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RESEARCH ARTICLE

A COMPARATIVE STUDY ON EFFECTIVENESS OF CO2 LASER + MICRONEEDLING AND CO2 LASERIN PATIENTS WITHACNE SCARS

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Abstract

Introduction: Acne is one of the most common disorders. Quite often, acne results in scar formation due to the preceding inflammation causing either loss or gain of tissue. Ablative CO2 laser resurfacing and microneedling are proven effective modalities for the treatment of acne scarring. However, one out of two techniques is done exclusively in a patient. In the present study we have compared the sequential usage of CO2 laser + Microneedling Versus Only CO2 laser.

Materials and Methods: A total of 50 patients were recruited for the study. 25 patients with moderate-to-severe acne scars underwent one sitting of fractional CO2 laser, followed by Microneedling after 3 weeks to follow the same sequence making total of four sittings over 6 months, while other 25 patients underwent total of four fractional CO2 laser sittings within a gap of 3 weeks each. Outcomes were based on Goodman's Qualitative and Quantitative assessment.

Results: Acne scarring improved significantly in all the 50 patients. Mean scar scores decreased to 9.05% as compared to 58.52% before treatment, decreasing by a mean of 49.47% in Group A, while in Group B, the mean scar scores decreased to 7.45% as compared to 30.20%, decreasing by a mean of 22.75%. Based on quantitative assessment of after treatment reduction of Acne Scars Comparing Group A and Group B. Very good reduction of acne scars was found in 2 (8%) patients in the Group A whereas in the Group B none of the patients had found the very good reduction. Good reduction of Acne scars was found to be in 12 patients (48%) in the Group A, whereas in the Group B was found in the 3 patients (12%), moderate reduction was found in the 10 patients (40%) in the Group A whereas in the group B had found in the 15patients (60%). It was found to be statistically significant association (P value= 0.001). This infers, maximum good reduction was found to be in association with the Group A than Group B. In the Group A, all the 25 patients presented with erythema, edema, needle impression and all the 25 patients in the Group B presented with the erythema respectively

Conclusion: The use of combination therapy of CO2 laser + Microneedling and CO2 laser is more efficacious than CO2 laser alone. This combination present with more or less similar side effects as compared to monotherapy.

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Introduction:-

Acne is one of the most common disorder affecting pilosebaceous units. It is one of the most common causes of facial scarring.Post-acne facial scarring is one of the psychologically devastating conditions and the affected patient invariably suffers from low self-esteem and many other psychological ill-effects, which leads to a negative impact on quality of life.[1]The extent of inflammation and tissue damage to the skin grossly decides the size and depth of the scars and thus makes choice for the mode of treatment.[4,5]Atrophic scars are again sub-classified into ice pick, rolling and box scars. Facial atrophic scars can be resurfaced through the proper use of a high-energy, pulsed or scanned carbon dioxide (CO2) lasers. A recently developed minimally invasive novel technique is microneedling. Microneedles penetrate into skin with minimal injury to epidermis and once within the dermis.[8]Microneedling (Mn) treatment has shown the significant improvement of acne scars, open pores and skin rejuvenation.[9]Hence, the treatment of acne scars with these two modalities, fractional carbon dioxide laser and microneedling is gaining increased impact showing high efficacy in the treatment of scars. However, till date not been compared side by side especially in Indian population. Through this study, we intend to assess the efficacy of fractional carbon dioxide laser+ microneedling versus only fractional carbon dioxide laser that of in the improvement of facial acne scars.

Aims & Objectives:-

To compare effectiveness of CO2 laser + Microneedling and CO2 laser in patients with acne scars
To compare side effects of CO2 laser + Microneedling and CO2 laser in patients with acne scars.

Methodology:-

Study design:
Prospective interventional study

Sampling Technique:
Simple random sampling technique

Study Period:
1st march 2021 to 31st august 2022 (18months)

Sample Size:
50
Group A= 25 (CO2 laser +Microneedling)
Group B = 25 (CO2 laser)

Method Of Data Collection:-

Totally 50 patients (20- 35 years) having atrophic scars, attending the out-patient department at the Department of Dermatology, Venereology and Leprosy at Basaweshwara teaching and general hospital ; attached to Mahadevappa Rampure Medical College, Kalaburagi were alternately allocated into Group-A(fractional CO2 + microneedling group) and Group-B (CO2 group). Approval from institutional ethical committee was obtained and a written informed consent was taken from all the patients before the enrollment. Later, a detailed history of the patients as per the prepared questionnaire was taken. A detailed dermatological examination of the face along with photographs of each patient was taken before and after the procedure with prominence on acne scars.

Group A: Fractional carbon dioxide laser and treatment protocol.
Patients with acne scars had received four sequential fractional carbon dioxide laser (Derma India 771suture RF30)treatment sessions+ Microneeding with an interval of 3 weeks between each session.Before the each of the treatment sessions, over the acne scars EMLA cream (lignocaine 2.5%) was applied and left for the period of 40mins followed by gentle cleansing.

The laser procedures were performed with the following settings.Power: 50%, scanning size: 3mmx3mm to 10mmx 10mm according to the width of the lesion, distance: 1.1mm, duration 2ms, patients were advised to apply broad spectrum sunscreen, emollients and to avoid sun exposure for 48 hours post treatment.

Followed by,
Microneedling treatment protocol

Patients received four sequential microneedling treatment sessions with an interval of about 3 weeks after the CO2 Laser treatment. Micro needling was performed with sterile needles of depth 2mm in crisscross pattern. Patient was prescribed topical anti- biotic application for complete three days and sun protection. Patients with predominantly ice pick scars and mixed scarring were given needle depth of 2.5mm.

This procedure was continued with the interval of 3 weeks each between each of the settings.

Group B: Fractional carbon dioxide laser treatment protocol.
Patients with acne scars had received four sequential fractional carbon dioxide laser (Derma India 2future).
The procedure area was then painted with povidine iodine and cleaned with the disinfectant (isopropyl alcohol) using sterile precautions and eye shields were placed to protect the eyes.

In each session, Before the each of the treatment sessions, over the acne scars EMLA cream (lignocaine 2.5%) was applied and left for the period of 40mins followed by gentle cleansing.

The laser procedures were performed with the following settings Power: 50%, scanning size: 3mmx3mm to 10mmx 10mm according to the width of the lesion, distance: 1.1mm, duration 2ms.

At initial visit (week 0) facial acne scars were graded based on Goodman and Baron's qualitative acne scar grading system. Later, objectives assessment of physician scores of improvement was determined by Goodman and Baron's qualitative and quantitative acne scar grading system side by side comparison of pre operative and post-operative photographs taken at their first visit and at the end of 1month after the last session (4 sessions).

Patients were assessed for side effects such as erythema, edema, pain, bleeding, and post inflammatoryhyperpigmentation.

Photograph 10:- Pre and post treatment photographs of CO2 Laser+Microneedlingpatients.


Before
After
Before
After
Before
After

Photograph 10:- Pre and post treatment photographs of CO2 laser.

Results table:-

1Distribution of patients based on Skin type

Out of 25patients, maximum number of patients had the Skin type IV in the Group A and Group B.

2. Distribution of patients based on AS Site

In the Group A, all the 25 patients had the B/L cheek site acne. Maximum number of patients had R & L cheeks affected acne sites i.e, 88%**.**

3.Distribution of patients based on Type of Scar

All the patients in both the groups had the Rolling, Box and IP scars.

4. Distribution of patients based on Depth

All the 25 patients in the Group A had superficial to deep acne and all the other 25 patients had the superficial to medium depth among Group B.

5.Distribution of patients based on number of sitting

Maximum number of patients based on number of settings had completed with the 4 settings in both the Groups A and B i.e, 84% in both the groups respectively.

6.Distribution of patients based on Complications

Complications		**Group A**	**Group B**
Erythema	**Present**	**25 (100%)**	**25 (100%)**
	Absent	**0**	**0**

Edema	**Present**	**25 (100%)**	**10 (40%)**
	Absent	**0**	**15 (60%)**
Needle impression	**Present**	**25 (100%)**	**0**
	Absent	**0**	**25 (100%)**
Hyperpigmentation	**Present**	**10 (40%)**	**9 (36%)**
	Absent	**15 (60%)**	**16 (64%)**
Infection	**Present**	**0**	**0**
	Absent	**25 (100%)**	**25(100%)**
Total		**25 (100%)**	**25 (100%)**

In the Group A, all the 25 patients presented with erythema, edema, needle impression and all the 25 patients in the Group B presented with the erythema respectively.

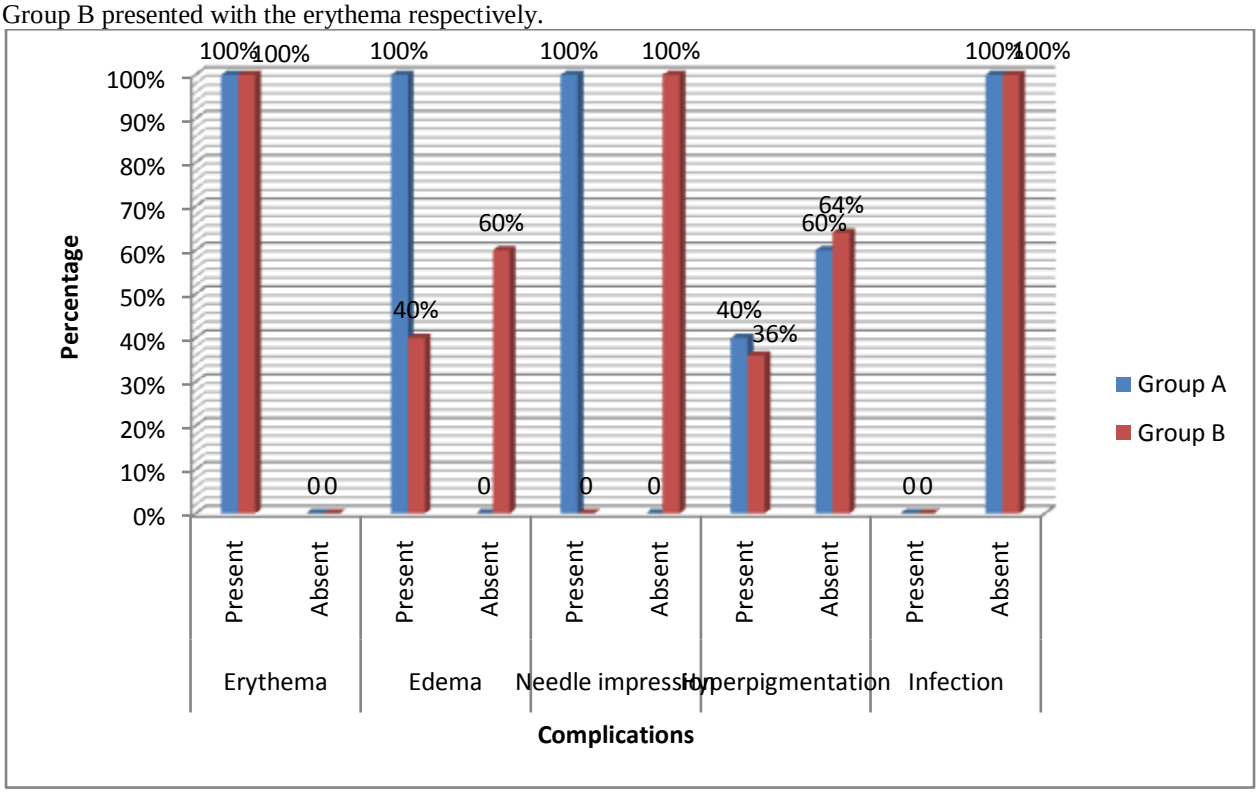
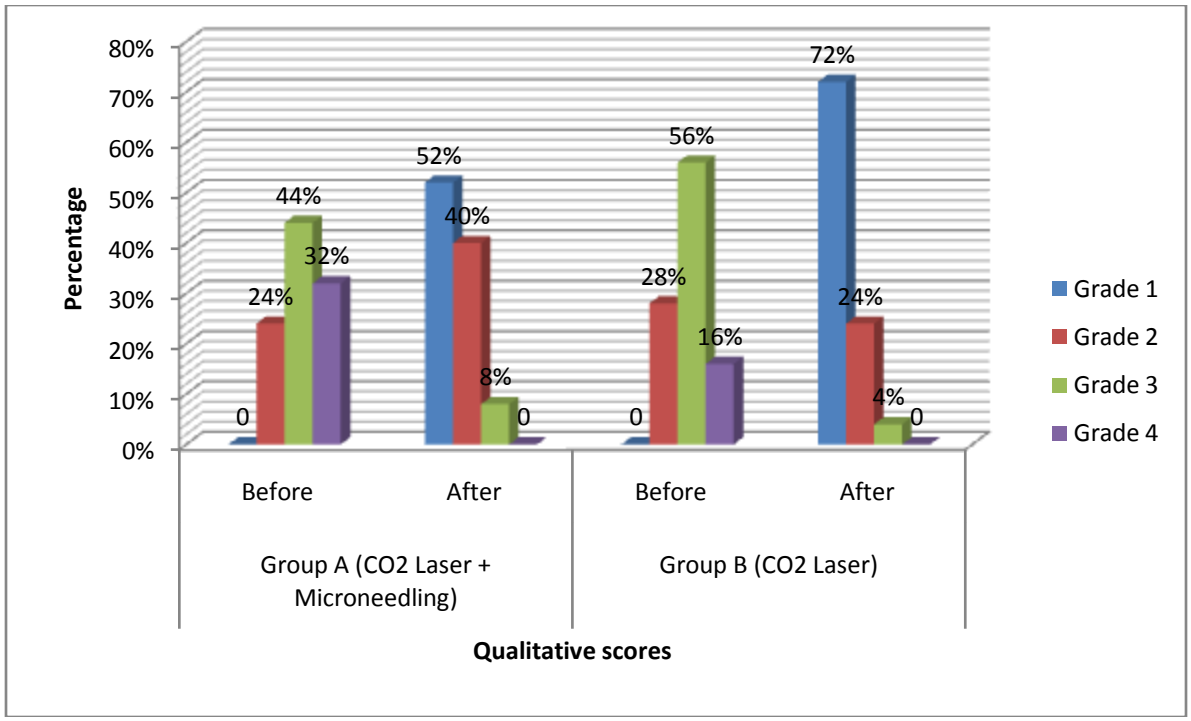


Table 7:- Goodman and barons Qualitative assessment of treatment reduction of Scars Comparing Group A and Group B.

Qualitative scores	**Group A (CO2 Laser + Microneedling)**		**Group B (CO2 Laser)**	
	Before	**After**	**Before**	**After**
Grade 1	**0**	**13 (52%)**	**0**	**18 (72%)**
Grade 2	**6 (24%)**	**10 (40%)**	**7 (28%)**	**6 (24%)**
Grade 3	**11 (44%)**	**2 (8%)**	**14 (56%)**	**1 (4%)**
Grade 4	**8 (32%)**	**0**	**4 (16%)**	**0**
Total	**25 (100%)**	**25 (100%)**	**25 (100%)**	**25 (100%)**

Based on Goodman and baron's qualitative assessment, in the Group A before the treatment maximum number of patients were found in the Grade 3 i.e, 11patients (44%), followed by Grade 4 i.e, 8patients (32%) and Grade 2 i.e, 6patients (24%). Whereas after the treatment maximum number of patients reduced from Grade 3 to Grade 1 i.e, 13 patients (52%), followed by Grade 2 i.e, 10 patients (40%) and Grade 3 i.e, 2 patients (8%).

In the Group B, before the treatment maximum number of 14 patients (56%) was found in the Grade 3, followed by 7 patients (28%), 4patients (16%). Whereas after the treatment maximum number of patients was found to be reduced to Grade 1 i.e, 18 patients (72%), followed by grade 2 i.e, 6 patients (24%) and 1patient



Graph 8:- Goodman and barons Qualitative assessment of treatment reduction of Scars Comparing Group A and Group B.

Table 9:- Comparison of Mean scores between the Groups.

	Before Treatment	After Treatment	% Improvement	P value
Group A	**58.52±16.71**	**9.05±10.92**	**49.47±5.79**	**0.001***
Group B	**30.20±18.77**	**7.45±15.10**	**22.75±3.67**	**0.001***

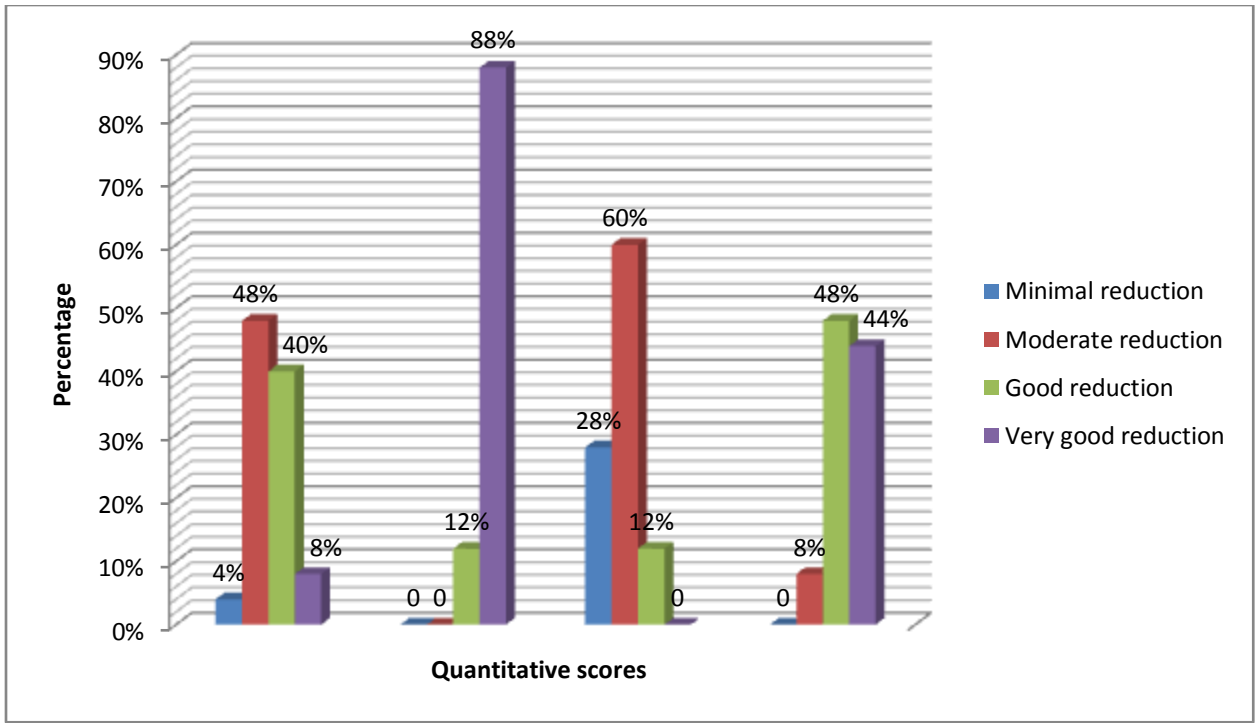
The mean score of % improvement in the Group A was higher (49.47±5.79) compared to that of Group B (22.75±3.67). Both the groups were found to be having statistically significant association.

Goodman and barons Quantitative assessment of before and after treatment reduction of Scars Comparing Group A and Group B

Quantitative scores	Group A (CO2 Laser + Microneedling)	Group B (CO2 Laser)
Minimal reduction	**1 (4%)**	**7 (28%)**
Moderate reduction	**10 (40%)**	**15 (60%)**
Good reduction	**12 (48%)**	**3 (12%)**
Very good reduction	**2 (8%)**	**0**
Total	**25 (100%)**	**25 (100%)**

P value= 0.001

Based on quantitative assessment of after treatment reduction of Acne Scars Comparing Group A and Group B.Very good reduction of acne scars was found in 2 (8%) patients in the Group A whereas in the Group B none of the patients had found the very good reduction. Good reduction of Acne scars was found to be in 12 patients (48%) in the Group A, whereas in the Group B was found in the 3 patients (12%), moderate reduction was found in the 10 patients (40%) in the Group A whereas in the group B had found in the 15patients (60%). It was found to be statistically significant association (P value= 0.001). This infers, maximum good reduction was found to be in association with the Group A than Group B.



Graph 10:- Goodman and barons Qualitative assessment of before and after treatment reduction of Scars Comparing Group A and Group B.

Discussion:-

The present study "A Comparative study on effectiveness of CO2 laser + Microneedling and CO2 Laser in patients with Acne Scars was a Prospective interventional study carried out in the Department of Dermatology, Venereology and Leprosy at Basaweshwra teaching and general hospital; attached to Mahadevappa Rampure Medical College, Kalaburagi. We have included 50 patients, their age from (20- 35 years) having atrophic scars, attending the out-patient departmentand were selected on the basis of Simple random sampling technique. Later, they were alternately allocated into Group-A(fractional CO2 group+ Microneedling) and Group-B (CO2 Laser alone group).

Group A: CO 2 Laser+ Microneedling

In the present study had found that, based on quantitative assessment of after treatment reduction of Acne Scars . Very good reduction of acne scars was found in 2 (8%) patients , Good reduction of Acne scars was found to be in 12 patients (48%) , moderate reduction was found in the 10 patients (40%).The mean score improvement after the 4 settings of treatment was found to be 49.47±10.92. It was found to be statistically significant association (P value= 0.001). This infers, maximum good reduction was found to be in association with the Group A than Group B. In contrast to the present study results Jawade SA et al[56], study had found that In Group A, patients statistically significant improvement (54%) in acne scars at the end of the 4th sitting follow-up .Mean patients' subjective score was recorded as 2, which represents a good improvement (25%– 50%) in Group A, while it was recorded as 1, representing mild improvement (0%–25%) in Group B.

Group B: Fractional carbon dioxide laser

In the present study found that , based on Goodman and Baron's qualitative assessment, showed 2(8%) of the patients showed reduction of acne scars by 3 grades, followed by 10 (40%) of the patients showed reduction by 2 grades and 13 (52%) of the patients showed reduction by 1 grade respectively. Whereas in the Reddy KY et al[50], study by the end of one month after the last session based on Goodman and Baron's qualitative assessment, 2 (13.33%) patients showed reduction by 3 grades,9 (60%) patients showed reduction of scars by 2 grades, 4 (26.66%) patients showed reduction by 1 grade.

Goodman and Baron's Quantitative assessment showed that, majority of the patients 22 (88%) showed very good reduction of acne scars and remaining 3(12%) patients showed good reduction.Whereas in the Reddy KY et al[50]

study showed, based on the Goodman and Baron's Quantitative assessment revealed that,2 (13.3%) patients had very good reduction, followed by 4 (26.7%) patients had good reduction and 33.3% (5) patients had moderate reduction and 26.7% (4) patients showed minimal reduction.

In the present study, we had compared sequential CO2 laser with microneedling in Group A versus CO2 alone in Group B. We had found much improvement in using the sequential CO2 Laser+ Microneedling therapy than only CO2 laser. Many researchers have been done to prove this result, while in 1994 Orentreich has described the use of a micro needling on skin releases fibrous strands thus, it results in depressed cutaneous scars and wrinkles.[47] In using dermaroller, mini wounds are created by micropuncturing the dermis by a drum-shaped roller with protruding needles[48] of different sizes ranging from 0.5 mm to 2 mm. Thus, it creates wounds in the papillary dermis without affecting the epidermis except for creating tiny punctures in the stratum corneum layer, which heals up very rapidly [48] with the augmentation of extracellular matrix proteins.[47] Later, it causes breakage of the damaged collagen and induction of new collagen. Thus, helping in skin scarring reduction [48].

Along with the micro punctures generation, which causes absorption of the topical creams.[49] It causes normal wound healing, and collagen formation in the dermis takes for about 12–18 months in the remodeling stage.[47]Microneedling causes minimal side effects.[49] According to an Imran Majid study[55], the response to the dermaroller was graded good in 72% of patients. In this study, the combination of CO2 laser and microneedling showed better results as compared to Majid and Imran study[55]

Even the Fractional resurfacing (CO2 laser) shows effective results in scar reduction.[55] It focuses only on a fraction of affected scar, leaving behind the areas of skin which is not treated. These areas are left behind and not treated with laser, which inturn helps in re-epithelialization, thus minimizing side effects.[55] It does not damage the epidermis. As fractional laser targets part of the skin, surrounding normal skin causes fast healing, thus causing less side effects.

The risks associated are its chances of erythema lasting for weeks to months, oozing and crusting, and post inflammatory pigmentation, especially in darker skin, thus limiting its use. In a study on Asian patients by Sung Bin Cho et al., 50% of his patients showed >50% clinical improvement after fractional

CO2 resurfacing.[3] In the present study, the combination of CO2 laser and microneeding showed 49.47% improvement in mean score as compared to 22.75% improvement in CO2 laser alone. This proved that when both these procedures are combined and further alternatively used, they can result in an adjuvant effect by remodeling collagen done by microneedling with surface resurfacing induced by CO2 laser.

Limitations

This study has few limitations-

Sample size was small. Hence, it is hindering the generalizability of this study to local population.

Conclusion:-

1. Acne scarring significantly improved in all the patients. Both the groups are found to be effective.
2. The use of combination therapy of CO2 laser +microneedling is more efficacious than CO2 laser alone.
3. This combination present with more or less similar side effects as compared to monotherapy

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