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Original Research Article

EFFICACY OF FRACTIONAL CO2 LASER VS COMBINATION OF FRACTIONAL CO2 LASER WITH 50% TCA IN THE TREATMENT OF ATROPHIC ACNE SCARS - A COMPARATIVE STUDY IN A TERTIARY CARE CENTER

Chaduvula Jahnavi[1], Kalagarla Sravani[2], Penugonda N S Sulakshmi Raajitha[3], Pasagadugula Venkata Krishna Rao[4], Pemmaraju Ramana Murty[5]

[1]Assistant Professor, Department of Dermatology, NRI Institute of Medical Sciences, Sangivalasa, Tagarapuvalasa, Visakhapatnam, Andhra Pradesh, India.
[2]Assistant Professor, Department of Dermatology, NRI Institute of Medical Sciences, Sangivalasa, Tagarapuvalasa, Visakhapatnam, Andhra Pradesh, India.
[3]Assistant Professor, Department of Dermatology, NRI Institute of Medical Sciences, Sangivalasa, Tagarapuvalasa, Visakhapatnam, Andhra Pradesh, India.
[4]Professor and HOD, Department of Dermatology, NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam, Andhra Pradesh, India.
[5]Professor, Department of Dermatology, NRI Institute of Medical Sciences, Sangivalasa, Tagarapuvalasa, Visakhapatnam, Andhra Pradesh, India.

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Corresponding Author:
Dr. Kalagarla Sravani,
Assistant Professor, Department of Dermatology, NRI Institute of Medical Sciences, Sangivalasa, Tagarapuvalasa, Visakhapatnam, Andhra Pradesh, India.
Email: sravani.laxmi1993@gmail.com

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ABSTRACT

Background: Acne, the most common skin disease, is a disorder of pilosebaceous units that affects adolescents mainly. Scarring is one of the main sequelae of acne which causes significant psychosocial burden on affected individuals. Acne scars are classified into atrophic and hypertrophic scars, atrophic scars being the most common among the two. Even though many cosmetic procedures are available for treatment of acne scars individually, the review of literature revealed a very meagre number of studies pertaining to combination procedures. Hence the present study of combination therapy was taken up to evaluate the advantage of combined therapy over monotherapy in the treatment of atrophic acne scars.

Materials and Methods: Patients attending the out-patient department of DVL from January 2024 to June 2025 presenting with facial atrophic acne scars were considered for this study. Written consent was taken. Details of symptoms, duration, site involved, type of scars, skin types, evolving dermatosis was recorded. Photographs were taken before and after completion of treatment. Qualitative grading is done before and after treatment. Patients meeting the inclusion criteria were randomly categorized into two treatment groups. Group A: Included only patients on Fractional CO2 laser. Group B: Included Fractional CO2 laser plus 50% TCA CROSS.

Results: Forty patients were recruited after following the inclusion and exclusion criteria. The results were assessed based on 3 parameters-reduction in Goodman and Baron grade, patient assessment, patient satisfaction. There was a statistically significant difference in Goodman and Baron grade reduction, patient satisfaction between both groups.

Conclusion: Fractional Co2 laser gives best results for superficial boxcar and rolling scars. TCA CROSS gives best results for ice pick and deep boxcar scars. Fractional CO2 laser followed by 50% TCA CROSS sequentially as a combination therapy has given excellent results with immense patient satisfaction.

Keywords: Atrophic acne scars, Fractional CO_2 laser, Trichloroacetic acid (TCA), Combination therapy, Acne scar management, Skin resurfacing, Dermatological procedures.

INTRODUCTION

Acne vulgaris is a chronic condition of the pilosebaceous unit.[1] It is multifactorial in origin, most commonly presenting during adolescence but often persisting into adulthood.[2] The global prevalence is estimated at 20%, while in Asia, it is slightly lower at 19.4%.[3] In India, acne predominantly affects individuals aged 18–25 years, with a significantly higher prevalence in females (81.7%).[2,4]

Recent advances have shown its multifactorial pathogenesis. Emerging evidence points to genetic factors, androgen activity, immune responses, and mTORC1 activation influenced by changing lifestyles and western diets as central contributors.

The development of acne scars is driven by complex inflammatory mechanisms that impair extracellular matrix regeneration. Sustained inflammation can hinder fibroblast activity and delay wound healing, leading to collagen degradation.

Common sequelae include facial scarring, postinflammatory erythema (PIE), and postinflammatory hyperpigmentation (PIH), which can often be more distressing than the acne itself.[2,4,6] Severe acne and scarring are frequently associated with a positive family history.[7] An observational study conducted in South India reported scarring in 34% of cases and pigmentation in 40%, with a family history of acne present in 33% of the individuals.[8] The risk of scarring is further increased in patients with skin-picking behaviors or excoriation disorder.[9] Delayed treatment initiation is another key contributor to scarring.[10] As a result, patients with active or unresolved acne frequently experience psychological distress, including depression and negative body image,[11] in view of limited literature available regarding the management of atrophic acne scrs ,we have taken up the present study of the efficacy OF FRACTIONAL CO2 LASER vs COMBINATION OF FRACTIONAL CO2 LASER WITH 50% TCA IN THE TREATMENT OF ATROPHIC ACNE SCARS - A Comparative Study In a Tertiary Care Center.

Several studies were conducted on combination therapies including microneedling and fractional Co2 ablative lasers in combination with modalities like platelet rich plasma,[8] combining microneedling with TCA peel.[9] However, there is a sparse amount of literature on combining TCA cross with fractional co2 laser.

Broadly acne scars are of two types -atrophic, sunken below the skin level and hypertrophic, raised above the skin level Atrophic scars are further classified as -ice-pick,boxcar, rolling scars based on their morphology. Atrophic acne scars, including ice-pick and rolling types, can lead to substantial psychological distress.[3,4]

The ablative laser operates on the principle of selective photothermolysis, with primary chromophore as H20, targeting intradermal water molecules to vaporise scar tissue and stimulate endogenous collagen remodeling. Fractional CO_2 laser resurfacing has been shown to up regulate gene expression related to wound repair, including matrix metalloproteinase-3 (MMP-3), which promotes fibroblast contraction and extracellular matrix reorganisation.[7] Through controlled induction of micro thermal zones within the dermis, fractional CO_2 laser initiates a cascade of wound-healing events that facilitate collagen synthesis and tissue renewal. This biologically mediated remodelling process results in smoother skin contours, decreased scar depth, and marked aesthetic improvement.[6]

The focal application of trichloroacetic acid (TCA) at concentrations ranging from 65% to 100% using the CROSS technique induces selective destruction of scar tissue while stimulating dermal collagen remodeling. Consequently, combination regimens incorporating TCA CROSS with fractional laser therapy or microneedling are increasingly utilized to maximize therapeutic outcomes while minimizing adverse effects.[5]

The current study offers valuable insights into this particular combination therapy and its superior efficacy to fractional co2 alone in the treatment of atrophic acne scars.

MATERIALS AND METHODS

A hospital-based cross-sectional study was conducted in our out-patient department of Dermatology, Venereology and Leprosy at NRI-Institute of Medical Sciences, Anil Neerukonda Hospital, Visakhapatnam from January 2024 to June 2025. Ethical approval was obtained prior to the study from the Institutional Ethical Committee.

A total of 40 patients presenting with facial atrophic acne scars were considered for this study.

Inclusion Criteria

1. All patients attending Dermatology OPD with atrophic acne scars at Anil Neerukonda hospital, Visakhapatnam are included in the study.
2. Patients with Fitzpatrick skin types IV, and V are included in this study.
3. Patient who undertook concurrent or recent isotretinoin therapy are also included in this study.

Exclusion Criteria

1. Patients with keloids, active viral infections especially herpes labials and bacterial infections.
2. Pregnant and Lactating females.
3. Patients with h/o allergies to TCA, patients with h/o photosensitivity were excluded from the study.

Written consent was taken.

Details of symptoms, duration, site involved, type of scars, skin types, previous history, presence of acne was recorded.

Photographs were taken before and at the end of treatment and after 3 months of completion of treatment.

Qualitative grading using Goodman and Baron scaling is done before and after treatment.

Table 1

Grade	Level of Disease	Clinical features
1	Macular	Erythematous,hyper or hypopigmented flatmarks
2	Mild	Mild atrophic or hypertrophic scars may not be obvious at social distance of >50 cm and may be covered adequately by makeup
3	Moderate	Moderate atrophic or hypertrophic scarring is obvious at social distance of >50 cm and not easily covered by makeup,and can be flattened by manual stretching of skin
4	Severe	Severe atrophic or hypertrophic scarring is obvious at social distance of >50 cm and not easily covered by makeup,and cannot be flattened by manual stretching of skin

Patients meeting the inclusion criteria were randomly categorized into two treatment groups:

Group A: Included patients treated with Fractional CO2 laser. Individuals assigned to Group A are treated for 5 sessions with Fractional CO2 laser at monthly intervals.

Group B: Included patients treated with a combination of Fractional CO2 laser along with 50% TCA CROSS.

Individuals assigned to Group B are treated alternatively with a session of Fractional CO2 laser and 50% TCA CROSS fortnightly.

For Group A Fractional CO2 laser from DermaIndia with wavelength of 10600 nm was used.

After degreasing the patient's facial skin with acetone. Thick application of topical anesthesia (EMLA) applied over the treatment area and left for a period of 1 hr.

Topical Anaesthesia was removed with a sterile gauze and acne scars to be treated were identified and marked with a skin marker. Treatment parameters were programmed in the laser system as 15W -18W, based on Fitzpatrick skin type, severity of acne scars, patient tolerance, and the power was slowly increasing in each sitting by 10W in the ablative mode. The procedure was followed for 5 sequential sittings with an interval of 4 weeks between each sitting. Patients are instructed to use physical sunscreen in adequate quantity and non-comedogenic moisturiser as per their requirement throughout the treatment period.

For Group B TCA CROSS and Fractional CO2 Laser, application of 50% trichloroacetic acid (TCA) focally at the base of atrophic scars is known as the chemical reconstruction of skin scars (CROSS) 6 the therapeutic effects of TCA are due to remodeling of dermal elements.[7-9]

The patient was kept in supine position (at an angle of 45) and eyes were covered with a cotton pad. The patient's facial skin was degreased with acetone and 50% TCA was applied with a toothpick to the scar area for one minute. Frosting was taken as the end point. Erythema and edema of surrounding skin was observed after the application.[10]

All the patients were instructed to apply non-comedogenic moisturizer and physical sunscreen after the procedure. After 15 days Fractional CO2 Laser was done for the same patient and the responses were evaluated accordingly.

Physician assessment: Scars were graded based on Goodman and Baron qualitative grading.

According to the physician assessment using Goodman and Baron's qualitative acne scar grading system, scars were graded both before and after the procedure. Only atrophic scars were c onsidered in this study, so all the scars were graded under grades 2,3,4.

A difference of two grades is considered an excellent response and a difference of 1 grade is considered a good response.

Statistical Analysis was done using M.S. Excel and SPSS Version 23.

The difference in the two groups were tested for statistical significance using parametric t –test and categorical variables tested by Chi square test.

P value less than 0.05 considered as statistically significant.

RESULTS

40 Patients with acne scars were recruited and randomly divided into two groups.

In the present study, the age of the patients ranged from 20 to 40 years.16(80%) of people in group A, 14(70%) of people in group B belonged the age range of 20-30 years and the rest 4(20%) in group A ,6 (30%) in group B belonged to the age group of 30-40 years. The commonest age group of patients was between 20 to 30 years in both the groups. The mean age of group A was 11.1 ±5.37 and group B was 12.65 ± 4.6 years.

The study population showed female preponderance (M:F ratio = 2.3:1), constituting 28 (70%) out of 40 cases. The remaining 12 out of 40 (30%) were males.

[Table 2] shows predominantly involved areas of acne scarring in the study population. Cheeks were the predominant site of involvement in both groups constituting 65% (26 out of 40), followed by forehead and cheeks in 8 out of 40 (20%) individuals, mandibular area 4 out of 40 (10%). Scar distribution only over the forehead was the least common type and was found in 2 individuals (5%) of the study population.

[Table 3] demonstrates distribution of scars, among which rolling and ice pick scars were the commonest.

Individuals assigned to Group A are treated with Fractional CO2 laser at monthly intervals for 5 sessions.

Individuals assigned to Group B are treated alternatively with a session of Fractional CO2 laser and 50% TCA CROSS fortnightly.

In the present study, the age of the patients ranged from 20 to 40 years.

The commonest age group of our patients was between 20 to 30 years (75%) in both the groups.

In group A Icepick scar was most common (40%) followed by rolling–icepick scar (25%).

In group B rolling icepick scar (40%) was most common followed by rolling boxscar (30%).

In both the groups most common area of involvement is Cheeks 80% in group A and 50% in group B.

[Table 3] shows physician assesment according to Goodman and Baron grading. Majority of the patients belonged to grade 3 or moderate grade in both groups, i.e,18 out of 40 patients.

The change in Goodman and Baron grade is shown in [Table 4] In group A, excellent change (reduction by 2 grades), is noted in a single patient whereas in group B it was noticed in 3 patients. The p value is 0.20156 and is statistically significant.

[Table 6] shows patient satisfaction.2 patients in group A and 8 patients in group B were very satisified.4 patients in group A and 3 patients in group b were not satisified at all.

Table 2: Distribution of patients according to predominant areas involved

Predominant areas of involvement	Group A	Group B	Total
Cheeks	16	10	26(65%)
Forehead	1	1	2(5%)
Forehead and cheeks	1	7	8(20%)
Mandibular area	2	2	4(10%)

Table 3: physician assessment according to goodman and baron

Grade	Goodman and baron grade	Group A	Group B	
Mild	Grade 2	8	1	9
Moderate	Grade 3	9	9	18
Severe	Grade 4	3	10	13
Total		20	20	40

Table 4: Change in goodman and baron Grade after treatment

	Group A	Group B		X2 test value
Reduction by 1 grade	11	16	29	P=0.20156
Reduction by 2 grades	1	3	5	
No change in grade	8	1	6	
Total	20	20	40	

Table 5: patient assessment (N1 =20, N2= 20)

Grade	Group A	Group B	X2 test values
Poor	1	1	P=2.26 (not significant)
Good	10	6	
Excellent	9	13	
Total	20	20	

Table 6: Patient Satisfaction (N1 =20, N2= 20)

Grade	Group A	Group B	X2 test values
Not satisified	4	1	P=0.451 (significant)
Satisified	14	12	
Very Satisified	2	8	
Total	20	20	

DISCUSSION

In the current study, most common age group for acne scars was 20-30 years and the mean age is 26.85 years. This finding is similar to a study conducted by Yaseen A, et al. Where the mean age for acne scars is 28.49 ± 5.7 years and most patients were in the third decade of life.[1] Mean Duration of acne is 11.88 years.

In the current study females (30 out of 40) (75%) outnumbered male (25%) (10 out of 40) which is concordant with the findings in the study conducted by Saeed and Alsaiari,[10] and Majid and Imran,[11] where females outnumbered males. On the basis of the site of involvement, in the present study cheek was the most common affected site, with 26 out of 40(65%) patients presenting with acne scars on cheeks. This was lower in comparison with the study by Saeed and Alsaiari,[10] in which 95% of patients had involvement of cheeks.

In the present study, a combination of rolling and ice pick(32.5%) (13 out of 40) is the commonest type and the least common type is rolling scars(5%).In a study conducted by Yaseen A, et al,[11] the majority of patients 74 (71%) had mixed type of post-acne scars, 19 (18.2%) had predominantly rolling and boxcar type of scars, whereas 11 (10.5%) had a predominantly ice-pick type of scars.

In the current study, in group A,11 patients showed reduction by 1 grade,1 patients showed reduction by 2 grades, no reduction in lesions is seen in 1 patients. Alster et al,[12] assessed fractional laser therapy in 53 individuals with facial atrophic acne scars, reporting 25%–50% clinical improvement in 91% after one session and 51%–75% improvement in 87% of patients following three treatments at 4 week intervals, with a uniformly mild adverse effect profile across all Fitzpatrick skin types. Walgrave et al,[13] found improvement in 23 of 25 patients with moderate to severe atrophic scars three months after three fractional CO_2 sessions, noting only transient reactions. Manuskiatti et al,[14] documented 25%–50% improvement in scar smoothness and volume in 13 Asian patients, while Hedelund et al,[15] showed significant texture and atrophy gains versus placebo after three monthly fractional CO_2 treatments. Cho et al,[16] reported >50% improvement in 10 and 26%–50% in 7 of 20 Korean patients. Chapas et al,[17] observed 26%–50% improvement in skin texture and atrophy in all participants, without long term or permanent side effects. Side effects in our study include post inflammatory hyperpigmentation (3 out of 40) (7.5%). In a study conducted by, apart from mild and tolerable burning pain, perceived by all cases during treatment session, only a few cases reported other side effects and included transient mild erythema and edema, crusting, and scaling which settled in 2–3 weeks.

In group B,16 patients showed reduction by 1 grade, 3 patients showed reduction by 2 grades, no reduction in lesions is seen in 1 patients. The p value is 0.20156 and is statistically significant.

There is statistically significant difference in the outcomes of patients treated with fractional co2 alone vs patients treated with combination of trichloroacetic acid and fractional co2 laser.

These findings are similar to a study conducted by F. Rastaghi et al,[18] has shown good results in patients with severe Grade 4 and 3 acne scars with 10 (62.5%) patients with Grade 4 scars moving to Grade 2 and 5 (22.7%) patients with Grade 3 scars improving to have no scars at the end of treatment. In a study conducted by Rullan et al,[19] each patient was treated with a combination of three procedures: CROSS, mainly with 88% carbolic acid, blunt bi-level cannula subcision, and microneedling. A total of 139 patients were treated, including 89 (64%) with Fitzpatrick Skin Types IV to VI. Triple approach to treating acne scars resulted in consistent high satisfaction among patients. In a study conducted by Muhammed et al,[20] describe nine patients with the age of 25 to 48 and rolling acne scars (moderate to severe) that were treated with combination therapy using subcision (cannula, 18 gauge) and autologous fibroblast injection was superior to subcision alone.

CONCLUSION

Fractional Co2 laser gives best results for superficial boxcar and rolling scars. TCA CROSS gives best results for ice pick and deep boxcar scars. Fractional CO2 laser followed by 50% TCA CROSS sequentially as a combination therapy has given excellent results with immense patient satisfaction.

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