MC, et al. Acne scars: Pathogenesis, classification and treatment. *Dermatol Res Pract*. 2010;2010:893080.
- [4] Fife D. Practical evaluation and management of atrophic acne scars: Tips for the general dermatologist. *J Clin Aesthet Dermatol*. 2011;4:50.
- [5] Hwang E, Suh D, Lee J. The efficacy and safety of new total combination techniques compared with classic sequential combination therapy with punch, fractional and long-pulsed Er-YAG laser for the treatment of acne scars: P3506. *J Am Acad Dermatol*. 2011; 64.
- [6] Goodman GJ, Baron JA. Postacne scarring—a quantitative global scarring grading system. *J Cosmet Dermatol*. 2006; 5: 48-52.
- [7] Rivera AE. Acne scarring: A review and current treatment modalities. *J Am Acad Dermatol* 2008; 59: 659-76.
- [8] Goodman GJ. Postacne scarring: A review of its pathophysiology and treatment. *Dermatol Surg* 2000;26:857-71
- [9] Manstein D, Herron GS, Sink RK, Tanner H, Anderson RR. Fractional photothermolysis: a new concept for cutaneous remodelling using microscopic patterns of thermal injury. *Lasers Surg Med* 2004;34:426–438
- [10] Nanni CA, Alster TS. Complications of carbon dioxide laser resurfacing. An evaluation of 500 patients. *Dermatol Surg* 1998;24:315–320
- [11] Saeed AHM, Alsaiani SA. The efficacy of fractional CO₂ laser resurfacing in the treatment of facial acne scars. *Int J Med Sci Public Health* 2018;7:630–637.
- [12] Goodman GJ. Postacne scarring: A review of its pathophysiology and treatment. *Dermatol Surg* 2000;26:857-71
- [13] Sundaram G, Vellaisamy SG, Gopalan K, Manickam N. A prospective study on the efficacy and safety of fractional carbon dioxide laser in the treatment of post-acne scars. *Egyptian Journal of Dermatology and Venereology*, 2022;42(2):103-109
- [14] Majid I, Imran S. Fractional CO₂ laser resurfacing as monotherapy in the treatment of atrophic facial acne scars. 2014;7(2):87-92.