

Comparison of Efficacy and Safety of Glycolic Acid Peel versus Glycolic Acid Peel Combined with Micro-needling in Treatment of Acne Scars: A Quasi-Experimental Study

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Abstract

Background Various treatment modalities for acne scars including chemical peels and microneedling, have been used to improve atrophic acne scars with varying degrees of success. Glycolic acid peel promotes skin exfoliation and collagen remodeling, while microneedling stimulates dermal collagen production. Combining these therapies may enhance treatment outcomes compared with glycolic acid peel alone.

Objective To compare the safety and effectiveness of 35% glycolic acid peel alone versus combined glycolic acid peel and micro needling in treating acne scars.

Methods Sixty patients were enrolled in the study and divided into Groups A and B, aged 18-45 years. Group A received six fortnightly sessions of microneedling using a 1.5 mm derma roller with glycolic acid peel, whereas Group B underwent six sessions of 35% glycolic acid alone. Goodman's Qualitative Acne Scar Grading System was used to assess the outcomes.

Results Boxcar scars were most common, followed by rolling scars and icepick scars with frequencies of 38.3%, 31.7%, and 30.0% respectively. Group A demonstrated better outcomes ($P=.041$): 60% of patients showed excellent improvement compared to 33.3% in Group B. Moderate improvement was recorded in 30% of Group A patients versus 40% in Group B, while poor response was seen in 10% versus 26.7%. Both treatment modalities were safe and well tolerated. Mild transient erythema and facial edema were the most commonly observed adverse effects, resolving spontaneously within 24-48 hours. No serious complications were observed in either group.

Conclusion Using glycolic acid with microneedling is safe and yields better results for the treatment of acne scars in comparison to the use of glycolic acid alone.

Keywords Acne scars; Glycolic acid peel; Microneedling, Atrophic scars; Combination therapy.

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Introduction

Acne vulgaris is regarded as one of the most common skin disorders across the globe, affecting 85% of individuals between the ages of 18-45 years. It is an inflammatory disorder originating in the pilosebaceous unit, commonly appearing on the face, upper arms, chest and back.¹ Repeated inflammation

and severe lesions often lead to permanent acne scars.

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There are two main types of acne scars: atrophic and hypertrophic. Atrophic scars account for the majority and occur due to collagen breakdown during healing.² Hypertrophic scars develop due to excessive collagen formation. Acne scars, particularly on the face, can negatively influence a person's self-confidence, social interaction, academic performance and emotional well-being.³ In severe cases, they may also lead to anxiety, depression and suicidal thoughts.

Treating acne scars is challenging because of their diverse morphology and depth. Therefore, a multimodal approach is necessary.⁴ Available treatment options include energy-based techniques (lasers and radiofrequency) and non-energy-based methods (chemical peels, microneedling, dermabrasion and dermal fillers).⁵

Acne scarring remains a major cosmetic and psychological concern, particularly among young adults. Atrophic scars are the most common subtype and are often difficult to treat because of their varying morphology and depth. Glycolic acid peels improve epidermal turnover and stimulate collagen synthesis, whereas microneedling promotes dermal remodelling through controlled collagen induction therapy. Recent evidence suggests that combination therapy may provide superior outcomes compared to monotherapy by targeting both epidermal and dermal components of scar formation. However, limited local data are available comparing these modalities in Pakistani patients with Fitzpatrick skin types IV-V. Therefore, this study was conducted to compare the efficacy and safety of glycolic acid peel alone versus glycolic acid peel combined with microneedling in the treatment of acne scars.

Glycolic acid peel is widely used for treatment of acne scars. It is an alpha-hydroxy acid derived from sugarcane.⁶ Its small molecular size allows for deeper dermal penetration. By causing exfoliation and stimulating dermal fibroblasts to produce collagen, elastin, and glycosaminoglycan, glycolic acid greatly improves the pigmentation and texture

of scars.⁷ Microneedling, another effective technique, promotes collagen synthesis and skin remodelling through controlled micro-injuries.^[8] Recent studies suggest that combining both treatments may produce better outcomes. However, there is limited data available from Pakistan comparing these approaches, emphasizing the need for further investigation.

Methods

This quasi-experimental study was conducted in the Dermatology Outpatient Department (OPD) of Sharif Medical & Dental College, Lahore, from January 2025 to June 2025 after obtaining approval from the Institutional Review Board/ ERC (Approval No. 356-24; dated 14.10.2024). Written informed consent was obtained from all participants before enrolment. A total of 60 patients with atrophic acne scarring were enrolled. They were divided into two groups (A and B), 30 patients each.

The sample size of 60 patients (30 in each group) was calculated using the WHO sample size calculator with a 95% confidence level, 80% study power, taking $P1=0.73$ (efficacy of microneedling) and $P2=0.33$ (efficacy of glycolic acid peel alone) as reported by Ishfaq *et al.* (2022).¹² A non-probability consecutive sampling technique was used. Patients fulfilling the inclusion criteria were recruited from the Dermatology Outpatient Department (OPD).

We included patients of either gender between the ages of 18 and 45 years with atrophic scars due to acne lasting longer than six months, encompassing all scar types categorized under Goodman's Qualitative Acne Scarring Grading System. Patients were screened for active acne lesions, facial infections, glycolic acid hypersensitivity, keloidal tendency, bleeding disorders, and uncontrolled systemic illnesses before inclusion. Patients with any of these conditions were excluded from the study.

Prior to enrolment, baseline demographic and clinical data were recorded. Weight was measured

using a calibrated digital weighing scale to the nearest 0.1 kg, with participants in light clothing and without shoes. Height was measured using a wall-mounted stadiometer to the nearest 0.1 cm. BMI was calculated as weight (kg) divided by height squared (m²). For subgroup stratification, a BMI cut-off of 25 kg/m² was used, as this threshold distinguishes normal weight from overweight and above, and has been consistently employed in similar dermatological intervention studies conducted in Pakistani populations. Prior to each session, the treatment area was cleansed thoroughly and standard antiseptic skin preparation was performed.

A lottery method was used to divide patients into two groups. Group A received 35% glycolic acid peel followed by microneedling with a 1.5 mm derma roller until pinpoint bleeding was observed. Group B received only the glycolic acid peel. Glycolic acid peel was subsequently neutralized with normal saline. Six treatment sessions were conducted at two-week intervals.

Post-procedure instructions included strict sun avoidance, use of sunscreen, gentle cleansing, and application of emollients. Patients were evaluated one month after completion of all six sessions using Goodman's Qualitative Acne Scar Grading System. Statistical analysis was performed using SPSS version 22.0. Continuous variables were compared between groups using the independent samples t-test, and categorical variables were compared using the chi-square test. Treatment outcome was compared between groups by classifying responses as excellent versus non-excellent. Subgroup analysis was performed using the Cochran-Mantel-Haenszel test. A P-value <.05 was considered statistically significant. Statistical comparison was performed using SPSS 22 with chi-square test; a p-value below .05 was considered statistically significant.

Result

As shown in **Table 1**, both groups were comparable at baseline demographically. There were no statistically significant differences in age, gender distribution, body mass index, or duration of scars ($P>.05$). Boxcar scars were the most frequently observed, followed by rolling and icepick scars. Group A showed significantly better results than Group B ($P=.041$): 60.0% of patients achieved excellent improvement compared to 33.3% in Group B.

Further subgroup analysis was conducted by stratification based on age, gender, scar duration, BMI, and scar type. P-values represent Cochran-Mantel-Haenszel (CMH) test comparing treatment response rates (responders vs. non-responders) between Group A and Group B, stratified by each variable. A non-significant p-value indicates no significant effect modification (**Table 2**). Both treatment modalities were found to be safe and well tolerated. Mild transient erythema and facial edema were the most commonly observed adverse effects. These reactions resolved spontaneously within 24-48 hours.

Table 1 Demographic characteristics, scar type distribution and treatment outcome.

Variables	Group A (n = 30)	Group B (n = 30)	Total (n = 60)	P-value
Demographic characteristics				
Mean Age (years)	26.8±5.1	27.4±4.8	27.1±4.9	.63
Gender (Male/Female)	12 / 18	14 / 16	26 / 34	.60
Mean BMI (kg/m ²)	23.7±2.8	24.1±3.1	23.9±2.9	.54
Duration of Scars (months)	20.4±7.2	19.8±6.9	20.1±7.0	.78
Scar Type distribution				
Icepick	8 (26.7%)	10 (33.3%)	18 (30.0%)	.041
Boxcar	12 (40.0%)	11 (36.7%)	23 (38.3%)	
Rolling	10 (33.3%)	9 (30.0%)	19 (31.7%)	
Treatment outcome				
Excellent	18 (60.0%)	10 (33.3%)	28 (46.7%)	.041
Good	9 (30.0%)	12 (40.0%)	21 (35.0%)	
Poor	3 (10.0%)	8 (26.7%)	11 (18.3%)	
Total	30 (100%)	30 (100%)	60 (100%)	

Group A (GA + Microneedling); Group B (GA Alone).

Table 2 Stratification based upon age, gender, scar duration, BMI and Scar type.

Variable	Category	Group A (n)	Responders in A n (%)	Group B (n)	Responders in B n (%)	P-value
Age	< 30 years	20	19 (95%)	18	14 (77.8%)	.846
	≥ 30 years	10	8 (80%)	12	8 (66.7%)	
Gender	Male	12	10 (83.3%)	14	9 (64.3%)	1
	Female	18	17 (94.4%)	16	13 (81.3%)	
Duration of Scars	< 6 months	22	20 (90.9%)	23	17 (73.9%)	1
	≥ 6 months	8	7 (87.5%)	7	5 (71.4%)	
BMI	< 25 kg/m ²	21	19 (90.5%)	20	15 (75%)	1
	≥ 25 kg/m ²	9	8 (88.9%)	10	7 (70%)	
Scar Type	Icepick	8	5 (62.5%)	10	6 (60%)	.619
	Boxcar	12	12 (100%)	11	7 (63.6%)	
	Rolling	10	10 (100%)	9	9 (100%)	

Table 3 Adverse effects profile.

Adverse Effect	Group A (GA + Microneedling)	Group B (GA Alone)
Mild erythema	8 (26.7%)	5 (16.7%)
Mild edema	5 (16.7%)	2 (6.7%)
Post-inflammatory hyperpigmentation	0	0
Infection	0	0
Scarring / Keloid	0	0

formation were observed in either group (**Table 3**).

Figures 1a, 2a shows the patient's facial appearance before treatment and **Figures 1b, 2b** shows the appearance after completion of six treatment sessions.

Discussion

The current study was designed to compare the therapeutic effectiveness of glycolic acid peel administered in isolation against its combined use with microneedling in order to manage post-acne atrophic scars. Among the different scar morphologies, boxcar scars were the most prevalent (38.3%), followed by rolling scars (31.7%) and icepick scars (30.0%). The results revealed that a combination of glycolic acid peel and microneedling proved significantly more efficient than isolated peeling in improving post-acne atrophic scars. This synergistic benefit may be explained by the dual mechanism of epidermal turnover and improved skin texture induced by glycolic acid, combined with microneedling-driven collagen production and dermal remodelling.

These results align with previous quasi-experimental research findings. Rana *et al.* (2017) used microneedling in combination with sequential 70% glycolic acid peels and found significantly lower ECCA scores in the combination group compared to microneedling alone (39.65±2.50 vs. 29.58±0.18, $P<.001$).⁹ The slight variation in treatment outcomes



Figure 1 Glycolic Acid Peel with Microneedling.



Figure 2 Glycolic acid peel with microneedling.

No serious complications such as post-inflammatory hyperpigmentation, infection, scarring, or keloid

compared to Rana *et al.* may also be attributed to differences in ethnicity, Fitzpatrick skin types, scar severity, and environmental factors. Pakistani patients predominantly possess Fitzpatrick skin types IV-V, which may influence healing response, collagen remodelling, and risk of pigmentary changes following procedural interventions. Although their study compared combination therapy relative to microneedling alone, collectively these studies further support that dual-modality treatment yields superior outcomes compared to single-modality therapy.¹⁰

Similarly, Saadawi *et al.* (2019) compared microneedling, GA peel, and combination therapy and observed superior findings for all scar types with enhanced patient satisfaction following combined treatment.¹¹ While Saadawi *et al.* found better treatment response in rolling scars, our study showed better results for boxcar scars, which may be attributed to variations in scar depth, severity, and patient skin types. Based on Ishfaq *et al.* (2022), who reported efficacy of 73.3% with microneedling and 33.3% with glycolic acid peel alone, taking $P1=0.73$ and $P2=0.33$, with 95% confidence level and 80% power, a minimum sample size of 26 per group was calculated using the WHO sample size formula for two proportions, which was rounded up to 30 per group to account for dropouts.¹²

Overall, findings from the present study and previous local and international literature consistently highlight the superiority of combination therapy over monotherapy.¹³ Dual-modality approaches produce faster, more significant, and more consistent improvement, strongly supporting our conclusion that GA peel plus microneedling is a better therapeutic approach for managing acne scars in Pakistani patients.

One of the major strengths of this study is that it provides local comparative data regarding

combination therapy for acne scars in Pakistani patients. The study also used a standardized scar grading system and uniform treatment protocol. However, certain limitations should be acknowledged, including relatively small sample size, short follow-up duration, lack of blinded assessment, and absence of patient satisfaction scoring. Future multicenter studies with larger sample sizes and longer follow-up are recommended for better generalizability.

Conclusion

Both therapeutic techniques for acne scars, glycolic acid (GA) alone and in combination with microneedling - represent safe and well-tolerated treatment options. However, the combined approach of GA and microneedling delivers superior results. Future research with larger sample sizes, prolonged follow-up periods, and patient-reported satisfaction metrics is necessary to further validate our findings.

Declaration of patient consent Authors certify that they have obtained all appropriate patients' consent.

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Conflict of interest No conflict of interest.

Author's contribution

AC: Substantial contribution to concept, study design, acquisition and interpretation of data. Drafting and writing the manuscript.

UA: Substantial contribution to acquisition of data, preparing outline of the study. Revising the manuscript for important intellectual content. Critical review of the manuscript.

MBA: Substantial contribution to acquisition of data, literature review and data analysis. Drafting and writing the manuscript.

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