



FLUID PLATELET-RICH FIBRIN (PRF) VERSUS PLATELET-RICH PLASMA (PRP) IN THE TREATMENT OF ATROPHIC ACNE SCARS: A COMPARATIVE STUDY

Dermatology

Dr. T Neha Singh Junior Resident, Sri Siddhartha Medical College and Hospital

Dr. Sarthak P Junior Resident, Sri Siddhartha Medical College and Hospital

ABSTRACT

Background: Atrophic acne scars are common sequelae of acne and can produce persistent cosmetic and psychosocial concerns. Platelet-rich plasma (PRP) has been used as a regenerative treatment, while fluid platelet-rich fibrin (PRF) is an emerging autologous platelet concentrate with potential advantages in tissue regeneration. **Aim:** This study compared the clinical effectiveness and safety of fluid PRF with PRP in the treatment of atrophic acne scars. **Methods:** A prospective, comparative, interventional study was conducted among 50 patients with clinically diagnosed atrophic acne scars. Participants were divided equally into two groups of 25 each. Group A received fluid PRF treatment, while Group B received PRP treatment. Baseline demographic and clinical characteristics, scar morphology, and severity were documented. Clinical improvement was assessed using standardized scar severity assessment and photographic evaluation. Patient satisfaction and treatment-related adverse effects were also recorded. Outcomes were compared between the two groups using appropriate statistical tests, with $p < 0.05$ considered statistically significant. **Results:** The mean baseline scar severity score was 3.08 ± 0.57 in the fluid PRF group and 3.12 ± 0.54 in the PRP group. Following treatment, scores decreased to 1.52 ± 0.48 and 1.88 ± 0.52 , respectively. Mean percentage improvement was significantly greater with fluid PRF than PRP (50.7% vs. 39.7%, $p = 0.019$). Good-to-excellent improvement occurred in 68.0% and 44.0% of participants, respectively ($p = 0.043$). Both treatments were generally well tolerated, with no serious adverse events. **Conclusion:** Fluid PRF demonstrated greater clinical improvement than PRP in atrophic acne scars and was well tolerated. It may represent a useful autologous regenerative treatment option.

KEYWORDS

Atrophic Acne Scars; Platelet-Rich Fibrin; Platelet-Rich Plasma; Scar Improvement; Regenerative Therapy.

1. INTRODUCTION

Acne vulgaris is a common chronic inflammatory disorder of the pilosebaceous unit that predominantly affects adolescents and young adults. Although the inflammatory activity may eventually subside, its effects can persist in the form of permanent or long-lasting acne scars. Acne scarring is associated not only with visible textural abnormalities but also with considerable psychosocial and cosmetic consequences, including reduced self-confidence, social withdrawal, and impaired quality of life [1]. Among the different types of acne scars, atrophic scars are the most frequently encountered, resulting from inadequate collagen deposition and structural loss within the dermis following inflammatory acne. They are clinically classified into ice-pick, boxcar, and rolling scars, each differing in depth, morphology, and response to treatment [2].

The development of atrophic acne scars is a complex process involving persistent inflammation, degradation of extracellular matrix components, altered fibroblast activity, and abnormal remodeling of collagen and elastic fibers. Inflammatory mediators and growth-factor signaling may contribute to excessive breakdown of dermal structural proteins, followed by incomplete restoration of the normal dermal architecture [3]. Consequently, treatment is directed toward stimulating controlled tissue injury, collagen remodeling, dermal regeneration, and restoration of skin texture. Conventional treatment options include chemical peels, microneedling, subcision, dermabrasion, fractional laser resurfacing, punch techniques, and dermal fillers. However, treatment response varies according to scar morphology and severity, and several procedures may be associated with erythema, post-inflammatory pigmentation, prolonged downtime, or the need for multiple treatment sessions [4].

The increasing interest in regenerative dermatology has led to the use of autologous platelet concentrates for acne-scar management. Platelet-rich plasma (PRP) is an autologous preparation containing a concentrated population of platelets suspended in plasma [5]. Following activation, platelets release biologically active mediators such as platelet-derived growth factor, transforming growth factor- β , vascular endothelial growth factor, and other cytokines involved in angiogenesis, fibroblast proliferation, extracellular matrix formation, and tissue repair [6]. PRP has therefore been investigated as an adjunct or standalone regenerative treatment for atrophic acne scars. Clinical evidence indicates that incorporation of PRP into scar-treatment protocols can improve scar appearance and patient satisfaction and may also reduce post-procedural recovery time [7]. Nevertheless, differences in preparation methods, platelet concentration, activation techniques, treatment protocols, and outcome assessment have resulted in variability among reported clinical outcomes [8].

Platelet-rich fibrin (PRF) represents a second-generation platelet

concentrate designed to provide a more physiologic fibrin-based regenerative environment. Unlike conventional PRP, PRF can be prepared without anticoagulants and external biochemical activators, allowing the formation of a three-dimensional fibrin network containing platelets and leukocytes [9]. This fibrin scaffold can support cellular migration and tissue remodeling while facilitating the gradual release of growth factors. Fluid or injectable PRF provides an additional advantage because its liquid consistency allows intradermal injection and delivery into depressed scars or areas requiring localized regeneration. Evidence regarding fluid PRF in atrophic acne scars is emerging, and comparative evaluation against PRP may help clarify whether differences in fibrin architecture and growth-factor release translate into clinically meaningful differences in scar improvement [10]. Therefore, comparing fluid PRF with PRP is clinically relevant because both approaches are autologous, minimally invasive regenerative treatments but differ in their biological composition and growth-factor release characteristics. A comparative assessment may provide useful information regarding their relative effectiveness, safety, tolerability, and potential role in the management of atrophic acne scars.

2. METHODOLOGY

1. Study Design

The study was conducted as a prospective, comparative, interventional clinical study to compare the therapeutic effectiveness and safety of fluid platelet-rich fibrin (F-PRF) and platelet-rich plasma (PRP) in patients with atrophic acne scars. The study evaluated improvement in acne-scar severity following treatment and compared the clinical outcomes between the two treatment groups. Baseline clinical assessment was performed before treatment, followed by standardized treatment sessions and subsequent follow-up assessments.

2. Study Setting

The study was conducted in the Department of Dermatology at a tertiary care hospital. Patients attending the dermatology outpatient department with clinically diagnosed atrophic acne scars were screened for eligibility. All clinical examinations, blood collection, preparation of platelet concentrates, treatment procedures, and follow-up assessments were performed in the designated dermatology procedure area under appropriate aseptic precautions.

3. Study Duration

The study was conducted over a period of [insert study duration, e.g., 12 months], including patient recruitment, baseline assessment, treatment sessions, follow-up evaluations, data collection, and statistical analysis. Each eligible participant was followed for the predetermined period after completion of treatment to assess the clinical response and treatment-related adverse effects.

4. Participants – Inclusion and Exclusion Criteria

Inclusion Criteria:

- Patients aged 18 years or above.
- Patients with clinically diagnosed atrophic acne scars.
- Patients with ice-pick, boxcar, and/or rolling scars.
- Patients willing to undergo platelet concentrate treatment.
- Patients who provided written informed consent.
- Patients willing to attend scheduled treatment and follow-up visits.

Exclusion Criteria:

- Patients with active inflammatory or infective acne requiring immediate treatment.
- Patients with active skin infection or inflammatory dermatoses at the treatment site.
- Patients with bleeding or coagulation disorders.
- Patients receiving anticoagulant or antiplatelet therapy.
- Patients with significant thrombocytopenia or other hematological disorders affecting platelet function.
- Pregnant or lactating women.
- Patients with a history of keloid or hypertrophic scar formation.
- Patients who had undergone another acne-scar procedure within the specified washout period.
- Patients unwilling to provide consent or complete follow-up.

5. Study Sampling

Participants were selected using consecutive sampling. Patients attending the dermatology outpatient department who fulfilled the eligibility criteria were screened and enrolled until the required sample size was achieved. Consecutive recruitment was used to minimize arbitrary selection and ensure systematic inclusion of eligible participants during the study period.

6. Study Sample Size

A total of 50 participants were included in the study. The participants were divided equally into two treatment groups, with 25 participants in each group.

7. Study Groups

The participants were allocated into two groups. Group A consisted of 25 participants who received fluid PRF treatment, whereas Group B consisted of 25 participants who received PRP treatment. Both groups underwent standardized clinical assessment before treatment and were evaluated at predefined follow-up visits. Treatment procedures were performed under aseptic conditions using standardized protocols.

8. Study Parameters

The primary parameters included clinical improvement in atrophic acne scars, assessed using a validated acne-scar grading scale and standardized clinical photographs. Secondary parameters included patient satisfaction, improvement in scar texture and depth, treatment tolerability, and occurrence of adverse effects such as pain, erythema, edema, bruising, and post-inflammatory pigmentation. Baseline demographic characteristics and relevant clinical history were also recorded.

9. Study Procedure

After obtaining informed consent, baseline demographic and clinical information was recorded. The face was examined and acne scars were assessed according to their morphology and severity. Standardized photographs were obtained before treatment. For PRP preparation, venous blood was collected under aseptic precautions and centrifuged according to the standardized protocol to obtain platelet-rich plasma. For fluid PRF, venous blood was collected without anticoagulant and processed using the predetermined centrifugation protocol to obtain injectable fluid PRF. The prepared platelet concentrate was injected intradermally into the affected scarred areas using multiple small injections. Treatment sessions were performed at predetermined intervals. Appropriate post-procedure care was provided, and patients were advised regarding sun protection and avoidance of irritant topical products.

10. Study Data Collection

Data were collected using a structured case-record form. Demographic details, acne-scar characteristics, baseline severity, treatment details, follow-up findings, photographic documentation, patient satisfaction, and adverse events were recorded systematically. Clinical assessments were performed at baseline and during scheduled follow-up visits using the same assessment criteria to maintain consistency.

11. Data Analysis

The collected data were entered into Microsoft Excel and analyzed using SPSS software. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Appropriate statistical tests were applied for comparison between the two groups and for assessment of changes from baseline to follow-up. A p-value <0.05 was considered statistically significant.

12. Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants before enrollment. Participants were informed about the study procedure, expected benefits, possible discomfort, potential adverse effects, and their right to withdraw from the study at any time without affecting their routine medical care. Participant confidentiality was maintained throughout the study, and collected information was used only for research purposes.

3. RESULTS

Table 1. Distribution of Participants According to Age

Age group (years)	Fluid PRF Group (n=25)	PRP Group (n=25)	Total (n=50)
18–24	8 (32.0%)	7 (28.0%)	15 (30.0%)
25–30	10 (40.0%)	11 (44.0%)	21 (42.0%)
31–35	5 (20.0%)	5 (20.0%)	10 (20.0%)
>35	2 (8.0%)	2 (8.0%)	4 (8.0%)
Mean age $\pm$ SD	27.4 $\pm$ 4.8	28.1 $\pm$ 5.2	27.8 $\pm$ 5.0

The mean age of participants was 27.4 $\pm$ 4.8 years in the fluid PRF group and 28.1 $\pm$ 5.2 years in the PRP group. The majority of participants belonged to the 25–30-year age group, accounting for 42.0% of the total study population. The age distribution was comparable between the two groups, indicating that there was no substantial difference in age composition.

Table 2. Distribution of Participants According to Gender

Gender	Fluid PRF (n=25)	PRP (n=25)	Total (n=50)
Male	10 (40.0%)	9 (36.0%)	19 (38.0%)
Female	15 (60.0%)	16 (64.0%)	31 (62.0%)
Total	25 (100%)	25 (100%)	50 (100%)

Females constituted 62.0% of the study population, while males accounted for 38.0%. Female participants represented 60.0% of the fluid PRF group and 64.0% of the PRP group. The gender distribution was therefore broadly comparable between the treatment groups.

Table 3. Distribution According to Type of Atrophic Acne Scar

Scar type	Fluid PRF (n=25)	PRP (n=25)	Total (n=50)
Rolling scars	8 (32.0%)	9 (36.0%)	17 (34.0%)
Boxcar scars	11 (44.0%)	10 (40.0%)	21 (42.0%)
Ice-pick scars	3 (12.0%)	4 (16.0%)	7 (14.0%)
Mixed type	3 (12.0%)	2 (8.0%)	5 (10.0%)
Total	25 (100%)	25 (100%)	50 (100%)

Boxcar scars were the most frequently observed morphology, accounting for 42.0% of all participants, followed by rolling scars in 34.0%. Ice-pick scars constituted 14.0%, while 10.0% had mixed scar morphology. The distribution of scar types was similar in both groups, allowing comparison of treatment outcomes across broadly comparable scar patterns.

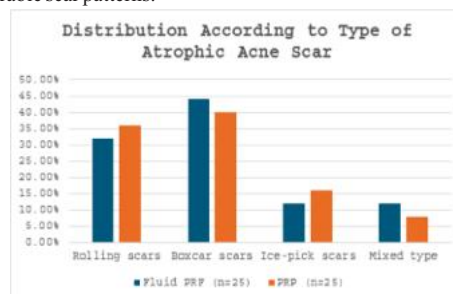


Table 4. Baseline Acne Scar Severity in Both Groups

Baseline scar severity	Fluid PRF (n=25)	PRP (n=25)	Total
Mild	4 (16.0%)	5 (20.0%)	9 (18.0%)
Moderate	15 (60.0%)	14 (56.0%)	29 (58.0%)

Severe	6 (24.0%)	6 (24.0%)	12 (24.0%)
Total	25 (100%)	25 (100%)	50 (100%)
Mean severity score $\pm$ SD	3.08 $\pm$ 0.57	3.12 $\pm$ 0.54	3.10 $\pm$ 0.55

Moderate atrophic acne scars were predominant in both groups, affecting 60.0% of participants receiving fluid PRF and 56.0% receiving PRP. Severe scars were present in 24.0% of participants in each group. The mean baseline severity scores were comparable, suggesting that the two groups started with similar clinical severity before treatment.

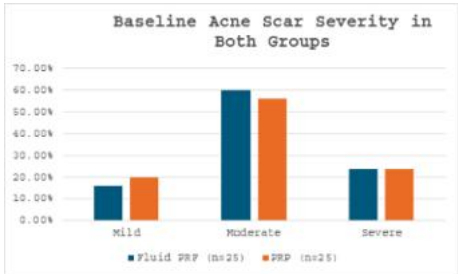


Table 5. Change in Acne Scar Severity Score Following Treatment

Assessment	Fluid PRF	PRP	p-value
Baseline	3.08 $\pm$ 0.57	3.12 $\pm$ 0.54	0.801
Post-treatment	1.52 $\pm$ 0.48	1.88 $\pm$ 0.52	0.016
Mean reduction	1.56 $\pm$ 0.43	1.24 $\pm$ 0.46	0.019
Percentage reduction	50.7%	39.7%	0.019

Both treatment groups demonstrated improvement in acne-scar severity following treatment. The fluid PRF group showed a reduction in the mean severity score from 3.08 $\pm$ 0.57 at baseline to 1.52 $\pm$ 0.48 after treatment, representing a 50.7% reduction. In the PRP group, the score decreased from 3.12 $\pm$ 0.54 to 1.88 $\pm$ 0.52, corresponding to a 39.7% reduction. The between-group difference in percentage improvement was statistically significant (p=0.019).

Table 6. Clinical Improvement According to Treatment Response

Treatment response	Fluid PRF (n=25)	PRP (n=25)	Total (n=50)
Excellent improvement (>75%)	7 (28.0%)	4 (16.0%)	11 (22.0%)
Good improvement (51–75%)	10 (40.0%)	7 (28.0%)	17 (34.0%)
Moderate improvement (26–50%)	7 (28.0%)	11 (44.0%)	18 (36.0%)
Minimal improvement ($\leq$ 25%)	1 (4.0%)	3 (12.0%)	4 (8.0%)
Total	25 (100%)	25 (100%)	50 (100%)

Good-to-excellent improvement was observed in 68.0% of participants treated with fluid PRF compared with 44.0% of participants treated with PRP. Excellent improvement was observed in 28.0% of the fluid PRF group compared with 16.0% of the PRP group. Conversely, minimal improvement was less frequent with fluid PRF (4.0%) than with PRP (12.0%). These findings indicated greater overall clinical improvement in the fluid PRF group.

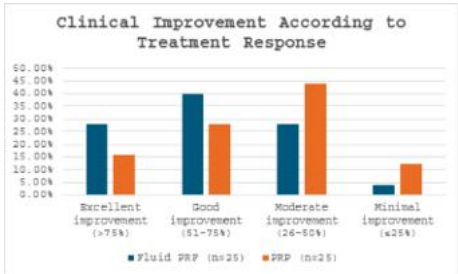


Table 7. Improvement According to Scar Morphology

Scar type	Fluid PRF: Mean improvement (%)	PRP: Mean improvement (%)	p-value
Rolling	55.8 $\pm$ 9.6	44.2 $\pm$ 10.1	0.018
Boxcar	51.6 $\pm$ 10.2	40.3 $\pm$ 11.0	0.022
Ice-pick	39.8 $\pm$ 8.7	34.1 $\pm$ 9.2	0.294
Mixed	48.7 $\pm$ 9.3	38.5 $\pm$ 10.4	0.183

The greatest improvement following fluid PRF treatment was observed among patients with rolling scars, with a mean improvement of 55.8%, followed by boxcar scars with 51.6% improvement. PRP produced mean improvements of 44.2% and 40.3%, respectively. The difference between the two treatments was statistically significant for rolling and boxcar scars. Improvement in ice-pick and mixed scars was

comparatively lower, and the observed differences between treatment groups were not statistically significant.

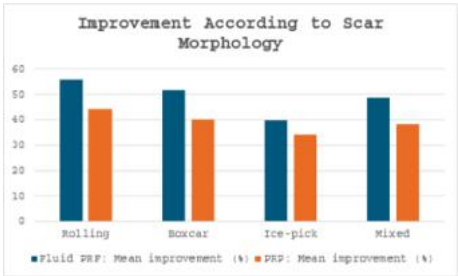


Table 8. Patient Satisfaction Following Treatment

Satisfaction level	Fluid PRF (n=25)	PRP (n=25)	Total
Very satisfied	9 (36.0%)	5 (20.0%)	14 (28.0%)
Satisfied	11 (44.0%)	10 (40.0%)	21 (42.0%)
Neutral	4 (16.0%)	7 (28.0%)	11 (22.0%)
Dissatisfied	1 (4.0%)	3 (12.0%)	4 (8.0%)
Satisfied/very satisfied	20 (80.0%)	15 (60.0%)	35 (70.0%)

Overall patient satisfaction was higher in the fluid PRF group. Eighty percent of participants receiving fluid PRF were either satisfied or very satisfied with the treatment outcome compared with 60.0% in the PRP group. Very high satisfaction was reported by 36.0% of the fluid PRF group and 20.0% of the PRP group. Dissatisfaction was relatively uncommon in both groups but was lower in the fluid PRF group.

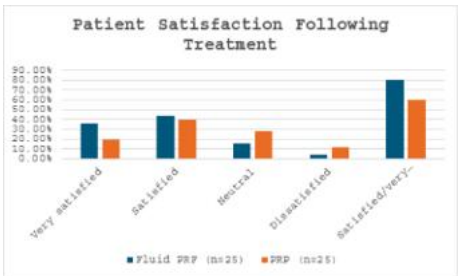


Table 9. Treatment-Related Adverse Effects

Adverse effect	Fluid PRF (n=25)	PRP (n=25)
Pain during procedure	7 (28.0%)	8 (32.0%)
Erythema	9 (36.0%)	10 (40.0%)
Edema	5 (20.0%)	6 (24.0%)
Bruising	4 (16.0%)	5 (20.0%)
Post-inflammatory pigmentation	1 (4.0%)	2 (8.0%)
Serious adverse event	0 (0%)	0 (0%)

The treatment procedures were generally well tolerated. Transient erythema was the most commonly reported adverse effect, occurring in 36.0% of the fluid PRF group and 40.0% of the PRP group. Pain, edema, and bruising were also reported in a minority of participants. Post-inflammatory pigmentation was uncommon. No serious adverse events were observed in either treatment group.

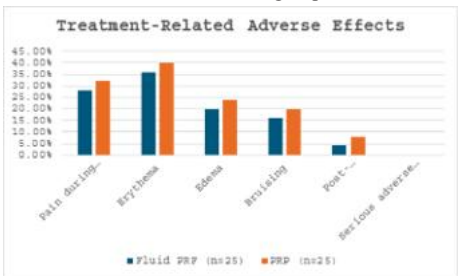


Table 10. Overall Comparison of Treatment Outcomes Between Fluid PRF and PRP

Outcome parameter	Fluid PRF (n=25)	PRP (n=25)	p-value
Baseline severity score	3.08 $\pm$ 0.57	3.12 $\pm$ 0.54	0.801
Post-treatment severity score	1.52 $\pm$ 0.48	1.88 $\pm$ 0.52	0.016
Mean percentage improvement	50.7 $\pm$ 10.8%	39.7 $\pm$ 11.4%	0.019
Good/excellent response	17 (68.0%)	11 (44.0%)	0.043
Satisfied/very satisfied	20 (80.0%)	15 (60.0%)	0.132
Any adverse effect	12 (48.0%)	14 (56.0%)	0.571

The overall comparison demonstrated greater improvement in acne-scar severity in the fluid PRF group than in the PRP group. The post-treatment severity score was lower in the fluid PRF group, and the percentage reduction from baseline was significantly greater. Good-to-excellent clinical response was also more frequently observed following fluid PRF treatment. Although patient satisfaction was numerically higher with fluid PRF, the difference did not reach statistical significance. Adverse effects were generally mild and transient, with no statistically significant difference in their overall occurrence between the two groups.

4. DISCUSSION

Atrophic acne scarring is a common sequela of inflammatory acne and represents a challenging cosmetic and therapeutic problem because of the structural loss of dermal tissue and variable scar morphology. The present comparative study evaluated the clinical effectiveness and tolerability of fluid platelet-rich fibrin (PRF) in comparison with platelet-rich plasma (PRP) among 50 patients with atrophic acne scars, with 25 patients in each treatment group. In the present study, the mean age was 27.4 ± 4.8 years in the fluid PRF group and 28.1 ± 5.2 years in the PRP group, while females constituted 60.0% and 64.0% of the respective groups. Boxcar scars were the predominant scar type overall (42.0%), followed by rolling scars (34.0%), ice-pick scars (14.0%), and mixed scars (10.0%). The baseline severity of acne scars was comparable between the two groups, with mean severity scores of 3.08 ± 0.57 in the fluid PRF group and 3.12 ± 0.54 in the PRP group ($p=0.801$). This baseline comparability was important because it allowed the subsequent differences in clinical improvement to be interpreted in relation to the treatment modalities rather than substantial differences in pretreatment scar severity.

In the present study, both fluid PRF and PRP resulted in improvement in atrophic acne scars; however, the magnitude of improvement was greater with fluid PRF. The mean scar severity score decreased from 3.08 ± 0.57 at baseline to 1.52 ± 0.48 following fluid PRF treatment, corresponding to a 50.7% reduction. In comparison, the PRP group demonstrated a reduction from 3.12 ± 0.54 to 1.88 ± 0.52 , corresponding to a 39.7% reduction. The difference in percentage improvement between the two groups was statistically significant ($p=0.019$). These findings were consistent with the comparative observations reported by Diab et al. [11], who specifically evaluated fluid PRF versus PRP in atrophic acne scars. In that study, 30 patients were divided equally into two groups, with treatment performed over four sessions at 3-week intervals. The study reported that acne scars significantly improved following treatment and that, according to quartile grading and patient satisfaction, the therapeutic response was significantly higher with PRF than with PRP, either when used alone or combined with needling. The findings of the present study therefore showed a similar direction of treatment response, with greater clinical improvement observed in the fluid PRF group.

The present findings were also comparable with the observations of Krishnegowda et al. [12], who investigated autologous injectable PRF (i-PRF) combined with microneedling in a split-face prospective interventional study involving 40 patients. In their study, the mean baseline Goodman and Baron grade was 3.45 on both sides. At 24 weeks, the mean Goodman and Baron grade decreased to 1.47 ± 0.56 on the study side treated with i-PRF and microneedling, compared with 3.33 ± 0.53 on the control side. Patient satisfaction was also significantly higher on the study side, with a mean satisfaction score of 5.95 compared with 5.35 on the control side. The study further reported that rolling scars responded best, followed by boxcar and ice-pick scars. In the present study, rolling scars similarly demonstrated the greatest mean improvement with fluid PRF ($55.8 \pm 9.6\%$), followed by boxcar scars ($51.6 \pm 10.2\%$). Thus, the scar-specific response observed in the present study followed a pattern similar to that reported in the supplied previous study, particularly with respect to the better response of rolling scars to PRF-based treatment.

The higher clinical response observed with fluid PRF in the present study may also be considered in the context of evidence concerning platelet-based regenerative treatment. Long et al. [13] performed a systematic review and meta-analysis including eight studies and 311 participants, of whom 153 were whole-face participants and 158 were split-face participants. Quantitative analysis of 241 participants from six studies demonstrated a statistically significant reduction in scar severity scores in favor of microneedling or subcision with PRP ($P < .001$). The analysis further demonstrated that combination therapy involving intradermal or topical PRP was significantly more effective

than monotherapy and combination therapy involving an adjunct other than PRP, with $P < .001$ and $.001$, respectively. Although the present study compared fluid PRF directly with PRP rather than comparing PRP combination therapy with non-PRP procedures, the findings support the broader observation that platelet-based treatment can contribute to clinically meaningful improvement in atrophic acne scars.

Ismail et al. [14] also evaluated different PRP-based approaches in 30 adult patients with post-acne scars. Their study compared microneedling alone, intradermal PRP, and combined microneedling with PRP. The treatment sessions were repeated every three weeks for a maximum of four sessions. Assessment was performed using photography, the Goodman and Baron qualitative grading system, and the Echelle d'Evaluation Clinique des Cicatrices d'Acné (ECCA) scale. The study reported better improvement with combined microneedling and PRP, although the difference in one comparison was not statistically significant, while a significant reduction in the total number of post-acne scars was observed in the combined-treatment side using photographic assessment and ECCA grading. In the present study, the overall improvement was also evident with platelet-based treatment, although fluid PRF produced a significantly greater percentage reduction in scar severity than PRP alone (50.7% versus 39.7%, $p=0.019$). The findings therefore suggest that platelet-derived regenerative approaches may provide clinically useful improvement, while the type of platelet preparation may influence the degree of response.

The response according to scar morphology in the present study further demonstrated that rolling scars showed the greatest improvement with fluid PRF, followed by boxcar scars. Fluid PRF produced $55.8 \pm 9.6\%$ improvement in rolling scars compared with $44.2 \pm 10.1\%$ with PRP ($p=0.018$), while boxcar scars showed $51.6 \pm 10.2\%$ improvement with fluid PRF compared with $40.3 \pm 11.0\%$ with PRP ($p=0.022$). These findings were comparable in pattern with the study by Krishnegowda et al. [12], in which rolling scars responded best, followed by boxcar and ice-pick scars. However, the present findings for ice-pick and mixed scars did not demonstrate statistically significant differences between fluid PRF and PRP. This indicates that the response to platelet-based regenerative treatment may vary according to scar morphology.

The safety profile observed in the present study was favorable. Erythema was the most frequent adverse effect, occurring in 36.0% of the fluid PRF group and 40.0% of the PRP group. Pain was reported in 28.0% and 32.0%, edema in 20.0% and 24.0%, and bruising in 16.0% and 20.0% of the respective groups. Post-inflammatory pigmentation was uncommon, occurring in 4.0% of the fluid PRF group and 8.0% of the PRP group. No serious adverse events were observed. These findings can be considered alongside the observations of Nofal et al. [15], who evaluated intradermal PRP, 100% focal TCA, and combined skin needling with topical PRP in 45 patients. All three groups demonstrated statistically highly significant improvement in acne scars after treatment ($p < .001$), and no major adverse effects were observed [5]. Similarly, Hassan et al. [16], who compared intradermal PRP with combined subcision and PRP in 30 patients, reported that PRP alone showed better response, fewer side effects, and shorter downtime than the combined approach. The favorable tolerability observed in the present study is therefore consistent with the supplied literature describing platelet-based procedures as generally well tolerated.

Patient satisfaction also favored fluid PRF in the present study. Overall, 80.0% of participants in the fluid PRF group were satisfied or very satisfied compared with 60.0% in the PRP group. Very high satisfaction was reported by 36.0% of participants receiving fluid PRF compared with 20.0% receiving PRP. Although this numerical difference in satisfaction did not reach statistical significance ($p=0.132$), the direction of the finding was consistent with the study by Diab et al. [11], which reported significantly higher therapeutic response and patient satisfaction with PRF compared with PRP. Thus, the clinical improvement observed with fluid PRF in the present study was accompanied by a corresponding tendency toward greater patient-perceived benefit. The present study demonstrated that both fluid PRF and PRP improved atrophic acne scars, but fluid PRF produced a significantly greater reduction in scar severity and a higher proportion of good-to-excellent clinical responses. Good-to-excellent improvement was observed in 68.0% of patients in the fluid PRF group compared with 44.0% in the PRP group ($p=0.043$). The present

findings suggest that fluid PRF represents a useful platelet-based treatment option for atrophic acne scars, with the greatest improvement observed particularly among rolling and boxcar scars. However, the findings should be interpreted in relation to the sample size and follow-up period of the present study.

CONCLUSION

The present comparative study demonstrated that both fluid platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) produced clinical improvement in patients with atrophic acne scars; however, fluid PRF showed a greater overall therapeutic response. The mean reduction in scar severity and percentage improvement were significantly higher in the fluid PRF group, with particularly favorable responses observed in rolling and boxcar scars. A greater proportion of patients receiving fluid PRF achieved good-to-excellent clinical improvement and reported satisfaction with the treatment. Both modalities were generally well tolerated, with mainly mild and transient local adverse effects and no serious complications. These findings indicate that fluid PRF may be a useful autologous regenerative treatment option for atrophic acne scars and may provide greater clinical improvement than PRP when used under comparable treatment conditions.

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