Section A -Research paper
ISSN 2063-5346

Comparative study of Fractional carbon dioxide with Dermaroller in post acne scars

Madhumitha Muthu1, Monisha B. Muthu2, Monisha B. Muthu2

1Associate Professor, Department of Skin & STD, Karpagam Faculty of Medical Sciences & Research, Coimbatore, Tamil Nadu, India
2Assistant Professor, Department of Skin & STD, Vinayaka Mission's Kirupananda Variyar Medical College, Salem, Tamil Nadu, India

Corresponding Author: Monisha B. Muthu,

ABSTRACT

Background: 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. 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.

Materials and methods: A total of 60 patients (18-40 years) having atrophic scars, attending the out-patient department at the Department of Dermatology, Venereology and Leprosy, Tertiary care Teaching Hospital over a period of 1 year were alternately allocated into group-A and group-B. Approval had obtained from institutional ethical committee and a written informed consent was taken from all the patients before enrolling them in the study. 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 emphasis on acne scars. Patients of acne scars between the age group of 21–35 years with Fitzpatrick's skin Type III, IV or V were enrolled into the study. The acne severity scales used were Lipper and Perez used to measure acne severity scores.

Result: A total of 60 patients were enrolled in the study, which was equally distributed with no statistical differences in terms of type and severity of acne scars. In Group A, patients showed statistically significant improvement in acne scars at the end of the 4th sitting follow-up. In Group B, patients showed 46.9% improvement in acne scars after 4^{th} sitting follow‑up with statistical significance. 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 patients had significant improvement in acne scars as compared to Group A with P = 0.01.

Conclusion: The use of combination therapy of microneedling and CO_2 laser is more efficacious than CO_2 laser alone. This combination present with more or less similar side effects as compared to monotherapy. Successfully combining fractional CO_2 laser with dermaroller constitutes a safe and extremely effective treatment modality for acne scarring.

Keywords: Acne Scars, CO2 Laser, Microneedling.

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] The extent of inflammation and tissue damage decides the size and depth of the scars and thus its mode of treatment. [3]

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. [4]

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. [5] 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. [6] 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 CO2 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]

MATERIALS AND METHODS

A total of 60 patients (18-40 years) having atrophic scars, attending the out-patient department at the Department of Dermatology, Venereology and Leprosy, Tertiary care Teaching Hospital over a period of 1 year were alternately allocated into group-A and group-B. Approval had obtained from institutional ethical committee and a written informed consent was taken from all the patients before enrolling them in the study. 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 emphasis on acne scars.

Patients of acne scars between the age group of 21–35 years with Fitzpatrick's skin Type III, IV or V were enrolled into the study. The acne severity scales used were Lipper and Perez used to measure acne severity scores. Patient satisfaction rate was measured separately on a 4 point scale. 0%–25% improvement was considered mild, 26%–50% improvement as good improvement, 51%–75% considered a significant improvement, and more than 75% improvement was considered as marked improvement.

Patients with history of photosensitive disorders like lupus erythematosus, dermatomyositis, or history of active infections like Herpes type I or II. Pregnant and lactating women and patients with history with scar formation, keloid and vitiligo are excluded from the study.

Patients who were on anti-coagulants, anti-platelet therapy, immunosuppressive drugs, patients with platelet disorders and patients who have received treatment with ablative or non-ablative lasers in the last 12 months were not considered for the study.

In Group A, patients were treated with fractional CO2 laser with 18 W power and spot distance of 0.5 mm for 1.5 ms pulse duration with double pass. This was followed up by a dermaroller of 1.5 mm needle with 15–20 passes in three directions till pinpoint bleeding in the next sitting after 6-week interval. The same sequence was followed in subsequent sittings of CO2 laser, followed by dermaroller at 6 weeks of interval making total of four sittings in the period of 6 months. In Group B, patients were treated with fractional CO2 laser with 18 W power and spot distance of 0.5 mm for 1.5 ms pulse duration with double pass. Total of four sittings were done 6 weeks apart. Digital photographs were taken before treatment and on each follow-up of 6 weeks.

Statistical Analysis

Data was collected and entered in Microsoft excel 2016 and was analysed using SPSS 25.0 Data was presented in the form of percentages, mean and standard deviation. Chi square test and t test were used wherever necessary. p value <0.05 was considered as significant at 95% confidence interval.

RESULTS

A total of 60 patients were enrolled in the study, which was equally distributed with no statistical differences in terms of type and severity of acne scars [Table 1].

Table 1: Demographic data

Gender	Group A		Group B		Total
	Frequency	Percentage	Frequency	Percentage	
Males	14	46.6	12	**40**	**16**
Females	16	53.3	18	**60**	**34**
Average age	29±5.98		28.34±5.48		

Table 2: Improvement in acne scarring scores (Lipper Parez's score)

	Before TT	After TT	*P* value in groups	*P* value between groups
Group A	82.77±15.63	36.38±5.20	0.01	0.01
Group B	78.5±6.8	42.7±3.7	0.02	

In Group A, patients showed statistically significant improvement (56.9%) in acne scars at the end of the 4th sitting follow-up. In Group B, patients showed 46.7% improvement in acne scars after 4th sitting follow- up with statistical significance [Table 2].

Table 3: Fitzpatrick's skin Type between Group A and Group B

Fitzpatrick's skin type	**Group A**		**Group B**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
III	2	6.6	1	3.3
IV	19	63.3	21	70
V	9	30	8	26.6
Total	30	100	30	100

Table 4: Type of Scars between Group A and Group B

Type of Scars	**Group A**		**Group B**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Rolling	16	53.4	17	56.6
Ice Pick	3	10.0	4	13.4
Boxcar	11	36.6	9	30.0
Total	30	100	30	100

Table 5: Patient subjective score after treatment between Group A and Group B

Patient subjective score	**Group A**		**Group B**	
	Mean	**SD**	**Mean**	**SD**
	1.98	0.6	1.13	0.5
p-value	0.01			

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 patients had significant improvement in acne scars as compared to Group A with P = 0.01.

DISCUSSION

Acne scarring occurs subsequent to visible resolution of deep inflammation. Scarring may occur regardless of the severity of acne. Although, acne scarring is likely to be associated more often with nodulocystic acne, it may occur in cases with only superficial forms of acne as well, especially when effective treatment is delayed. A study showed that approximately 16% of patients with acne seek proper treatment and among those seeking such help, 74% wait greater than 12 months, 12% wait for 6 to 12 months, 6% wait for 6 months and only 7% wait for less than 3 months to be seen professionally for therapy of their acne. [8]

Here, in this study, we are comparing sequential CO_2 laser with dermaroller in Group A versus CO_2 alone in Group B. Orentreich described the use of a skin needling to release fibrous strands responsible for depressed cutaneous scars and wrinkles in 1994. [9] In dermaroller, mini wounds are created by micropuncturing the dermis by a drum-shaped roller with protruding needles of different sizes ranging from 0.5 mm to 2 mm. [10] It creates these wounds in the papillary dermis without affecting the epidermis except for creating tiny punctures in the stratum corneum layer, which heals rapidly with the enhancement of extracellular matrix proteins. [11] It causes breakage of damaged collagen and induction of new collagen, helping in skin scarring reduction along with the generation of micro punctures, which causes absorption of topical creams. [12] It causes normal wound healing, which causes collagen formation in the dermis over 12–18 months in the remodeling stage. [13] Microneedling causes minimal side effects. [14] According to an Imran Majid study, the response was graded good to the dermaroller in 72% of patients. In this study, the combination of CO_2 laser and dermaroller showed better results as compared to Majid and Imran study. [15]

Fractional resurfacing (CO_2 laser) shows effective results in scar reduction. [16] It focuses only on a fraction of affected, leaving behind areas of skin untreated. These areas are left behind and not treated with laser, which helps in re-epithelialization, thus minimizing side effects. [17] It does not damage the epidermis. As fractional laser targets parts of the

skin, surrounding normal skin causes rapid healing, thus causing less side effects. The risks associated are its chances of erythema lasting for weeks to months, oozing and crusting, and postinflammatory 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 CO_2 resurfacing. [18]

In the present study, the combination of CO_2 laser and dermaroller showed 56.9% improvement in Lepper and parez's acne scar severity score as compared to 46.7% improvement in CO_2 laser alone. This proved that when both these procedures are combined and further alternatively done, they cause an adjuvant effect by remodeling collagen done by microneedling with surface resurfacing induced by CO_2 laser. Patients were more satisfied with treatment in Group A showing patient subjective score 2 (good improvement) as compared to a score of 1 (mild improvement) in Group B. In mild/moderate atrophic scars, monotherapy of laser resurfacing, microneedling, or their combinations are used. In ice-pick scars/box scars, subcision, punch-excision, focal CO_2 microneedling can be used as monotherapy or in their various combinations. [19] Combination of various treatment modalities gives better results than monotherapy alone, as shown by the above study.

CONCLUSION

It is important to realize that 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 and multiple techniques are required. However, of all the treatment options available to treat postacne scars, fractional photothermolysis is probably the only monotherapy that offers the highest degree of scar amelioration and patient satisfaction. Considering the recovery time, adverse effects and outcome, fractional CO2 laser can be an alternative treatment technique for acne scar. In summary, Dermaroller is a simple, inexpensive office method of treatment for management of facial acne scars with relatively less downtime and fewer complications as compared to fractional CO2 laser with larger downtime with severe complications of post-inflammatory hyperpigmentation. It would be difficult to conclude considering the small sample size of the study, there is a need to have a large sample-sized study with a relatively long-term follow up of the patients focusing different types of scars and duration.

REFERENCES

1. Petrov A, Pljakovska V. Fractional carbon dioxide laser in treatment of acne scars. Open Access Maced J Med Sci 2016;4(1):38-42.
2. Aust MC, Fernandes D, Kolokythas P, et al. Percutaneous collagen induction therapy: an alternative treatment for scars, wrinkles and skin laxity. Plast Reconstr Surg 2008;121(4):1421-1429.
3. Fernandes D, Signorini M. Combating photoaging with percutaneous collagen induction. Clin Dermatol 2008;26(2):192-199.
4. Layton AM, Eady EA, Zouboulis CC. Acne. In: Griffiths C, Barker J, Bleiker T, Chalmers R, Creamer D, editors. Rook's Textbook of Dermatology. 9th ed. Oxford: Wiley Blackwell; 2016. p. 90.1‐65.
5. Vaishampayan S, Baveja S, Garg S. Acne, Rosacea and perioral dermatitis. In: Sacchidan and S, Oberai C, Inamdar AC, editors. IADVL Text Book of Dermatology. 4rd ed. Mumbai: Bhalani Publishing House; 2015. p. 1365‐412.
6. Leyden JJ. Understanding and reducing the risk for acne scarring. Semin Cutan Med Surg 2015;34:S89‐91.
7. Hayashi N, Miyachi Y, Kawashima M. Prevalence of scars and AND "mini‐scars" AND, and their impact on quality of life in Japanese patients with acne. J Dermatol. 2015;42:690‐6.
8. Tan J, Kang S, Leyden J. Prevalence and risk factors of acne scarring among patients consulting dermatologists in the Unites States. J Drugs Dermatol 2017;16:97‐102.
9. Leo MS, Kumar AS, Kirit R, Konathan R, Sivamani RK. Systematic review of the use of platelet‐rich plasma in aesthetic dermatology. J CosmetDermatol. 2015;14:315‐23.
10. Goodman GJ, Baron JA. Postacne scarring‐ a quantitative global scarring grading system.J Cosmet Dermatol 2006;5:48‐52.
11. Goodman GJ, Baron JA. Postacne scarring: A qualitative global scarring grading system. Dermatol Surg 2006;32:1458‐66.
12. Chuah SY, Goh CL. The impact of post-acne scars on the quality of life among young adults in Singapore. J Cutan Aesthet Surg 2015;8:153-8.
13. Garg S, Baveja S. Combination therapy in the management of atrophic acne scars. J Cutan Aesthet Surg 2014;7:18-23.
14. Majid I, Imran S. Fractional CO2 laser resurfacing as monotherapy in the treatment of atrophic facial acne scars. J Cutan Aesthet Surg 2014;7:87-92.
15. Kubba R, Bajaj AK, Thappa DM, Sharma R, Vedamurthy M, Dhar S, et al. Acne in India: Guidelines for management – IAA consensus document. Indian J Dermatol Venereol Leprol 2009;75 Suppl 1:1-62.

16. Fabbrocini G, Annunziata MC, D'Arco V, De Vita V, Lodi G, Mauriello MC, et al. Acne scars: Pathogenesis, classification and treatment. Dermatol Res Pract 2010;2010:893080.
17. Chandrashekar BS, Sriram R, Mysore R, Bhaskar S, Shetty A. Evaluation of microneedling fractional radiofrequency device for treatment of acne scars. J Cutan Aesthet Surg 2014;7:93-7.
18. Taub AF. The treatment of acne scars, a 30-year journey. Am J Clin Dermatol 2019;20:683-90.
19. Porwal S, Chahar YS, Singh PK. A comparative study of combined dermaroller and platelet-rich plasma versus dermaroller alone in acne scars and assessment of quality of life before and after treatment. Indian J Dermatol 2018;63:403-8.