

The Role of Fractional CO₂(Carbon Dioxide)Laser in Management of Acne Scars' as Monotherapy

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Abstract:-

Background: Acne scars develop following severe episodes of acne, usually during adolescence. Acne scars can be listed under two main groups: atrophic and hypertrophic. Atrophic scarring is further divided based on morphologic criteria into ice pick', boxcar' and rolling' scars. With the emergence of fractional lasers, depressed acne scars can now be treated effectively.

Aims and objective: The study intends to evaluate the role of fractional CO₂ laser resurfacing in treatment of acne scars in Indian patients (Skin type IV – V) and objectives were to assess the efficacy and side effects of fractional CO₂ laser resurfacing in treatment of acne scars in Indian patients (Skin type IV – V)

Materials and methods: A sum total of 78 patients of age 18 years & above with moderate to severe grade of acne scars were given four sessions of fractional CO₂ laser at 4 weeks interval. At the initial visit and final visit (after 6 months), acne scar scoring was done & photographs were taken. Percentage reduction in acne scar scoring was done at the end of 6 months and response to treatment was graded as poor response (0-25% improvement), good response (26 – 50% improvement), very good response (51 - 75% improvement) and excellent response (75-100% improvement).

Results: Fractional CO₂ laser was done on 78 patients with moderate to severe grade of acne scars. 6 patients were lost to follow up. Excellent results were achieved in 15(21%), very good in 43(60%), good in 12(17%) and poor in 2(3%) patients. Transient acneiform lesions and post-inflammatory hyperpigmentation were seen in 6 and 3 patients respectively. Mild erythema, edema and slight pain were observed in all patients.

Conclusion: Fractional CO₂ laser is a safe and effective option for treatment of acne scars with minimum side effects, which are also reversible.

Keywords:- Acne scars, Fractional CO₂ laser.

I. INTRODUCTION

Acne vulgaris is a common chronic inflammatory disorder of the pilosebaceous unit, mainly seen in adolescents and young adults. Due to high androgenic activity, acne is more severe in males than in females. Acne scars emerge after severe episodes of acne in teenage and early 20s. Acne scar formation can either be due to excessive tissue formation or loss or damage of localized tissue, with the latter being a more common phenomenon. The cutaneous manifestations and severity of acne scars' is directly proportional to the magnitude of inflammatory reaction, extent of damage to underlying tissue, and the time elapsed since the onset of tissue inflammation.¹

Acne Scarring is majorly divided into 2 categories: atrophic and hypertrophic with atrophic scarring being more prevalent than hypertrophic. It is identified by depletion in collagen content locally, clinically, seen as depressions in the skin. Atrophic scars are further classified into various subtypes according to morphological criteria (eg, size, depth) as boxcar' scars, ice pick' scars, and rolling' scars. On the contrary, hypertrophic scarring results from proliferation in collagen content and is seen as raised, smooth, firm lesions.² There are abundant modalities to manage acne scars like chemical peels, dermabrasion, microneedling, subcision, punch excision, radiofrequency, cryotherapy, and lasers.³ Numerous studies have shown an acceptable response to laser skin resurfacing such as Carbon dioxide fractional in treating depressed acne scars.⁴ Fractional CO₂ laser treatment works with a "fractional" approach for resurfacing the skin. This suggests that during each treatment, the laser is used on only a localized fraction of the skin targeted for enhancement. The surrounding area is left unaffected, with a much shorter recovery time post procedure.⁵ Complications of fractional Carbon dioxide laser include infection, pain, dyschromia, contact dermatitis, prolonged erythema, edema, bruises.⁶

II. MATERIALS AND METHODS

Patients with moderate to severe grade of acne scars and older than 18 years of age, attending the Out-patient department of Dermatology, Venereology and Leprosy at Teerthankar Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India from January 2021 to December 2021 were enrolled for the study. An informed consent was taken from the patients.

- **Inclusion criteria:** Patients aged 18 years or more with fresh previously untreated acne scars of moderate grade or higher and willing for procedure & regular follow up were taken.
- **Exclusion criteria:** Patients with active acne, age below 18 years, having mild grades of acne scars, keloidal tendency, pregnant & lactating females, history of post inflammatory hyperpigmentation & any bleeding disorder, treatment with oral isotretinoin for a minimum period of 6 months preceding the procedure were excluded.

III. METHODOLOGY

- **Study Design:** This was an open labelled randomized study carried out in the Outpatient Department of Dermatology, Venereology and Leprosy at TeerthankerMahaveer Medical College & Research Centre on patients with moderate to severe grade of Acne Scars, during the study period of one year. Written and informed consent were also taken from all the patients.
- **Sample Size:** 78 previously untreated patients with moderate to severe grades of acne scar who fulfilled the above criteria were included in the study group.
- **Data collection:** Seventy-eight patients presenting with moderate to severe grade of acne scars were signed up for the study and were followed up for a period of 6 months. Patients were described about the procedure in details and written informed consent was obtained. Then the patients were rigorously evaluated & grading of the acne scars was done by using the Goodman & Baron’s quantitative global acne scarring grading system before & 6 months after the first sitting of the procedure. The patients were explained about the fractional CO₂ laser, the cost factor involved, benefits, duration of the treatment, possible side effects and the prognosis of the treatment. Topical anaesthetic cream (viveta) was applied for 1 hour under occlusion followed by fractional CO₂ laser therapy. Power started from 30% & used accordingly, till vaporization phenomena on skin; Distance: 1-2 mm (distance b/n shots); Repeat: 5 ms (delay b/n shots); Scan mode: sequence was used. Individual morphological type of scar

was treated in a similar manner and the patients were given ice-packs for skin cooling for 5-10 minutes thereafter the procedure has taken place, to look out for post-treatment erythema, edema and burning sensation. The patients were instructed to apply a broad-spectrum sunscreen generously in between the subsequent laser sessions. Photographic documentation keeping uniform camera settings, lighting, and patient positioning were obtained at baseline, before each treatment session, and 2 months after the final treatment session. Adverse effects (if any) and recovery times were noted at each session and visit. The degree of patient's satisfaction with the treatment was also duly recorded at final visit as ‘highly satisfied’, ‘somewhat satisfied’ and ‘not satisfied’.

The percentage improvement was calculated at the end of 6 months and the improvement was graded as:
 Poor response to treatment - < 25% improvement
 Good response to treatment - 25 – 50% improvement
 Very good response to treatment - 51 - 75% improvement
 Excellent response to treatment - > 75% improvement

- **Data Analysis:** Data entered on Microsoft Excel spreadsheet was imported into SPSS version 22 for statistical analysis. Independent Chi-square test was performed to find an association. A *P*-value < 0.05 was considered statistically significant.

IV. OBSERVATIONS & RESULTS

Of the 78 patients, 6 patients dropped out of the study due to lack of follow up. 72 patients completed the study. In a total of 72 patients, there were 39 male (54%) and 33 female (46%) patients. Maximum patients (50%) were in the age group 26-30 years, followed by 34.7% in the age group 21-25 yrs. The mean age of patients was 26.5 years. Most of the patients were educated & belonged to urban areas. In our study acne scars were most commonly seen on the cheeks followed by temples, forehead, chin, nose or perioral.

Types (predominantly)	Number of patient	Percentage (%)
Ice pick scar	8	11.1%
Boxcar	12	16.7%
Rolling	12	16.7%
Mixed	40	55.6%
Total	72	100%

Table 1: Distribution of patients with acne scars’ according to type of scarring:

In our study, most of the patients had predominantly mixed acne scars, followed by boxcar type, rolling type and ice pick type. Statistically significant association was

noticed between sex and pre-treatment acne scarring pattern in the study group. Acne scarring was more fulminant in males as compared to females.

Duration of scar (years)	Excellent improvement	Very good improvement	Good improvement	Poor improvement	TOTAL
<1	12	11	0	0	23
1-5	3	32	10	1	46
>5	0	0	2	1	3
TOTAL	15	43	12	2	72

Table 2: Distribution of acne scar patients according to duration of scar and percentage improvement:

Chi square: 38.9 degree of freedom: 6 p value: < 0.0001

Statistically significant association was noticed in percentage improvement of the scar & duration of scar. Excellent results were mostly seen in scars of duration less than 1 year and very good results were observed in scars of duration 1-5 years.

Response	Number of patient	Percentage (%)
Poor	2	2.8%
Good	12	16.7%
Very good	43	59.7%
Excellent	15	20.8%
Total	72	100%

Table 3: Distribution of acne scar patients according to response to CO₂ laser treatment:

Improvement in average acne scarring grade according to Goodman & Baron’s quantitative global acne scarring grading system was 59.92%. Excellent response was seen in 20.8% patients, very good response in 59.7%, good response in 16.7% poor response in 2.8% patients.

Response	Predominantly rolling scars	Predominantly boxcar scars	Predominantly ice pick scars	Mix type	Total
> 75%	10	3	0	2	15
51-75%	2	7	0	34	43
25-50%	0	1	7	4	12
< 25%	0	1	1	0	2

Table 4: Response shown by different types of scars towards treatment:

Most of the patients with predominantly rolling scars showed excellent improvement whereas mix type and boxcar scars showed very good improvement. Ice pick scars showed very little improvement.

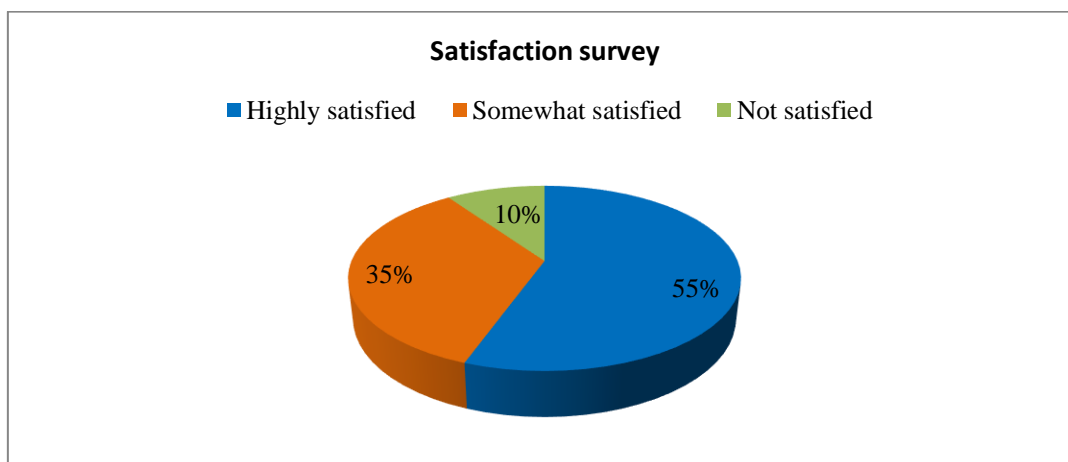


Table 5: Self-assessment satisfaction survey of the patients after 6 months

Out of 72 patients, 40 patients were highly satisfied, 25 patients were somewhat satisfied and 7 patients were not satisfied with the treatment.



Fig. 1(at 0 visit)



Fig. 2 (After 6 month)



Fig:3 (at 0 visit)

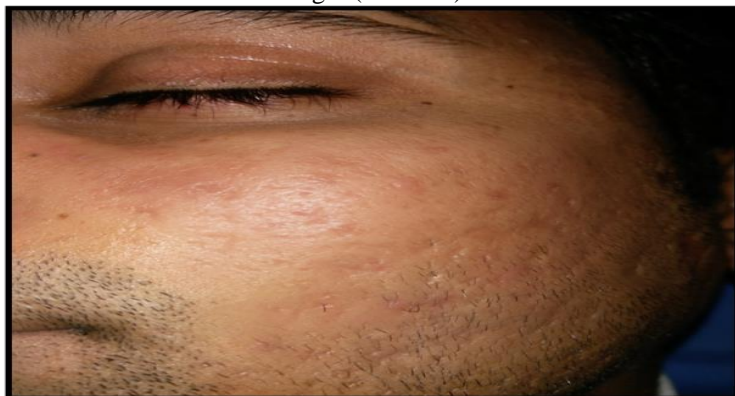


Fig 4 (after 6 months)

Adverse effect: All patients experienced mild pain during the procedure of each session. On follow up after 3 days, edema was still present in 2 patients. After the procedure, erythema developed in all patients. 6 patients came with momentary acneiform lesions post procedure. Post-inflammatory hyperpigmentation emerged in 3 cases. 4 patients complained of excessive oozing.

V. DISCUSSION

Acne scarring has a multiplex pathogenesis, including infra-infundibular inflammatory process, breakdown of the follicle and formation of perifollicular abscess, which in turn stimulates of wound healing. But, healing of the injured tissue encircling the pilosebaceous unit is hindered which induces the emergence of atrophic or hypertrophic acne scars. Laser skin resurfacing has transformed the treatment of atrophic acne scars. Ablative lasers result in destruction of the scar tissue through the process of melting and vaporization. CO₂ laser and Erbium YAG laser are the routinely used for treating the of acne scars. Fractionated CO₂ laser technology has allowed dermatologists to resurface with less complications than non-fractionated ablative laser treatment.

In our study, males outnumbered females which is in accordance with other studies.⁷ But no significant difference in the final scar quality was noticed between males and females. This is in contrary to the study published by **Dao and Kazin** who reported that high levels of estrogen in women as compared to men, help with better wound healing. However, they also assumed that the patient's gender does not always need modification of treatment approach.⁸

A. Clinical efficacy and variable side effects of fractional CO₂ laser resurfacing for acne scars:

Amongst the different types of atrophic scars, the best treatment response was seen with rolling scars whilst ice pick scars' showed the worst response against the treatment, which was comparable to study conducted by **Imran Majid et al**⁹ who found >75% improvement in all of his patients who presented predominantly with rolling type of acne scars and poor response in icepick scars. This observation is of utmost therapeutic importance to conclude that simple fractional laser resurfacing monotherapy is unlikely to take care of icepick scars. Thus, fractional laser resurfacing monotherapy alone would just be as good as placebo, if icepick scars are the predominant scar type in any patient.

In our study, 97.2% patients showed 25 – 85% reduction in acne scars. It was comparable to some studies. In study by **Simin et al**¹⁰ 85% patients showed 30 – 70% reduction in acne scars and in study by **Wajieha Saeed et al**¹¹ 96.7% patients showed 25 – 80% reduction in acne scars which is comparable with our study. Very good to excellent response was accomplished in approximately 81% patients on the grading scale. This percentage is in accordance with the figures labelled in most of the studies on use of CO₂ fractional laser in acne scars. In a study by **Imran Majid et al**¹² good to excellent response was observed in 84% patients and poor response was seen in 16% patients. Since CO₂ laser is an ablative laser used for

the treatment of acne scars, it causes exfoliation of the skin. A nice way to outsmart this problem is to carry out the procedure just before the weekend so that the patients can take off at least for 2 days after the laser sessions. The usual time taken for re-epithelialization in almost all our patients was approximately 2 weeks.

In our study, only 3 (4.2%) patients showed long-term post-inflammatory hyperpigmentation which eventually resolved with topical therapy over a period of 2-3 months. It was comparable to studies conducted by **Graber et al**³² who observed PIH in 2% of their patients. The other minor complications noted in a few patients were momentary acneiform lesions, seen in 6 (8.3%) patients, which was taken care of with oral and topical therapy in a few weeks. This was comparable to a study conducted by **Graber et al**¹³ who observed acneiform eruption in 4.3% cases. 4 patients complained of excessive oozing for which they were advised normal saline soaks while the rest of the treatment was continued. In our study, the average pre-treatment acne scarring grade was 29.64 and after 6 months' post treatment the score reduced by 59.92% to a mean post treatment score of 11.88. We had applied the Goodman and Baron's quantitative acne scarring grading system which though time consuming, was very accurate and reproducible.

Lastly, it is crucial to understand that a standard patient can present with various morphological scar types and grades and it is almost impossible to take care of all the scar types satisfactorily with a single treatment option. However, among all the treatment options available for post-acne scars, fractional photothermolysis is probably the lone monotherapy that offers the highest degree of scar amendment and patient satisfaction.

VI. CONCLUSION

After 4 sessions with CO₂ laser, improvement in severity of acne scarring was approximately 60%. None of the enrolled patients' complaint of any long-term or permanent side effects because of the procedure. By the end of the study period, none of the patients showed complete clearance of the scars. Combination therapies might help to attain a bit better outcome as scars will never disappear completely, just modified.

• **CONFLICTS OF INTEREST:** None

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