



## **A Comparative Study of Efficacy of Resurfacing with Fractional Carbon Dioxide Laser versus Microneedling Combined with Platelet Rich Plasma in The Treatment of Post Acne Scars in Tertiary Healthcare Centre, Uttar Pradesh**

<sup>1</sup>Hiteshwar Singh Kalsi, Junior Resident, Department of D.V.L, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India

<sup>2</sup>Sachin Agarwal, Professor and HOD, Department of D.V.L, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India

<sup>3</sup>Mohini Yadav, Junior Resident, Department of D.V.L, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India

<sup>4</sup>Harman Walia, Junior Resident, Department of D.V.L, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India

**Corresponding Author:** Hiteshwar Singh Kalsi, Junior Resident, Department of D.V.L, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India

**How to citation this article:** Hiteshwar Singh Kalsi, Sachin Agarwal, Mohini Yadav, Harman Walia, “A Comparative Study of Efficacy of Resurfacing with Fractional Carbon Dioxide Laser versus Microneedling Combined with Platelet Rich Plasma in The Treatment of Post Acne Scars in Tertiary Healthcare Centre, Uttar Pradesh”, IJMACR- December - 2024, Volume – 7, Issue - 6, P. No. 63 – 71.

**Open Access Article:** © 2024 Hiteshwar Singh Kalsi, et al. This is an open access journal and article distributed under the terms of the creative common’s attribution license (<http://creativecommons.org/licenses/by/4.0>). Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

### **Abstract**

**Introduction:** Acne vulgaris is a persistent skin condition causing inflammation of the pilosebaceous unit and potentially leading to scarring, which poses significant health risks including disfigurement and psychological issues. Thus, prompt and effective treatment of post-acne scars is essential.

**Objectives:** To evaluate the effectiveness of Fractional Carbon Dioxide Laser resurfacing and Microneedling combined with Platelet Rich Plasma (PRP) for treating

post acne scars, and to compare the outcomes of both treatments.

**Methods:** This 24-month prospective and comparative study on 110 cases of post acne scars, evenly divided into two groups of 55 each was conducted at Saraswathi Institute of Medical Sciences and Hospital, Hapur. One group received treatment with Microneedling with Platelet Rich Plasma (PRP), while the other received treatment with Fractional Carbon Dioxide Laser, aiming to compare their efficacy in scar reduction. Follow-up

assessments every four weeks after treatment sessions using patient photographs and clinical evaluations were done to measure treatment effectiveness, ending either four weeks post-treatment or upon achieving a 76% improvement threshold.

**Results:** Microneedling with PRP demonstrated superior outcomes compared to Fractional CO<sub>2</sub> laser treatment across different lesion severities: severe ( $10.8 \pm 7.01$  vs.  $1.33 \pm 0.60$ ), moderate ( $7.41 \pm 3.11$  vs.  $1.74 \pm 0.27$ ), and mild ( $1.58 \pm 1.18$  vs.  $0.14 \pm 0.04$ ), with statistically significant differences in mean scores favoring microneedling with PRP.

**Conclusion:** In conclusion, when comparing fractional CO<sub>2</sub> laser treatment to microneedling combined with PRP for post-acne scars, the results show that the former is more effective.

**Keywords:** Acne vulgaris; Acne scars; Fractional CO<sub>2</sub> laser; Microneedling; Scar resurfacing; Platelet rich plasma.

## Introduction

### Acne Vulgaris (AV)

Pilosebaceous units, which consist of hair follicles and the sebaceous gland that surrounds them, can become clogged or inflamed in Acne Vulgaris, a prevalent chronic skin disease. Acne, which primarily affects the face but can also appear on the back and chest, can manifest as either non-inflammatory lesions (such as open and closed comedones) or inflammatory lesions (such as papules, pustules, and nodules), or a combination of the two. Acne is a major health risk since it leaves scars and causes psychological problems like low self-esteem, anxiety, and depression, all of which lower people's quality of life.<sup>i</sup> Adolescent years are peak years for AV, with the highest rates observed in males between the ages of 16 and 20, and in girls between the

ages of 13 and 17. The lifetime frequency of AV is around 85%.

### Acne Scars

Any inflammatory skin condition that damages the dermal collagen and the epidermis to a sufficient degree might lead to scarring. Damage to the skin during its healing process causes scars to develop. Extreme nodular or nodulocystic acne, infections (such as varicella and herpes simplex), trauma, and surgical operations are the leading causes of atrophic scars, particularly on the face.<sup>ii</sup>

The pathogenesis of acne scars involves injury to the skin which initiates a cascade of wound healing events. The wound healing process progresses through 3 stages: (1) inflammation, (2) granulation tissue formation, and (3) matrix remodeling.<sup>iii,iv</sup> The extent of inflammation and tissue damage decides the size and depth of the scars and thus its mode of treatment.<sup>v,vi</sup>

Scars caused by acne can be classified as either atrophic, hypertrophic, or keloidal, based on whether collagen is lost or gained. Ice pick, rolling, and box scars are subtypes of atrophic scars.

Icepick scars are small, deeply incised epithelial tracts that reach into the dermis or subcutaneous tissue and are less than 2 mm in width. As the scar narrows from its surface to its deepest point, the surface aperture is typically wider than the deep infundibulum. Dermal tethering causes rolling scars, which are typically broader than 4-5 mm and appear on otherwise normal-looking skin. Surface shadowing and an uneven or rolling look to the skin above are caused by aberrant fibrous dermal anchoring to the subcutis. Identical to varicellar scars, boxcar scars are depressions that range in shape from circular to oval and have highly defined vertical borders. In comparison to icepick scars, these

are noticeably broader at the surface and lack a sharp tip. Typically, their diameter ranges from 1.5 to 4.0 mm, but they can be either shallow (0.1-0.5 mm) or deep (>0.5 mm).<sup>vii</sup> Scar classification is important as it can help guide treatment options.<sup>viii</sup>

Post acne scarring is one of the most common causes of disfiguring scars over the face.<sup>ix</sup> Acne has been associated with higher rates of depression, anxiety, failure to thrive at school and in social environments, suicidal ideation, and suicidal attempts and dermatology life quality index in these patients is lower than in patients without scars.<sup>x,xi</sup> This psychological impact is rooted in real-world implications because patients have been found to have higher rates of unemployment. In addition to the psychological and occupational impairments, AV can have a major impact on self-esteem and self-image. Therefore, as a visible and potentially disfiguring skin disease, it can lead to interpersonal rejection and issues with social, vocational, and sexual competence.<sup>xii</sup>

The process of managing acne scars starts with minimising any redness present, and then addressing the atrophic scarring. The approach for treating atrophic scars depends on the type of scar and whether it is isolated or broad. A pulsed dye laser is the most efficient approach to diminish redness surrounding scars.<sup>xiii</sup>

However, combination treatment in a patient specific way can offer the best chance of significant improvement.<sup>xiv</sup> Early treatment of active acne remains the best way to prevent or limit acne related scarring.<sup>xv</sup>

Dermaroller therapy, sometimes referred to as Microneedling or Percutaneous Collagen Induction (PCI) therapy, is a cosmetic procedure. Dr. Des Fernandes debuted the technique in Europe, referring to it as "skin needling" or "percutaneous collagen induction

(PCI)" during the XII Congress of the International Society of Aesthetic Plastic Surgery in Paris, France in 1993. The process involves using a device with a barrel that is covered with several needles. These needles generate numerous tiny punctures in the skin, reaching the papillary to mid-dermis layer. This triggers the production of collagen and elastin underneath. The inclusion of platelet-rich plasma (PRP) in the microneedling treatment regimen has recently gained popularity, resulting in an increased demand for combination therapy.<sup>xvi</sup>

Fractional photothermolysis system selectively damages the dermal tissue to induce a wound healing response that affects the stimulation of prolonged neocollagenesis without damage to the epidermis. Among ablative fractional lasers, fractional CO2 laser is the most commonly used with promising results. Energy at 10,600nm wavelength is absorbed by both intracellular and extracellular water, causing rapid heating and vaporization of tissue.<sup>xvii</sup> Fractional CO2 laser can be used to treat moderate to severe atrophic acne scars with good variable results in macular superficial and medium depth scars but deep scars and icepick scars may improve only marginally and it can be used alone as monotherapy or combined with other procedures.<sup>xviii</sup>

### **Aim**

To compare the efficacy of resurfacing with fractional carbon dioxide laser versus microneedling combined with platelet rich plasma in the treatment of post acne scars.

### **Objectives**

1. To study the efficacy of resurfacing with Fractional Carbon Dioxide Laser in the treatment of post acne scars.

2. To study the efficacy of Microneedling combined with Platelet Rich Plasma (PRP) in the treatment of post acne scars.
3. To compare the results of both the procedures.

### Methodology

**Site of the Study:** The study was conducted in Hapur, Uttar Pradesh, at the tertiary healthcare facility known as the Saraswathi Institute of Medical Sciences and Hospital.

**Study Period:** July 2022 – June 2024 (2 years)

**Study Design:** Prospective, comparative study

**Study Population:** People with post-acne scars (both male and female) who sought treatment at the dermatology department of the healthcare centre were included in the study. Participants' ages ranged from 18 to 45 years.

**Sample of the Study:** Two groups of 55 patients each made up the total sample size of 110. Two groups were treated: one with fractional carbon dioxide laser resurfacing and the other with microneedling with platelet rich plasma (PRP).

### Inclusion Criteria

1. Patients with acne scars under the groupings of a score > 3 points on the Global Acne Scarring Classification Scale.
2. Patients who were willing to undergo the procedure.
3. Patients between 18 years to 45 years of age.

### Exclusion Criteria

1. Patients with active acne.
2. Patients with active bacterial, viral, or fungal infections in the area to be treated.
3. Patients who had taken isotretinoin within the previous 6 months.
4. Predisposition to keloid formation / hypertrophic scarring.

5. Ongoing ultraviolet exposure or prior radiation therapy to the treatment area.
6. Pregnant and lactating mothers.
7. Any serious medical conditions including diabetes, bleeding diathesis, delayed wound healing, collagen vascular diseases.
8. Patients on corticosteroids or anticoagulants.

### Procedure

#### Microneedling with Platelet Rich Plasma (PRP):

A small volume of the patient's blood was drawn and sent for centrifugation. The tube containing blood was centrifuged at 1300 rpm for 10mins (soft spin) followed by second centrifugation at 2000 rpm for 10mins (hard spin). After centrifugation, the plasma layer was carefully separated from the red blood cell layer using a sterile technique. This plasma fraction, which contained a higher concentration of platelets, i.e. PRP, was used in the procedure.

While holding the skin to be treated in one hand, the dermaroller—equipped with 1.5 mm needles that penetrated the dermal layers and facilitated collagen synthesis—was rolled over the skin with the other hand, in the manner of a pen grip. The instrument was spun six to ten times in four different directions, covering an area of about 2 × 2 inches: horizontally, vertically, and diagonally right and left. It was rolled until thin, even blood splatters appeared. Microneedling was followed by massaging the PRP solution into the treatment area.

#### Fractional Carbon Dioxide Laser

The acne scars of the second group were treated using a fractional CO<sub>2</sub> laser, employing the following parameters of the scan mode: a wavelength of 10,600 nm, a duration of 1.0 ms, a distance of 1.0 mm, and a single repeat. The laser was activated by pressing the foot pedal, while simultaneously holding the handpiece

at a right angle to the lesion. All scars and their boundaries were concealed with a single stroke. The treatment procedure was uniform for all morphological variations of scars.

**Ethical Considerations**

- Written informed consent was obtained from all patients recruited in the study.

- All gathered information was kept confidential throughout the study.
- Participation or non-participation did not affect the services offered to patients in the OPD.

**Results of The Study**

Although the two groups' levels of efficacy varied, both demonstrated substantial reductions in acne scar severity following therapy.

Table 1: Before and after assessment of lesions and the objective score within Treatment Group 1(Fractional CO2 Laser)

	Variables	Mean Score	Standard Deviation	Mean difference	Standard Deviation of difference	P value
Pair 1	Total lesions (Before Treatment)	62.83	25.823	22.830	1.658	<0.001
	Total Lesions (After Treatment)	40.00	17.974			
Pair 2	Objective score (Before Treatment)	27.51	9.679	9.604	0.679	<0.001
	Objective score (After Treatment)	17.91	6.206			
Pair 3	Mild lesion points (Before Treatment)	2.05	1.026	0.145	0.048	0.004
	Mild lesion points (After Treatment)	1.91	1.005			
Pair 4	Moderate lesion points (Before Treatment)	10.40	1.978	1.745	0.270	<0.001
	Moderate lesion points (After Treatment)	8.65	2.640			
Pair 5	Severe lesion points (Before Treatment)	15.33	9.833	1.333	0.602	0.031
	Severe lesion points (After Treatment)	14.00	8.683			

In Treatment Group 1 (Fractional CO2 laser), the results of the objective score and before-and-after evaluation of lesions are shown in Table 1. Following fractional CO2 laser: Average total lesion score decreased from 62.83 ± 25.82 to 40.00 ± 17.97.

Average mild lesion points decreased from 2.05 ± 1.02 to 1.91 ± 1.0.

Average moderate lesion points decreased from 10.40 ± 1.97 to 8.65 ± 2.60.

Average severe lesion points decreased from 15.33 ± 9.83 to 14.00 ± 8.68.

Table 2: Before and after assessment of lesions and the objective score within Treatment Group 2 (Microneedling with PRP)

	Variables	Mean Score	Standard Deviation	Mean difference	Standard Deviation of difference	P value
Pair 1	Total lesions (Before Treatment)	64.34	30.635	23.113	12.869	<0.001
	Total Lesions (After Treatment)	41.23	21.029			
Pair 2	Objective score (Before Treatment)	26.68	10.610	14.830	9.238	<0.001
	Objective score (After Treatment)	11.85	6.485			
Pair 3	Mild lesion points (Before Treatment)	2.11	1.012	1.582	1.182	<0.001
	Mild lesion points (After Treatment)	0.53	0.604			
Pair 4	Moderate lesion points (Before Treatment)	10.33	2.742	7.418	3.119	<0.001
	Moderate lesion points (After Treatment)	2.91	2.367			
Pair 5	Severe lesion points (Before Treatment)	14.07	9.914	10.800	7.014	<0.001
	Severe lesion points (After Treatment)	3.27	5.009			

In Treatment Group 2 (Microneedling with PRP), the results of the objective score and before-and-after evaluation of lesions are shown in Table 2. Considerable decreases in total lesions, objective ratings, and lesion severity after therapy are shown by low P-values (<0.001) and considerable mean changes. Following microneedling with PRP:

Average total lesion score decreased from 64.34± 30.63 to 41.23± 21.02. Average mild lesion points decreased from 2.11 ± 1.01 to 0.53 ± 0.60. Average moderate lesion points decreased from 10.33 ± 2.74 to 2.91 ± 2.36. Average severe lesion points decreased from 14.07 ± 9.91 to 3.27 ± 5.01.

Table 3: Comparison of scores in different treatment methods

	Treatment				P value
	Fractional CO2 laser		Microneedling with PRP		
	Mean	Standard Deviation	Mean	Standard Deviation	
Severe lesion points (After Treatment)	1.33	0.602	10.8	7.014	<0.001
Moderate lesion points (After Treatment)	1.745	0.27	7.418	3.119	<0.001
Mild lesion points (After Treatment)	0.145	0.04	1.582	1.182	<0.001
Objective score (After Treatment)	9.604	0.679	14.83	9.238	<0.001
Subjective score	2.53	0.932	2.70	0.932	0.351

\*Unpaired t-test

Results from comparing post-treatment scores in the two groups are presented in Table 3. Following treatment, the average reduction in severe lesion points was 1.33 points for the fractional CO2 laser group and 10.8 points for the microneedling with PRP group. The treatment had a stronger impact on moderate lesion points in the microneedling with PRP group (7.418) compared to the fractionated CO2 treatment group (1.745). Similarly, the mild lesion points were better treated with microneedling with PRP than in the fractional CO2 laser group, with 1.582 points compared to 0.145 in the fractional CO2 laser group. Subjective scores improved by 2.53 and 2.70 points, respectively, while objective scores improved by 9.604 and 14.83 points, with a p-value of 0.351 for fractional CO2 laser and microneedling with PRP. Patients treated with microneedling incorporating PRP showed substantially greater improvement in scores compared to those treated with fractional CO2 laser. With the exception of the subjective evaluations, all of the other scores were determined to be statistically significant.

## Discussion

### Fractional CO<sub>2</sub> Laser versus Microneedling with Platelet Rich Plasma

The current analysis found that there were significant differences in the mean ratings for severe lesion points between Microneedling with PRP ( $10.8 \pm 7.01$ ) and Fractional CO2 laser ( $1.33 \pm 0.60$ ). When comparing microneedling with PRP ( $27.41 \pm 3.11$ ) to fractional CO2 laser ( $1.74 \pm 0.27$ ), there was a statistically significant difference in the average scores of moderate lesion points. The use of Microneedling with PRP led to considerably higher average scores for mild lesion points ( $1.58 \pm 1.18$ ) compared to the use of Fractional CO2 laser ( $0.14 \pm 0.04$ ).

Microneedling with PRP resulted in significantly higher mean objective scores ( $14.83 \pm 9.238$ ) compared to fractionated CO2 laser ( $9.604 \pm 0.679$ ) in the current investigation. In a study conducted by Pooja T et al, it was discovered that fractional CO2 laser had a significantly higher mean percentage of improvement in qualitative grades compared to both micro needling and PRP, but no significant difference in quantitative scores. **Error! Bookmark not defined.** The average score dropped from  $3.2 \pm 0.7$  to  $1.8 \pm 0.6$  on the side that received skin needling and PRP, and from  $2.1 \pm 1.1$  on the side that received only skin needling, according to research by Ibrahim MK et al.<sup>xix</sup> According to a study conducted by Mukhtar M et al., the fractional CO2 laser was significantly more successful than microneedling. The mean score prior to and following treatment for the microneedling group was  $2.52 \pm 0.74$  and  $2.67 \pm 0.62$ , respectively. In contrast, for the CO2 laser group, the mean score was  $2.57 \pm 0.43$  before treatment and  $2.04 \pm 0.03$  after treatment.<sup>xx</sup>

## Conclusion

Efficacy in Reducing Lesion Severity: Microneedling with platelet-rich plasma significantly reduced post-treatment acne lesion severity and number. This is supported by the fact that the "Microneedling with PRP" group experienced a decrease in severe, moderate, and mild lesion points, total lesion count, and objective scores.

In conclusion, when comparing fractional CO2 laser treatment to microneedling combined with PRP for post-acne scars, the results show that the former is more effective.

## Recommendations

Clinicians, researchers, and patients thinking about post-acne scar treatments can benefit from the following

suggestions founded on the study's findings and observations:

1. **Consider Microneedling with PRP as a Preferred Treatment Option:** Microneedling combined with PRP is a promising and potentially preferred treatment option for patients with post-acne scars, especially those concerned about side effects. This therapy has shown effectiveness in lowering the severity of lesions and has a superior safety profile.
2. **Patient Counseling and Expectation Management:** To ensure patients are well-informed, it is crucial to provide counselling on all available treatment alternatives, including their effectiveness, safety profiles, potential side effects, and expected timelines for results.
3. **Personalized Treatment Plans:** When dermatologists provide recommendations for treatment, they must consider the individual characteristics of each case, such as the patient's scar type, skin tone, past therapies, and personal preferences. A more individualized approach could lead to enhanced treatment outcomes and increased patient satisfaction.
4. **Care and Monitoring over the Long Term:** Establish a plan for monitoring over the long term to see how long the effects of treatment last and when any adverse effects may start to show up. To guarantee long-term success and patient happiness, it is important to provide continuous care and make adjustments to the treatment plan as needed.
5. **Further Research with Larger and Diverse Samples:** In order to verify the findings and examine the effectiveness and safety of these treatments among different demographic groups and skin types, future

studies should aim to include larger and more diverse samples.

## References

1. Tan AU, Schlosser BJ, Paller AS. A review of diagnosis and treatment of acne in adult female patients. *Int J Womens Dermatol.* 2017;4:56-71.
2. Majid I, Imran S. Fractional CO2 Laser Resurfacing as Monotherapy in the Treatment of Atrophic Facial Acne Scars. *J Cutan Aesthet Surg.* 2014 Apr;7(2):87-92.
3. Wolfram D, Tzankov A, Püzl P, Piza-Katzer H. Hypertrophic scars and keloids—a review of their pathophysiology, risk factors, and therapeutic management. *Dermatol Surgery* 2009; 35: 171-81
4. Cowin AJ, Brosnan MP, Holmes TM, Ferguson MWJ. Endogenous inflammatory response to dermal wound healing in the fetal and adult mouse. *Dev Dyn.* 1998; 212: 385-93.
5. Goodman G. Post acne scarring: a review. *J Cosmet Laser Ther.* 2003;5:77-95.
6. Sadick NS, Palmisano L. Case study involving use of injectable poly-L-lactic acid(PLLA) for acne scars. *J Dermatolog Treat.* 2009;20:302-7.
7. Jacob CI, Dover JS, Kaminer MS. Acne scarring: A classification system and review of treatment options. *J Am Acad Dermatol.* 2001;45(1):109-17.
8. Kravvas G, Al-Niaimi F. A systematic review of treatments for acne scarring. Part 1: Nonenergy-based techniques. *Scars, burns & healing.* 2017;3:2059513117695312.
9. Vaishampayan S, Baveja S, Garg S. Acne, Rosacea and perioral dermatitis. In: Sacchidan and S, Oberai C, Inamdar AC, editors. *IADV Text Book of Dermatology.* 4rd ed. Mumbai: Bhalani Publishing House; 2015. p. 1365-412.



10. Hayashi N, Miyachi Y, Kawashima M. Prevalence of scars and “mini-scars”, and their impact on quality of life in Japanese patients with acne. *J Dermatol*. 2015 1;42(7):690–6.
11. Layton AM. Psychosocial aspects of acne vulgaris. *J Cutan Med Surg*. 1998 May;2 Suppl 3:19–23.
12. Gallitano SM, Berson DS. How Acne Bumps Cause the Blues: The Influence of Acne Vulgaris on Self-Esteem. *Int J Womens Dermatol*. 2017;4:12-17.
13. Alster TS, McMeekin TO. Improvement of facial acne scars by the 585 nm flashlamp-pumped pulsed dye laser. *J Am Acad Dermatol*. 1996 Jul;35(1):79–81.
14. Connolly D, Vu HL, Mariwalla K, Saedi N. Acne scarring- pathogenesis, evaluation, and treatment options. *J Clin Aesthet Dermatol*. 2017;10(9):12–23.
15. Williams HC, Dellavalle RP, Garner S. Acne vulgaris. *Lancet* (London, England). 2012 Jan;379(9813):361–72.
16. Fernandes D. Minimally Invasive Percutaneous Collagen Induction. *Oral Maxillofac Surg Clin North Am*. 2005;17(1):51–63.
17. Gozali MV, Zhou B. Effective treatments of atrophic acne scars. *J Clin Aesthet Dermatol*. 2015;8:33-40.
18. Petrov A, Pljakovska V. Fractional carbon dioxide laser in treatment of acne scars. *Open Access Maced J Med Sci*. 2016;4(1):38–42.
19. Ibrahim MK, Ibrahim SM, Salem AM. Skin microneedling plus platelet-rich plasma versus skin microneedling alone in the treatment of atrophic post acne scars: a split face comparative study. *J Dermatolog Treat*. 2018 Apr 3;29(3):281–6.
20. Mukhtar M, Ikram A, Javed J, Rahat A, Ullah A. Efficacy of microneedling versus fractional CO2 laser in treatment of atrophic facial acne scar: A Randomize COnTrol Trial. *J Popul Ther Clin Pharmacol*. 2023 Dec 20;30(19):881–90.