DOI: https://doi.org/10.53350/pjmhs2023172955

ORIGINAL ARTICLE

Comparison of Fractional CO_2 Laser versus Combined Platelet Rich Plasma and Fractional CO_2 Laser in Treatment of Post-Acne Scars

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ABSTRACT

Background: Post-acne scarring is a common sequela of acne vulgaris and often causes psychosocial burden. Fractional CO_2 laser resurfacing and platelet-rich plasma (PRP) are widely used treatments. Several studies suggest that combining PRP with fractional CO_2 laser may improve outcomes, but evidence comparing the two approaches directly remains limited.

Methods: This randomized prospective clinical study was conducted at Department of Dermatology Khyber Teaching Hospital Peshawar from Jan 2022 to June 2022 with included 110 patients aged 18 to 40 years with moderate to severe atrophic acne scars. Patients were assigned to Group A (fractional CO_2 laser alone) or Group B (combined PRP plus fractional CO_2 laser). All patients received three monthly sessions. Outcomes were assessed using the Global Acne Scar Score (GASS), the Visual Analog Scale (VAS) for satisfaction, and standardized photographs. Cox regression analysis was used to estimate the likelihood of significant scar improvement.

Results: Both groups showed significant improvement, but Group B achieved greater reductions in GASS and higher VAS scores. Demographic characteristics were similar between groups. Cox regression indicated that the combined treatment increased the likelihood of achieving significant improvement, with a hazard ratio of 2.3 ($p = 0.01$).

Conclusion: PRP combined with fractional CO_2 laser is more effective than fractional CO_2 laser alone for improving atrophic post-acne scars. The combination enhances collagen remodeling and yields better clinical and patient-reported outcomes.

Keywords: Acne scars, Fractional CO_2 laser, Platelet-rich plasma, PRP, Laser resurfacing, Scar remodeling, Aesthetic dermatology

INTRODUCTION

Acne vulgaris is a chronic inflammatory disease that commonly leads to permanent scarring. Atrophic acne scars remain a therapeutic challenge because of their varied morphology and the need for treatments that stimulate collagen and restore skin architecture. Fractional CO_2 laser resurfacing has been one of the most effective modalities for atrophic scars, as it induces controlled dermal injury and triggers collagen production (Jafferany 2020)[1]. Several studies have established its utility for improving skin texture and scar depth (Alam 2015)[2], (Goldman 2018)[3].

PRP is another modality that has gained popularity due to its regenerative capabilities. It contains high concentrations of autologous growth factors that stimulate fibroblasts, enhance vascularity, and promote tissue remodeling. Multiple investigations have shown that PRP improves wound healing and can complement energy-based devices (Zhou 2020)[4], (Suh 2021)[5].

Combining PRP with laser resurfacing is believed to accelerate recovery and enhance collagen regeneration. Studies have noted that PRP reduces downtime and improves outcomes in laser-treated patients (Fabbrocini 2021)[6], (Lolis 2022)[7]. Research comparing fractional CO_2 alone versus combination therapy has also suggested superior results with the addition of PRP (Kaur 2022)[8], (Nadeem 2019)[9].

Despite existing data, the literature still lacks strong comparative trials with adequate sample sizes. This study compares fractional CO_2 laser alone with fractional CO_2 plus PRP to determine whether combination therapy delivers significantly better outcomes.

METHODOLOGY

Study Design: This was a prospective, randomized, controlled clinical trial conducted at Department of Dermatology Khyber Teaching Hospital Peshawar during from January 2022 to June 2022. Ethical approval was obtained from the Institutional Review Board (IRB), and written informed consent was obtained from all participants.

Participants: A total of 110 patients with moderate to severe post-acne scars were enrolled. The demographic details of the participants are as follows**:**

- Age: 18–40 years.
- Gender: 60% female (66 patients) and 40% male (44 patients).
- **Inclusion Criteria:**
  - Moderate to severe atrophic acne scars.
  - Age between 18–40 years.
  - No prior treatments for acne scars (PRP or laser).
  - Written informed consent for participation.
- **Exclusion Criteria:**
  - Active acne.
  - History of keloidal scarring.
  - Pregnancy or lactation.
  - Any active skin infection or systemic disease**.**

Randomization: Participants were randomly assigned to one of two groups:

- Group A (Fractional CO2 laser): 55 patients treated with fractional CO2 laser alone.
- Group B (PRP + Fractional CO2 laser): 55 patients treated with a combination of PRP and fractional CO2 laser.

Treatment Protocol:

- Fractional CO2 laser: A 10,600 nm wavelength CO2 laser was used for fractional resurfacing. Three treatment sessions were performed at 4-week intervals.
- PRP preparation: Platelet-rich plasma was prepared by collecting 10 mL of venous blood, which was then centrifuged to concentrate platelets. The PRP was applied topically to the skin after fractional CO2 laser treatment.

Assessment Methods:

- Global Acne Scar Score (GASS): A standardized scale to assess the severity of acne scars before and after treatment.
- Visual Analog Scale (VAS): To evaluate patient satisfaction with the treatment.
- Photographic Analysis: Standardized photographs were taken to document changes in scar appearance.

Statistical Analysis:

- Descriptive statistics were used to summarize patient demographics and clinical scores.
- Cox regression analysis was used to predict treatment success and assess the relative risk of scar improvement based on the type of treatment received.
- p-value < 0.05 was considered statistically significant.

RESULTS

The study population consisted of 110 patients. The mean age was 26.4 years. Females represented 60 percent (n = 66) and males 40 percent (n = 44). Both groups were similar in age, gender distribution, baseline GASS score, scar type, and Fitzpatrick skin type, with no statistically significant differences between them. Rolling and boxcar scars were the most common types. Fitzpatrick types III and IV were predominant.

Table 1: Baseline Demographics

Variable	Group A (n=55)	Group B (n=55)	p value
Mean age (years)	26.7 ± 4.9	26.1 ± 5.2	0.58
Gender (F/M)	32/23	34/21	0.68
Baseline GASS	10.1 ± 2.3	9.8 ± 2.1	0.52
Fitzpatrick III (%)	49	51	0.79
Fitzpatrick IV (%)	51	49	0.83
Dominant scar type	Rolling	Rolling	—

Group A (Fractional CO2 laser) showed a significant reduction in the GASS score from 10.1 ± 2.3 at baseline to 6.4 ± 1.9 after three sessions ($p < 0.001$). Group B (PRP + Fractional CO2 laser) demonstrated a greater reduction in the GASS score from 9.8 ± 2.1 to 4.3 ± 1.6 ($p < 0.001$). VAS scores: Group B reported significantly higher satisfaction scores (mean VAS = 8.2 ± 1.1) compared to Group A (mean VAS = 6.4 ± 1.5) ($p = 0.03$). Table 2

Table 2: Comparison of GASS and VAS Scores Pre- and Post-Treatment

Parameter	Group A (Fractional CO2)	Group B (PRP + Fractional CO2)	p-value
Pre-treatment GASS Score	10.1 ± 2.3	9.8 ± 2.1	0.65
Post-treatment GASS Score	6.4 ± 1.9	4.3 ± 1.6	0.001
Pre-treatment VAS Score	4.3 ± 1.2	4.4 ± 1.0	0.75
Post-treatment VAS Score	6.4 ± 1.5	8.2 ± 1.1	0.03

A Cox proportional hazards model was performed to assess the likelihood of achieving significant improvement, defined as a GASS reduction of 40 percent or more.

Group B had a hazard ratio (HR) of 2.3 (95 percent CI 1.2 to 4.1, $p = 0.01$).

This indicates that patients receiving PRP plus fractional CO_2 laser were more than twice as likely to achieve significant improvement compared with those receiving fractional CO_2 alone.

Table 3: Cox Regression Analysis

Variable	Hazard Ratio	95% CI	p value
Group A (reference)	1.0	—	—
Group B (PRP + CO_2)	2.3	1.2–4.1	0.01
Age	0.97	0.90–1.03	0.24
Male gender	0.89	0.54–1.47	0.63

DISCUSSION

This study found that adding PRP to fractional CO_2 laser resurfacing significantly enhances treatment outcomes for post-acne scars. Similar findings have been reported in multiple trials. PRP likely enhances outcomes by accelerating re-epithelialization, reducing inflammation, and stimulating collagen production through growth factors such as PDGF, VEGF, and TGF-β[4].

Several studies have shown that fractional CO_2 laser alone is effective but can be limited by prolonged recovery and variable response[3,10]. The addition of PRP appears to shorten downtime and enhance collagen remodeling[6,7].

Our results align with other randomized studies reporting superior improvement when PRP is combined with fractional lasers[8,9]. This combination approach has also been supported in studies involving other scar types and resurfacing modalities[11,12].

The Cox regression analysis confirms that the combined therapy significantly increases the probability of clinically meaningful improvement. This supports prior evidence suggesting PRP enhances laser-induced tissue remodeling[5,13].

The synergistic effects of laser-induced microthermal zones and PRP-driven regenerative signaling may explain these outcomes. Histologic studies have shown enhanced collagen bundle organization and increased dermal thickness when PRP is added to laser treatments[14,15-16].

Overall, the findings of this study reinforce PRP as a valuable adjunct in laser resurfacing.

CONCLUSION

The combination of PRP with fractional CO_2 laser offers superior improvements in post-acne scarring compared with fractional CO_2 laser alone. The combined therapy increases the likelihood of meaningful improvement, enhances patient satisfaction, and provides a more robust remodeling response. It is a safe and effective option for patients seeking optimal outcomes in acne scar management.

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