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Original Article

Comparison of Microneedling with Platelet-Rich Plasma versus Distilled Water for Atrophic Acne Scar

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ABSTRACT

Objective: To compare the effectiveness of microneedling with platelet-rich plasma (PRP) and distilled water for the treatment of atrophic acne scars.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Dermatology, Pakistan Air Force Hospital, Rafiqui, Shorkot Cantt Pakistan, from Jan to Jun 2023.

Methodology: The study included 80 patients, aged 15 to 40 years, of both genders with atrophic acne scars. An equal patients were divided into 2 groups. In Group-A, 2 mL of PRP was applied simultaneously over the face, along with micro-needling. In Group-B, distilled water was used instead of PRP. A total of 3 sessions of micro-needling were performed at monthly intervals in both groups. Each patient was followed up for 3 months after the final session. Effectiveness was noted after 6 months of the 1st treatment session.

Results: The mean age of 26.825±3.32 years in Group-A and the mean age of 26.80±3.26 years in Group-B. Effectiveness was observed in 20(50.0%) patients in Group-A as compared to 5(12.5%) patients in Group-B (*p*-value <0.001).

Conclusion: The study concluded that platelet-rich plasma has proven to be more effective in the management of atrophic acne scars as compared to the distilled water microneedling process.

Keywords: Atrophic Acne Scars, Effectiveness of PRP, Microneedling, Platelet-Rich Plasma.

How to Cite This Article: *Ghaus I, Mashhood AA, Yousaf F, Rathore HS, Yasmin G, Khan S. Comparison of Microneedling with Platelet-Rich Plasma versus Distilled Water for Atrophic Acne Scar. Pak Armed Forces Med J 2025; 75(4): 778-782. DOI: https://doi.org/10.51253/pafmj.v75i4.10730*

INTRODUCTION

Facial acne is one of the common skin conditions among teenagers. Most people do not experience severe symptoms, but their quality of life can be significantly affected. Therefore, acne should be managed like any other skin issue, with a patient-centered approach. A Polish study found that 547 participants (74.9%) reported having facial acne; there was no noticeable difference in prevalence between females (75.1%) and males (74.6%).[1] Since post-acne scarring is a different problem from acne vulgaris, it requires specific clinical expertise beyond that used for active acne. Up to 95% of individuals with acne experience scarring, making it a persistent and disfigurement-causing condition, often without a definitive cure. Acne scars are usually the main, ongoing concern for patients because they are permanent. They can also lead to significant cosmetic issues, resulting in psychological and social problems that can seriously harm a patient's quality of life.[2] The cause of acne scarring remains unknown despite its clinical and societal importance.

It's interesting to note that not every acne patient will develop scars. While most other scars typically originate as hypertrophic forms, acne scars mainly appear as atrophic shapes.[3] The biological complexity of acne scars is reflected in the moderate success of many acne scar management techniques. These suggest that specific characteristics of the underlying pathogenesis distinguish acne scars from other types of scar formation. A growing body of research shows that early inflammatory episodes in acne are a crucial stage in scar development. Atrophic scarring is affected by the persistent perifollicular infiltration of pro-inflammatory cells and mediators in early acne lesions, and increased involvement of innate immune pathways has been observed in these settings.[4]

Microneedling of the skin, also called a method of stimulating percutaneous collagen production, is a skin rejuvenation treatment that is increasingly popular.[5] In a minimally invasive way, this technique uses tiny needles to pierce the skin and promote localized collagen creation. Platelet-rich plasma (PRP)

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Received: 31 Aug 2023; revision received: 26 Jan 2024; accepted: 16 Feb 2024

has recently been used by physicians to enhance cosmetic outcomes in various dermatological procedures by leveraging its ability to improve wound healing.[6]

According to the available evidence, local data on the concomitant use of platelet-rich plasma (PRP) and microneedling for the treatment of acne scars are scarce. A variety of therapeutic modalities have been employed to reduce the severity of acne scars, including chemical peels, laser resurfacing, dermabrasion or microdermabrasion, punch techniques, subcision, microneedling, and various combination regimens, each demonstrating variable effectiveness. In recent years, PRP has garnered global attention for its potential to modulate collagen synthesis and enhance wound healing, thereby improving acne scar outcomes.[7]

Given the absence of similar studies in the general population within our setting, this study aims to compare the effectiveness of microneedling combined with PRP versus microneedling with distilled water in the management of atrophic acne scars.

METHODOLOGY

This quasi-experimental study was conducted at the dermatology department, Pakistan Air Force Hospital Rafiqui, Shorkot Cantt, from Jan to Jun 2023, after taking permission from the hospital's Institutional Review Board (LM No RAF (H)/2609/1/Med/2023). The size of the sample comprised 80 patients (40 in each group). It was calculated using the WHO calculator with 90% power of test, 5% level of significance, using the effectiveness of microneedling with autologous platelet-rich plasma as 40% (P1) compared to 10% (P2) of microneedling with distilled water.[7] Non-probability consecutive sampling was used for sampling (Figure).

Inclusion Criteria: Patients of both genders, aged between 15 to 40 years with atrophic acne scars on both sides of the face without active lesions of acne were included in the study, and their lesions were assessed as per Goodman's Qualitative score[8] (Table-I).

Exclusion Criteria: Patients having keloidal tendency, bleeding tendency or dysfunction of platelets, any major surgery done in the previous 6 months, acute infection on face including herpes simplex, folliculitis, positive serology for HIV, HCV, HBV, or any chronic ailment and pregnant patients were excluded from the study.

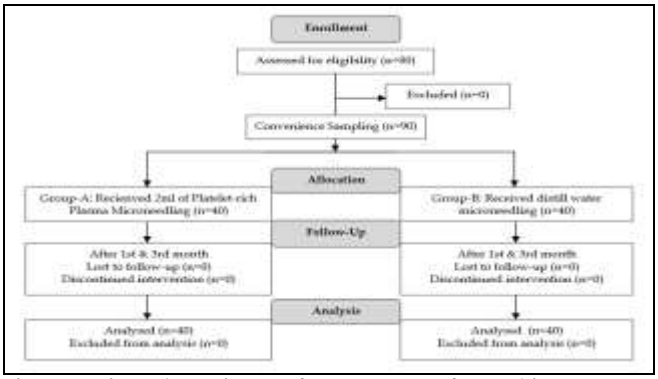

Figure: Patient Flow Diagram for Treatment of Atrophic Acne Scars with PRP and Distilled Water (n=80)

Written informed consent was obtained from every participant. Basic demographics were noted, such as age, gender, duration of scar, and weight on the weight scale. Group assignments were concealed in sealed envelopes, which were opened only at the time of patient enrolment for the procedure. Before each session, a topical anesthetic—an eutectic mixture of Lidocaine and Prilocaine—was applied to the face and removed after 40 minutes.

Table-I: Goodman's Qualitative Score 8

Grade	Level of Disease	Clinical Features
1	Macular	These scars can be erythematous, hyper- or hypopigmented flat marks. They do not represent a problem of contour like other scar grades, but of color.
2	Mild	Mild atrophy or hypertrophic scars that may not be obvious at social distances of 50cm or greater and may be covered adequately by makeup or the normal shadow of shaved beard hair in men or normal body hair if extra facial.
3	Moderate	Moderate atrophic or hypertrophic scarring that is obvious at social distances of 50cm or greater and is not covered easily by makeup or the normal shadow of shaved beard hair in men or body hair if extra facial but is still able to be flattened by manual stretching of the skin (if atrophic).
4	Severe	Severe atrophic or hypertrophic scarring that is evident at social distances greater than 50cm and is not covered easily by makeup or the normal shadow of shaved beard hair in men or body hair if extra facial and is not able to be flattened by manual stretching of the skin.

Autologous platelet-rich plasma was prepared for every session. 10ml of blood was taken in a test tube of 20ml. It was already filled with an anticoagulant (Acid-Citrate-Dextrose) 1ml in quantity. A standard centrifuge machine was used during each session. First spin was at 1500 revolutions/min for 10 minutes. The buffy coat and layer of plasma at the end of the first spin were taken for further processing. It was again centrifuged after discarding the red cell sediment. The next cycle of centrifugation was carried out at 4000 revolutions/min for 10 minutes, which resulted in the formation of platelet-rich plasma, settling at the base with the platelet-poor segment on

top. The upper platelet-depleted segment was discarded. The final solution was 2-3 mL of platelet-rich plasma. Platelet count was estimated with the help of an automatic platelet analyzer machine, prior to the start and then of the first session. A 3-fold rise in platelet count was essential in the PRP solution before use for the treatment.

Microneedling was performed on all patients using a Dermapen® with 36 needles, at a depth of 1-1.5 mm. Patients were made to lie down in supine position on the couch, and microneedling was done for 5 min on each side. The endpoint of the procedure was considered when minute pinpoint bleeding appeared on both sides of the face. A new pin was used for each patient, every time.

In Group-A, 2mL of PRP was applied simultaneously over the face, along with microneedling. In Group-B, distilled water was used instead of PRP. The whole procedure lasted for about 10 minutes in both groups. After the procedure, the face was cleaned with distilled water. Patients were advised regarding regular application of topical antibiotics for five days to prevent post-procedure infection and strict sun protection throughout the duration of the study to prevent post-inflammatory hyperpigmentation. Microneedling was performed every 1 month for 3 months. After completion of the third session, patients were called for follow-up after every month for the next three months. Final results were recorded at the end of six months from the start of treatment. Subjective scoring was done by one independent dermatologist to minimize individual bias.

Effectiveness was defined as the reduction in Goodman's qualitative score by 2 points from the baseline assessment score and was noted at the end of 6 months in both groups. Analysis of data was done by Statistical Package for the the Social Sciences (SPSS) version 22:00. The variables of duration of scar, weight, and age were quantified and their Mean±SD was evaluated. The qualitative variables of effectiveness and gender were assessed for frequency and percentage. The level of effectiveness was evaluated by applying the Chi-square test in both groups; a p-value of ≤0.05 was considered significant.

RESULTS

A total of 80 patients were included in this study. Out of these, 36(45.0%) patients were males and 44(55.0%) patients were females. Mean age was 26.825±3.32 years, the mean duration of scar was 9.650±3.19 weeks in Group-A, and mean age of 26.800±3.26 years, the mean duration of scar was 12.450±4.36 weeks in Group-B. Effectiveness was observed in 20(50%) patients in Group-A as compared to 5(12.5%) patients in Group-B (*p*-value <0.001), as shown in Table-II.

Table-II: Comparison of Effectiveness of Treatment in both Study Groups (n=80)

Effectiveness	Study Groups		*p*-value
	Group-A (n=40)	Group-B (n=40)	
Yes	20(50.0%)	5(12.5%)	<0.001
No	20(50.0%)	35(87.5%)	

In Group-A, female gender was dominant, and male gender was predominantly present in Group-B, as shown in Table-III. In Group-A, 9(22.5%) patients had duration of scars older than 12 weeks, while 31(77.5%) patients had duration of acne scars within 12 weeks, as compared to 21(52.5%) and 19(47.5%), respectively, in Group-B. There was a statistically significant difference found for less than 12 weeks scar duration as the *p*-value was 0.006, while for greater than 12 weeks duration, effectiveness had no significant association as the *p*-value was >0.05, as shown in Table-IV.

Table-III: Gender-Based Comparison Between Effectiveness and Study Groups (n=80)

Parameters	Study Groups	Effectiveness		*p*-value
		Yes	No	
Male	Group-A (n=15)	8(53.3%)	7(46.7%)	0.003
	Group-B (n=21)	2(9.5%)	19(90.5%)	
Female	Group-A (n=25)	12(48.0%)	13(52.0%)	0.025
	Group-B (n=19)	3(15.8%)	16(84.2%)	

Table-IV: Comparison of Treatment Effectiveness According to Duration of Scar in Both Groups (n=80)

Duration of Scar	Study Groups	Effectiveness		*p*-value
		Yes	No	
1-12 weeks	Group-A (n=31)	19(61.3%)	12(38.7%)	0.006
	Group-B (n=19)	4(21.1%)	15(78.9%)	
>12 weeks	Group-A (n=9)	1(11.1%)	8(88.9%)	0.053
	Group-B (n=21)	1(4.8%)	20(95.2%)	

In addition, out of total 80 patients in both groups, the effectiveness of the treatment given was recorded as 50% in Group-A while in Group-B it was recorded as 12.5 % (*p*-value <0.001). Association done

for effectiveness of treatment for patients ranging from 15 to 40 years showed 47.2% response in Group-A, whereas it was 13.9% in Group-B. For patients aged more than 30 years, it was 75% and 0% in Group-A and B, respectively.

DISCUSSION

The study demonstrated that microneedling combined with platelet-rich plasma (PRP) was more effective than the comparator in the treatment of atrophic acne scars. The study population was predominantly female, and the effectiveness of PRP was particularly notable in patients younger than 30 years and those with scar duration of less than 12 weeks.

The use of platelet-rich plasma for facial rejuvenation has garnered immense attention in recent years owing to its noninvasive technique and promising outcome, with considerable evidence for being safe and effective.[9] The mechanism of action of PRP in accelerating wound healing at any site, be it chronic leg ulcers or bone grafting, by providing a concentrated amount of growth factors, is widely established.[10] In the dermatological arena, it is being used for treatment of acne scars, androgenetic alopecia, and facial rejuvenation.

PRP, upon administration to the diseased area, initiates a mild inflammatory process. The basis of it is local administration of a large variety of growth factors, which include transforming growth factor beta (TGF-β), platelet-derived epidermal growth factor, platelet-derived growth factor, platelet-derived angiogenesis factor, various amino acids, and insulin-like growth factor 1.[11] All these stimulate the process of wound healing and augment the regeneration of tissues.

With regards to acne scars, PRP, when used in conjunction with microneedling, is postulated to improve the appearance of scars by enhancing collagen production by stimulating fibroblasts via TGF-β and modulating inflammation. Long *et al.,* concluded in their study that with increased collagen synthesis and remodeling of scar tissue, PRP can help fill the depressed or pitted scars, resulting in improved skin texture with more uniformity and reduced visibility of scars.[12] In addition, Min *et al.,* explained that the anti-inflammatory properties of PRP can subdue the inflammatory process linked with acne scars therefore help to decrease the associated edema and erythema.[13] The micro-wounds produced in the dermis by microneedling further potentiate this process by stimulating the production of growth factors which results in formation of collagen and elastin, that leads to remodeling of the dermis and resurfacing of skin as proven by Schoenberg *et al*.[14]

Asif *et al.,* carried out a study involving the use of microneedling with distilled water on one side of the face and microneedling with PRP on the other side of the face, which showed increased effectiveness of microneedling combined with PRP as compared to microneedling with distilled water.[15] A study done by Vivekanandh *et al.,* showed similar results with the combined use of PRP with microneedling. In their study, out of the total 40 participants, 42.5 % patients achieved significant betterment in their appearance and reduction in the grade of severity of the acne scars, 35% patients demonstrated moderate results; however, no difference was observed in 7.5% of the patients.[16] An RCT conducted by Behrangi *et al.,* showed that microneedling, when done in combination with platelet-rich plasma, resulted in the highest number of patients with significant improvement in the depth and appearance of acne scars as compared to fractional CO2 laser or microneedling as a sole therapy.[17]

This study potentiates the findings of literature mentioned above, which reported an increased response to PRP combined with microneedling in the resolution of acne scars. However, the combined regimen has its drawbacks as well. The procedure time is much longer for the combined regimen; preparation of PRP and its standardization could have their possible risks.[18] The need for multiple visits for assessment could pose a possibility of losing patients to follow up which we fortunately did not face.

There has been limited research to ascertain the combined effectiveness of microneedling with PRP in our region. This study aimed to assess the difference brought about by the use of PRP as an adjunctive treatment with microneedling for atrophic acne scars. Compared to microneedling alone, combining PRP with microneedling results in better scar remodeling, with lesser time taken for wound healing and better skin texture, hence improved results as per the assessment of physicians and patients.

LIMITATIONS OF THE STUDY

This study was conducted at a single center with a relatively small sample size, which has limited the generalizability of the findings. The quasi-experimental design lacked randomization and blinding, introducing potential selection and observer bias. The unequal gender distribution between the groups has influenced the results.

Follow-up duration was short, restricting the ability to assess long-term treatment outcomes. Patient-reported satisfaction and quality-of-life measures were not evaluated.

CONCLUSION

It was concluded that microneedling with concomitant use of platelet-rich plasma has more effectiveness in the management of atrophic acne scars, with more reduction in the severity of scars as compared to microneedling alone. Age and scar duration have a profound effect on the treatment of acne scars.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

IG & AAM: Data acquisition, data analysis, critical review, approval of the final version to be published.

FY & HSR: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

GY & SK: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Szepietowska M, Dąbrowska A, Nowak B, Skinderowicz K, Wilczyński B, Krajewski PK, et al. Prevalence and quality of life of facial acne: a cross-sectional study in high school students in Poland. Postepy Dermatol Alergol 2022; 39(6): 1035-1039. https://doi:10.5114/ada.2021.112765
2. Zhou C, Vempati A, Tam C, Khong J, Vasilev R, Tam K, et al. Beyond the Surface: A Deeper Look at the Psychosocial Impacts of Acne Scarring. Clin Cosmet Investig Dermatol 2023; 16: 731-738. https://doi:10.2147/CCID.S406235
3. Moon J, Yoon JY, Yang JH, Kwon HH, Min S, Suh DH. Atrophic acne scar: a process from altered metabolism of elastic fibres and collagen fibres based on transforming growth factor-β1 signalling. Br J Dermatol 2019; 181(6): 1226-1237. https://doi:10.1111/bjd.17851
4. Saint JM, Khammari A, Jasson F, Nguyen JM, Dréno B. Different cutaneous innate immunity profiles in acne patients with and without atrophic scars. Eur J Dermatol 2016; 26(1): 68-74. https://doi:10.1684/ejd.2015.2713
5. Hashim PW, Levy Z, Cohen JL, Goldenberg G. Microneedling therapy with and without platelet-rich plasma. Cutis 2017; 99(4): 239-242.
6. Lin MY, Lin CS, Hu S, Chung WH. Progress in the Use of Platelet-rich Plasma in Aesthetic and Medical Dermatology. J Clin Aesthet Dermatol 2020; 13(8): 28-35.
7. Everts P, Onishi K, Jayaram P, Lana JF, Mautner K. Platelet-Rich Plasma: New Performance Understandings and Therapeutic Considerations in 2020. Int J Mol Sci 2020; 21(20): 7794. https://doi:10.3390/ijms21207794
8. Goodman GJ, Baron JA. Postacne scarring: a qualitative global scarring grading system. Dermatol Surg 2006; 32(12): 1458-1466. https://doi:10.1111/j.1524-4725.2006.32354.x
9. Banihashemi M, Zabolinejad N, Salehi M, Hamidi AD, Nakhaizadeh S. Platelet-rich Plasma use for facial rejuvenation: a clinical trial and review of current literature. Acta Biomed 2021; 92(2): e2021187. https://doi:10.23750/abm.v92i2.9687
10. Huber SC, de Moraes MB, Quintero M, de Paula LÍS, Cataldo JL, de Lima MSA, et al. A case series of platelet rich plasma in chronic venous ulcers. Regen Ther 2021; 18: 51-58. https://doi:10.1016/j.reth.2021.03.005
11. Hesseler MJ, Shyam N. Platelet-rich plasma and its utility in the treatment of acne scars: A systematic review. J Am Acad Dermatol 2019; 80(6): 1730-1745. https://doi:10.1016/j.jaad.2018.11.029
12. Long T, Gupta A, Ma S, Hsu S. Platelet-rich plasma in noninvasive procedures for atrophic acne scars: A systematic review and meta-analysis. J Cosmet Dermatol 2020; 19(4): 836-844. https://doi:10.1111/jocd.13331
13. Min S, Yoon JY, Park SY, Moon J, Kwon HH, Suh DH. Combination of platelet rich plasma in fractional carbon dioxide laser treatment increased clinical effectiveness of for acne scar by enhancement of collagen production and modulation of laser-induced inflammation. Lasers Surg Med 2018; 50(4): 302-310. https://doi:10.1002/lsm.22776
14. Schoenberg E, Wang JV, Zachary CB, Saedi N. Treatment of acne scars with PRP and laser therapy: an up-to-date appraisal. Arch Dermatol Res 2019; 311(8): 643-646. https://doi:10.1007/s00403-019-01936-7
15. Asif M, Kanodia S, Singh K. Combined autologous platelet-rich plasma with microneedling verses microneedling with distilled water in the treatment of atrophic acne scars: a concurrent split-face study. J Cosmet Dermatol 2016; 15(4): 434-443. https://doi:10.1111/jocd.12207
16. Vivekanandh K, Nivin SJ, Sushma I, Pravin AJS, Reshma JA, Agnes V, et al. Effectiveness of Combined Effect of Microneedling and PRP for the Treatment of Acne Scars: An Open Uncontrolled Study. J Cardiovasc Dis Res 2023; 4: 244-251. https://doi:10.31838/jcdr.2023.14.04.29
17. Behrangi E, Goodarzi A, Ghasemi M, Mohamadi FZ, Hassani P, Gharajeh R, et al. Effectiveness and safety of microneedling with and without platelet-rich plasma versus fractional CO2 laser for treatment of acne scars: a randomized clinical trial. Iran J dermatol 2022; 25(2): 91-98. https://doi:10.31838/jcr.07.04.133
18. Nandini AS, Sankey SM, Sowmya CS, Sharath Kumar BC. Split-face Comparative Study of Effectiveness of Platelet-rich Plasma Combined with Microneedling versus Microneedling alone in Treatment of Post-acne Scars. J Cutan Aesthet Surg 2021; 14(1): 26-31. https://doi:10.4103/JCAS.JCAS_160_18