

A Clinical Study of Evaluating the Effectiveness and Safety of Microneedling Alone and in Combination with Platelet-Rich Plasma Compared to Fractional CO₂ Laser in the Treatment of Acne Scars

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Received: 25-10-2023 / Revised: 23-11-2023 / Accepted: 26-12-2023

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Conflict of interest: Nil

Abstract:

Background: Acne scars are a common concern with substantial impact on skin aesthetics and quality of life. Various treatments, including microneedling with or without platelet-rich plasma (PRP) and fractional CO₂ laser therapy, have emerged as potential solutions. This study aimed to compare their effectiveness and safety for acne scar management.

Methods: A randomized clinical trial involving 60 participants was conducted, with three treatment arms: microneedling alone, microneedling plus PRP, and fractional CO₂ laser therapy. Data included acne scar severity, depth, patient satisfaction, and complications. Statistical analysis was performed using SPSS 16.0.0 software, with a significance level of 0.05.

Results: All treatment groups exhibited substantial reductions in acne scar severity and depth. The microneedling plus PRP group demonstrated the most significant improvements, followed by the microneedling group, compared to the fractional CO₂ laser group. Patient satisfaction scores favored microneedling plus PRP and microneedling, with no significant difference between microneedling plus PRP and fractional CO₂ laser groups.

Conclusion: Microneedling with or without PRP is a promising treatment option for acne scars, offering comparable or superior outcomes to fractional CO₂ laser therapy. These findings provide valuable insights for clinicians and patients in selecting suitable treatments.

Recommendation: Further research and long-term follow-ups are necessary to validate these results and assess treatment durability.

Keywords: Acne Scars, Microneedling, Platelet-Rich Plasma, Fractional CO₂ Laser Therapy.

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Introduction

Acne scars, a common sequelae of acne vulgaris, pose a significant dermatological concern due to their persistent nature and impact on skin aesthetics. These scars can lead to psychological distress and reduced quality of life among affected individuals. Over the years, various therapeutic modalities have been developed to address this issue, with a focus on improving skin texture and appearance [1]. Among these, microneedling, platelet-rich plasma (PRP) therapy, and fractional CO₂ laser

treatment have emerged as prominent options. Microneedling, a minimally invasive procedure, involves the use of fine needles to create controlled micro-injuries in the skin. This process stimulates the body's natural wound healing mechanisms, leading to collagen and elastin production. When combined with platelet-rich plasma (PRP), a concentrate of platelets derived from the patient's own blood, the treatment is believed to enhance the healing and rejuvenative processes. PRP is rich in

growth factors that can potentially accelerate tissue repair and regeneration [2].

On the other hand, fractional CO₂ laser therapy represents a more technologically advanced approach. This method uses a carbon dioxide laser to create microscopic wounds in the skin, which, similar to microneedling, initiates a healing response [3]. The precision and depth control offered by the laser allow for targeted treatment of acne scars, making it a popular choice among dermatologists [4].

Despite the widespread use of these treatments, there is an ongoing debate regarding their relative efficacy and safety. This study aims to compare the effectiveness and safety profiles of microneedling with and without PRP versus fractional CO₂ laser in the treatment of acne scars.

By evaluating these modalities, the study seeks to provide a comprehensive understanding of their benefits and limitations, thereby guiding clinicians in making informed decisions about acne scar management. The comparison is crucial for dermatologists and patients alike in choosing the most appropriate treatment strategy based on individual needs and clinical outcomes.

Methodology

Study Design: This investigation employed a randomized clinical trial framework to evaluate the effectiveness and safety of various treatments for acne scars.

Study Setting: The study took place at S.K.M.C.H. during the year 2022 to 2023.

Participants: A total of 60 participants, who met the inclusion criteria and willingly consented to participate, were involved in the study.

Inclusion Criteria

- Presence of acne scars
- Willingness to participate in the study
- Commitment to adhere to the prescribed treatment plan

Exclusion Criteria

- Smoking
- Diabetes
- Platelet dysfunction
- Thrombocytopenia (platelet count below 50,000)
- Chronic infections
- Hemodynamic instability
- Local inflammatory skin conditions or active herpes infection at the procedure site
- Use of anticoagulation or nonsteroidal anti-inflammatory drugs (NSAIDs) within 48 hours before treatment

- Systemic corticosteroid use within the past 10 weeks
- Hemoglobin levels below 10
- Fever
- History of cancer, particularly leukemia

Bias: To mitigate bias, randomization was employed to allocate participants to their respective treatment groups.

Variables: The variables included the type of acne scar treatment (Group A: microneedling, Group B: microneedling + PRP, Group C: fractional CO₂ laser), severity of acne scars (evaluated using the Goodman and Baron's classification system), depth of acne scars, patient satisfaction with treatment, occurrence of complications, patient demographics, age, and coexisting medical conditions.

Data Collection: The trial encompassed three distinct treatment arms: microneedling as a standalone treatment (Group A), microneedling combined with platelet-rich plasma (PRP) (Group B), and fractional CO₂ laser treatment (Group C). Participants were assigned randomly to one of these treatment groups, employing a parallel-group design.

Data collection encompassed several components

- Patient demographics and medical history were recorded during the initial assessments.
- Severity and depth of acne scars, along with patient satisfaction, were evaluated at each session using clinical assessments and photography.
- Complications and adverse events were documented during and after each session.
- Data were collected at baseline and during follow-up visits, with the final assessment conducted three months after the last session.

Statistical Analysis: Statistical analysis was carried out using SPSS 16.0.0 software. Descriptive statistics, including means, standard deviations, medians, interquartile ranges, frequencies, and percentages, were employed to summarize the data. A significance level of 0.05 was established for the statistical tests.

Ethical Considerations: This study adhered to ethical principles and received approval from the relevant ethical review board. Informed consent was obtained from all participants before their inclusion in the study, ensuring their autonomy and understanding of the potential risks and benefits associated with the treatments. Patient confidentiality was maintained throughout the study, and data were anonymized during analysis and reporting.

Results

The study involved a total of 60 participants with acne scars, distributed as follows: 17 individuals in the microneedling plus PRP group, 25 participants

in the microneedling group, and 18 individuals in the ablative fractional CO₂ laser group. Importantly, there was a noteworthy reduction in the mean severity scores of acne scarring in all groups from the initial baseline assessment to three months after the final session.

When compared to the fractional CO₂ laser group, the microneedling plus PRP group displayed a more significant reduction in the severity score of acne scarring from baseline to three months after the last session, with a mean difference of 2.40 points ($P < 0.0001$). Similarly, the microneedling group also exhibited a more pronounced reduction in the severity score of acne scarring compared to the fractional CO₂ laser group, with a mean difference of 2.15 points ($P < 0.0001$). However, there was no significant difference observed in the pattern of change in acne scarring severity scores over time between the "microneedling plus PRP" and "microneedling alone" groups, as evidenced by a lack of a significant group time interaction (mean difference 0.25 points, $P = 0.75$).

All three groups demonstrated substantial reductions in the depth of their scars three months after the final visit. Notably, the microneedling plus PRP group exhibited a more substantial reduction in scar depth compared to the fractional CO₂ laser group, with a mean difference of 4.80 mm ($P < 0.0001$). Additionally, the microneedling group showed a greater reduction in scar depth compared to the fractional CO₂ laser group, with a mean difference

of 2.30 points ($P = 0.02$). Furthermore, the microneedling plus PRP group exhibited an additional decrease in scar depth compared to the microneedling group, with a mean difference of 2.55 mm ($P = 0.03$).

The Generalized Estimating Equation (GEE) analyses revealed that factors such as age, gender, and acne duration were not significant predictors of changes in acne scarring severity scores ($P = 0.52$, $P = 0.20$, and $P = 0.84$, respectively).

Regarding patient satisfaction scores, there was a significant difference observed among the study groups ($P = 0.04$).

Specifically, the median patient satisfaction score was 62.5% (IQR: 35% to 70%; range: 20% to 80%) in the microneedling plus PRP group, 42.5% (IQR: 22.5% to 60%; range: 15% to 75%) in the microneedling group, and 50% (IQR: 40% to 60%; range: 30% to 80%) in the fractional CO₂ laser group. A significant difference was noted between the microneedling plus PRP group and the microneedling group in terms of median patient satisfaction scores ($P = 0.03$). Similarly, the median patient satisfaction scores differed significantly between the microneedling group and the fractional CO₂ laser group ($P = 0.04$). However, the microneedling plus PRP group and the fractional CO₂ laser group exhibited similar median patient satisfaction scores ($P = 0.57$).

Table 1: Study key finding summary

Study Results	Microneedling + PRP	Microneedling Alone	Fractional CO ₂ Laser
Number of Participants	17	25	18
Reduction in Acne Scarring Severity Score	2.40 points	2.15 points	0.00 points
Reduction in Scar Depth (mm)	4.80 mm	2.30 mm	0.00 mm
Patient Satisfaction Median Score (%)	62.5%	42.5%	50.0%
Interquartile Range (IQR)	35% to 70%	22.5% to 60%	40% to 60%
Range	20% to 80%	15% to 75%	30% to 80%

Discussion

In a study of 60 participants with acne scars, treatments with microneedling plus PRP, microneedling alone, and ablative fractional CO₂ laser all demonstrated significant reductions in acne scar severity and depth over three months. Notably, microneedling plus PRP was more effective than the fractional CO₂ laser in reducing both scar severity (mean difference of 2.40 points) and depth, while microneedling alone also outperformed the laser in scar severity reduction (mean difference of 2.15 points). No significant difference was found between microneedling plus PRP and microneedling alone, suggesting comparable effectiveness. Patient satisfaction was highest in the microneedling plus PRP group, followed by the fractional CO₂ laser and microneedling groups. Factors such as age,

gender, and acne duration did not significantly predict changes in scarring severity, indicating the treatments' broad applicability.

The recent advancements in acne scar treatments have been explored in various studies. [5] demonstrated the superior efficacy of combined treatments like fractional microneedling radiofrequency with ablative fractional laser and CO₂ laser with microneedling over single modalities. [6] compared microneedling with PRP against fractional CO₂ laser with PRP, finding both effective in scar improvement without significant differences in patient satisfaction. [7, 8] proposed the synergistic effects of combining treatments like nanofat, PRP, and fractional CO₂ laser, showing significant improvements in scar appearance. [9] highlighted the safety and reduced downtime of microneedling with PRP, particularly for darker skin tones. [10] and [11]

focused on comprehensive facial treatments, including combinations of fat grafting, PRP, microneedling, and CO₂ laser, yielding significant aesthetic improvements. [12] found that microneedling with PRP led to higher patient satisfaction and clinical improvement compared to microneedling alone, emphasizing the potential of combined therapies in acne scar treatment.

Conclusion

In conclusion, this trial comparing microneedling with and without PRP to fractional CO₂ laser treatment for acne scars revealed significant results. All treatments substantially reduced scar severity and depth. Microneedling with PRP showed the most improvement, followed by microneedling alone, compared to fractional CO₂ laser. Patient satisfaction favored microneedling treatments.

These findings suggest microneedling, with or without PRP, as promising for acne scars, potentially superior to fractional CO₂ laser, guiding clinicians and patients. Further research and long-term follow-ups are needed for validation and treatment durability assessment.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population.

Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation: Further research and long-term follow-ups are necessary to validate these results and assess treatment durability.

Acknowledgement: We are thankful to the patients; without them the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in patient care of the study group.

List of abbreviations

PRP: Platelet-Rich Plasma.

CO₂ Laser: Carbon Dioxide Laser.

GEE: Generalized Estimating Equation.

IQR: Interquartile Range.

Source of funding: No funding received.

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