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Original Research Article

A comparative study of efficacy of resurfacing with fractional carbon dioxide laser versus derma roller in the treatment of post acne scars

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ABSTRACT

Background: Acne vulgaris is a chronic skin disease which can present as non-inflammatory lesions, inflammatory lesions, or a mixture of both, resulting in distressing and difficult to treat scars. The objective of this study is to compare the efficacy of fractional carbon dioxide (CO_2) laser technique (FCLT) versus derma roller therapy (DT) with respect to post-acne scars and to study their respective side effects.
Methods: A total of 200 patients of post acne scars were enrolled for this study from the outpatient Department of Dermatology, Venereology and Leprology, Navodaya Medical College Hospital and Research Centre, Raichur. The patients were randomly allocated into two groups of 100 patients each in which one group was treated with derma roller therapy and the other group was treated with fractional CO_2 laser every 4 weeks over a period of 24 weeks each.
Results: In the derma roller group, 89 patients completed the treatment with 11 drop out cases. The percentage reduction in the mean objective scores was found to be 37.63%. In the fractional CO_2 laser group, 93 patients completed the treatment with 7 drop out cases. The percentage reduction in mean objective scores was found to be 41.22%.
Conclusions: Comparing the efficacy of derma roller therapy and fractional CO_2 laser resurfacing method in the treatment of post acne scars, both the modalities were found to be equally efficacious.

Keywords: Derma roller therapy, Micro-needling, Acne-scars, Carbon dioxide laser, Fractional laser, Ablative laser

INTRODUCTION

Acne vulgaris is a common skin disease presenting as non-inflammatory lesions, inflammatory lesions and varying degrees of scarring, affecting mostly the face but also the back and chest. Acne leads to significant morbidity that is associated with residual scarring and psychological disturbances such as poor self-image, depression, and anxiety, which leads to a negative impact on quality of life.[1] The pathogenesis of acne scars involves injury to the skin which initiates a chain of events leading to wound healing. The wound healing process progresses through 3 stages inflammation, granulation tissue formation, and matrix remodeling.[2,3] The extent of inflammation and tissue damage decides the size and depth of the scars and thus its mode of treatment.[4,5]

Acne scars can be classified into three main categories, depending on whether there is a net loss or gain of collagen atrophic; hypertrophic and keloidal scars respectively. Atrophic scars can be further sub-classified into ice pick; rolling; and box scars. Scar classification is important as it can help guide treatment options.[6]

There are different treatment options that are available for the atrophic scars caused by acne, like chemical peels, microdermabrasion, lasers - non-ablative, ablative lasers, fractional photo thermolysis (FP), pin point irradiation technique, radio-frequency (RF), punch techniques - punch excision, punch elevation, punch replacement grafting, tissue augmenting agents, micro-needling, subcision, combined therapy, stem cell therapy, IPL.

Micro needling was first introduced by Dr. Des Fernandes in Europe who called it as a 'skin needling or percutaneous collagen induction (PCI) in the XII congress of the international society of aesthetic plastic surgery in Paris, France in 1993.

It is the technique of rolling a device comprising a barrel studded with hundreds of needles, which create thousands of micro punctures in the skin to the level of the papillary to mid-dermis.

Of the various ablative fractional lasers, fractional CO_2 laser is the most commonly used. Energy at 10,600 nm wavelength is absorbed by both intracellular and extracellular water, causing rapid heating and vaporization of tissue.[7]

Aim

The study was done to compare and evaluate the efficacy between the two resurfacing treatment modalities in the treatment of atrophic post-acne scars i.e., fractional CO_2 laser versus derma roller therapy (micro needling).

METHODS

This study was performed in accordance with standard clinical guidelines and in compliance with local regulatory requirements. This was a prospective, single centre, randomized, comparative study of efficacy of resurfacing with fractional CO_2 laser versus derma roller therapy in the treatment of post acne scars. An ethical clearance was obtained before starting the study.

Method of collection of data

The study included 200 patients with post acne scars attending the outpatient Department of Dermatology, Venereology and Leprology, Navodaya Medical College Hospital and Research Centre, Raichur. The duration of study was of 18 months (January 2018 to June 2019).

Sample size

A total of 200 patients were enrolled in the study. They were divided into two groups of 100 each. One group was treated with derma roller every four weeks for a period of 24 weeks and the other group was treated with fractional CO_2 laser again every four weeks for a period of 24 weeks. All 200 patients did not complete the treatment.

Inclusion criteria

Inclusion criteria were patients with acne scars under the groupings of a score >3 points on global acne scarring classification scale. Patients who were willing to undergo the procedure. Patients above 18 years.

Exclusion criteria

Exclusion criteria were patients below 18 years. Patients with acne scars under the groupings of a score <3 points on global acne scarring classification scale. Patients with active acne. Patients with active bacterial, viral, or fungal infections in the area to be treated. Patients who has taken isotretinoin within previous 6 months.

Predisposition to keloid formation/hypertrophic scarring. Ongoing ultraviolet exposure or prior radiation therapy to treatment area. Pregnant and lactating mothers. Any serious medical conditions, including diabetes, bleeding diathesis, delayed wound healing, collagen vascular diseases. Patients on corticosteroids or anticoagulants. Patients with unrealistic expectations.

Preparation of the patient

All patients in study underwent a detailed history taking, general physical, systemic and dermatological examination. An objective and subjective baseline assessment was done for each patient using global acne scarring classification (Table 1).

Evaluation

Response to treatment was assessed every 4 weeks during therapy. Final evaluation of area of involvement was done at 4 weeks after completion of therapy i.e. after 28 weeks according to improvement in objective scoring as per quantitative global acne scarring classification.

End point of the study is at 4 weeks from the termination of therapy >76% objective improvement in point score as per global acne scarring grade of the patient whichever is earlier.[8]

Objective assessment

A baseline objective score was calculated for each patient using global acne scarring classification.

Statistical analysis

The statistical analysis of the variables in the study has been performed using the following tests descriptive statistics, frequencies and percentages, independent sample t-test and Chi square test.

Table 1: Global acne scarring classification.

Grade or type	Number of Lesions 1 (1-10)	Number of Lesions 2(11-20)	Number of Lesions 3(>20)
Milder scarring (1 point each)			
Macular/erythematous/pigmented/mildly atrophic/dish-like	1 point	2 points	3 points
Moderate scarring (2 points each)			
Moderately atrophic - dish like	2 point	4 points	6 points
Punched out with shallow bases, small scars (<5 mm)			
Shallow but broad atrophic areas			
Severe scarring (3 points each)			
Punched out with deep but normal bases, small scars (<5 mm)	3 points	6 points	9 points
Punched out with deep but abnormal bases, small scars (<5 mm)			
Linear or troughed dermal scarring			
Deep, broad atrophic areas			
Hyperplastic			
Papular scars	2 points (area <5 mm)	4 points (area 5-20 cm^2)	6 points (area >20 cm^2)
Keloidal/hypertrophic scars	6 points	12 points	18 points

RESULTS

A total of 200 patients of acne scars were enrolled for this study from the outpatient Department of Dermatology, Venereology and Leprology, Navodaya Medical College Hospital and Research Centre, Raichur.

Age of the patients

In case of derma roller treatment, it was seen that the majority of the patients were in the age group of 21 to 25 years and 26 to 30 years comprising 32.6% and 34.8% of each group respectively. Thus, on an aggregate together they made up 67.4% of the total patients in the derma roller group. On the contrary, the least number of patients were in the >35 years age group comprising 2.2%.

Similarly, age analysis of patients who underwent the fractional CO_2 laser resurfacing treatment showed that the majority of the patients belonged to the age group of 26-30 years 39.8%, followed by patients under the age group of 21-25 years 35.5%. Together it comprised 75.3%. This group a had the least number of patients in <20 years age group forming 1.1%.

Gender analysis

The two groups who underwent the derma roller and fractional CO_2 laser resurfacing treatment were analysed for male-female ratio. It was seen that 45% of the patients were male and 55% were females for the derma roller treatment and in the case of fractional CO_2 laser resurfacing treatment the number of females who underwent the treatment was 61.3% as compared to males who were 38.7%.

Response of derma roller and fractional CO_2 laser on scars

The student t-test statistical analysis and chi square test was conducted to compare the number and type of scars before and after treatment with the derma roller and the fractional CO_2 laser resurfacing treatment. Lesions were categorized into severe, moderate, and mild lesions as per the global acne scarring classification system.

Objective assessment

Derma-roller therapy

Out of 100 patients treated with derma roller, 14 patients had satisfactory response i.e. 0-25% improvement in point score, 32 patients had very good response i.e. 51-75% improvement in point score, majority of the patients i.e. 34 patients had good response (26-50% improvement in point score) and 9 patients had an excellent response. There were 11 drop out cases (Table 2).

Table 2: Objective assessment of patients in derma roller group.

DT	Frequency	Percentage
Satisfactory	14	15.73
Good	34	38.20
Very good	32	35.96
Excellent	9	10.11
Total	89	100

Fractional CO_2 laser

Out of 100 patients treated with fractional CO_2 laser, 03 patients had satisfactory response i.e. 0-25% improvement in point score, majority of patients had very good response 41 i.e. 51-75% improvement in point score, 37 patients were in the good response category (26-50% improvement in point score) and 12 patients had excellent results. There were 7 drop out cases (Table 3).

Table 3: Objective assessment of patients in fractional CO_2 laser group.

FCLT	Frequency	Percentage
Satisfactory	3	3.23
Good	37	39.78
Very good	41	44.09
Excellent	12	12.90
Total	93	100.00

Improvement in mean objective scores for derma roller

The objective score was calculated for derma roller therapy, and the results indicated that the baseline mean objective score which was 26.97±1.15 was reduced to 16.82±0.81 after the treatment. This difference was found to be highly significant with p value as 0.000. The reduction in the objective scores was found to be 37.63% (Table 4).

Table 4: Comparing baseline mean objective score with follow up after DT.

Objective score	Mean	SD	SE mean	T value	P value
Baseline	26.97	10.86	1.15	17.833	0.000*
Follow up	16.82	7.66	0.81		
% reduction	37.63				

Improvement in mean objective scores for fractional CO_2 laser

The objective scores for the baseline and follow up after fractional CO_2 laser therapy was evaluated and the results indicated that the mean objective score before treatment was 30.81±0.92 and after treatment, it was 18.11±0.6. This difference was highly significant with t value 21.27 and p value 0.000. The reduction percentage was found to be 41.22% (Table 5).

Comparison of percentage reduction in mean objective score between DT and FCLT

On comparing the difference in percentage reduction in mean objective score between derma roller and fractional CO_2 laser it was not found to be statistically significant (t=-1.215, p=0.226).

Table 5: Comparing baseline mean objective score with follow up after FCLT.

Objective	Mean	SD	SE mean	T value	P value
Baseline	30.81	8.87	0.92	21.271	0.000*
Follow up	18.11	5.81	0.6		
% reduction	41.22				

Objective assessment of individual scars

Severe scars

The severe type scars were compared for improvement before and after derma roller treatment. It was seen that the score for severe scars for derma roller therapy showed a mean value of 14.16±1.1 before and 9.1±0.72 after treatment which was statistically significant with p value 0.000. The percentage reduction was 35.73%.

Similarly, the mean values for fractional CO_2 laser group for severe scars score were 18.19±0.9 before treatment and 10.06±0.54 after treatment which was again statistically significant with p value 0.0. The percentage of reduction in scars was seen to be 44.69%.

On comparing derma roller and fractional CO_2 laser for treatment of severe type of post acne scars, it was seen that the comparative percentages for the reduction being 35.73% for derma roller and 44.69% for fractional CO_2 laser. The difference in percentage reduction between the two treatment modalities was found to be statistically significant (t value=-4.56; p=0.000).

Moderate scars

Similarly, moderate type of scars was also compared for improvement before and after treatment. The score for moderate scars showed a mean value of 10.79±0.22 before treatment and 6.2±0.25 after treatment with the derma roller therapy. The t-value was found to be 23.207 and the p value was 0.000 which is highly significant.

In the fractional CO_2 laser group, the score for moderate scars showed a baseline mean value of 10.58±0.23 before treatment and 6.54±0.23 after treatment (Table 5). This indicates a 38.19% reduction in moderate scars after derma roller therapy, which is statistically significant (t=7.53; p=0.000). On comparing derma roller and fractional CO_2 laser for treatment of moderate type of post acne scars, it was seen that the comparative percentages for the reduction was 42.54% for derma roller and 38.19% for fractional CO2 laser. Again, the difference in percentage reduction between the two treatment modalities was not statistically significant (t value=1.74; p=0.083).

Mild scars

The analysis of the mild scars showed the following results, the mean value of mild scars score for the derma roller therapy was 2.04±0.11 before treatment, and 1.52±0.88 after treatment. T value is 8.804 and p value is 0.000 which is statistically significant. The reduction percentage for mild scars is 25.49%.

Similarly, for fractional CO_2 laser the values for mild scars score were 2.03±0.09 before treatment and 1.48±0.08 after treatment. The reduction percentage for the mild scars with comes out to be 27.09%.

The reduction in the mild scars after treatment with fractional CO_2 laser and derma roller were compared. After fractional CO_2 laser treatment, 27.09% reduction was found in mild scars, whereas derma roller treatment showed a reduction of 25.49% in mild scars. However, the difference in percentage reduction between the two treatment modalities was not statistically significant (t value=-0.309; p=0.758).

Comparison of complications that arise after DT and FCLT

The complications occurring due to derma roller and the fractional CO_2laser treatment were statistically analysed. The complications which were analysed were occurrence of erythema (redness), pain, and hyperpigmentation.

Erythema

The erythema in the post procedure period was seen in 93.3% of patients in derma roller group and in 77.4% of patients in fractional CO2 laser group.

Pain

Patients in the derma roller group experienced comparatively more pain during procedure and immediately post procedure than those in the laser group i.e. 88% of the patients experienced pain in derma roller group and 63.4% patients experienced pain in the laser group.

Hyperpigmentation

Six patients in derma roller and nine patients in fractional CO_2 laser group developed hyperpigmentation post procedure.

Itching

Itching is not seen as a complication in the treatment with derma-roller, but in case of fractional CO_2 laser group, a very small percentage of patients experienced itching a few days after the treatment due to peeling off of the scab that was formed after treatment.

DISCUSSION

Acne vulgaris affects majority of the teenage groups and the most sufferers belong to the age group of 12-24 years.[9] The occurrence of acne reduces after the age of 25 years and the percentage of patients is as low as 8%.[10] It was seen that the majority of the patients were in the age group of 21 to 25 years and 26 to 30 years comprising 67.4% of the total patients in derma roller group. Similarly, in fractional CO2 laser group majority of the patients belonged to the age group of 26-30 years 39.8%, followed by patients under the age group of 21-25 years 35.5%. Similarly, in this study majority of the patients are in the age group of 20-30 years.

It was seen that 45% of the patients were male and 55% were females for the derma-roller treatment and in the case of fractional CO_2 laser resurfacing treatment the number of females who underwent the treatment was 38.7% compared to the males who were 61.3%. The results indicated a higher prevalence of females undergoing treatment for post acne scars than the males.

Studies conducted on the gender distribution of the acne scar treatment among boys and girls indicated a lot of variation. The severity of acne in males is higher than in females in studies conducted by Adhityan and Thapa.[11] Female patients account for two thirds of visits made to dermatologists for acne, and one third of all dermatology office visits for acne are by women who are older than 25 years. Girls with acne are known to show greater levels of anxiety in comparison to the boys though it has known to be unrelated to acne. As compared to men, in general, women have a higher chance of developing major depression, anxiety, and neurotic disorder and might have overall impaired quality of life.[12] They experience more negative body language than boys and are more anxious about their looks and thus feel a greater need for the acne scar treatment than the boys.[13]

Various studies on the efficacy of derma roller and fractional CO_2 laser in treatment of scars have been conducted in the past but very limited data is available on comparison between these two modalities. Both derma roller and fractional CO_2 laser have proven their efficacy in treatment of scars.

A comparative study conducted in 2017 between the two modalities of treatment showed that all patients in Derma roller group improved of which 88% improved by at least one grade and 12% patients showed improvement of the scars by 2 grades in Goodman and Baron qualitative scar grading scale. All the patients in fractional CO_2 laser group showed improvement, of which 80% improved by 1 grade and rest 20% by another 2 grades in Goodman and Baron qualitative scar grading scale.[14]

In this study, on comparing of the efficacy of the derma roller and the fractional CO_2 laser resurfacing treatment significant results have been shown individually. It has

been shown that all types of scars at all stages have been reduced and removed by both the methods. Therefore, both methods were found to be equally effective in overall scar reduction. The percentage reduction achieved by fractional CO_2 laser as compared to derma roller therapy was higher in case of severe scars, the difference was found to be statistically significant. Hence, severe boxcar or rolling type of atrophic scars have been shown to respond better with fractional CO_2 laser. In case of moderate scars though a higher percentage reduction was achieved using derma roller therapy as compared to fractional CO_2 laser, but the difference was not statistically significant. No statistically significant difference was noticed in mild scars as well. The downtime is more in case of fractional CO_2 laser) which was due to the transient dotted pigmentation of the laser lasting for 3-5days as compared to derma roller where erythema lasted upto 1-2 days in majority of the patients. The incidence of complications like pain and hyperpigmentation observed is very low and all the complications seen are temporary and reversible.

CONCLUSION

This study thus concludes that both methods are equally effective in overall scar reduction, but fractional CO2 laser resurfacing method is more effective method for the treatment of severe acne scars than derma roller as indicated by the statistical analysis.

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