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Evaluating topical treatments for mild to moderate acne: A cross-sectional study

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Abstract. *Acne vulgaris* (AV) is a chronic, inflammatory skin disease affecting 80% of young adults and adolescents, causing lesions, scarring, and pigmentation in the pilosebaceous unit. Managing AV effectively crucial to improving patients' quality of life and preventing long-term dermatological complications. This study aimed to evaluate the efficacy of three widely used topical treatments for AV, which are: benzoyl peroxide, retinoid, and salicylic acid treatments, in managing mild to moderate acne using a cross-sectional observational study design. The study analysed the effectiveness of benzoyl peroxide, retinoid, and salicylic acid treatments for mild to moderate acne over an 8-week period. Participants aged 15 to 50 were randomly assigned to three treatment groups and outcomes were measured through physical exams and questionnaires. The variables assessed included lesion count, acne severity using GAGS scores, scarring, and skin texture and the data was analysed using SPSS, paired T-tests, and ANOVA to identify the most effective treatment. The study found that benzoyl peroxide significantly improved skin texture and eliminated severe inflammatory cases. Retinoids showed the most reduction in non-inflammatory and inflammatory lesions, with 55% of participants showing only mild lesions post-treatment. Retinoids also reduced severe acne scarring and improved skin texture. Salicylic acid produced moderate improvements, reducing non-inflammatory lesions and improving skin texture. Benzoyl peroxide and retinoids significantly improved skin texture, however, benzoyl peroxide showed mixed results in scarring. Paired sample t-tests confirmed significant improvements in skin texture and non-inflammatory lesions for both benzoyl peroxide and retinoid groups. The findings revealed that retinoids are more effective for non-inflammatory acne lesions and benzoyl peroxide for severe inflammatory cases, allowing for personalised treatment plans. This approach offers valuable insights for improving acne management outcomes. The study can help dermatologists in selecting effective treatments for acne based on lesion type and severity

Keywords: Acne Vulgaris; retinoid; benzoyl peroxide; salicylic acid; skin texture

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Introduction

Acne vulgaris (AV) is one of the most prevalent dermatological conditions, with a significant impact on the physical and psychological well-being of individuals, particularly young adults and adolescents. AV is a complex condition influenced by hormonal changes, microbial activity and demographic factors. Since acne continues to influence millions of people worldwide, it is essential to comprehend the efficacy and safety of prevalent topical therapies. Despite the availability of a variety of treatment options, the rising incidence of acne and the possibility of treatment resistance, particularly in mild to moderate instances, highlight the need for continuous evaluation of existing treatments. Traditional therapies are limited due to adverse effects and poor patient adherence. The rising prevalence of sensitive skin and antibiotic resistance makes it necessary to provide safer and more effective treatments. Furthermore, with the increased interest in alternative treatments and concerns about the long-term adverse reactions of conventional medicine, it is time to assess the efficacy of established therapies in managing acne symptoms.

In response, recent literature explores advances in acne treatment, therapies and new skin regimens. Hence, researchers are exploring innovative anti-inflammatory and antibacterial agents, such as phytochemicals derived from natural products, as safer and more effective alternatives for combating P. acnes and reducing the impact of acne vulgaris [1, 2]. T. Zhang *et al.* [3] conducted a study comparing 2% supramolecular SSA hydrogel and Davuwen Adapaline gel for treating mild to moderate acne vulgaris. Results showed both treatments were effective, however, SSA showed a lower rate of adverse effects and better outcomes in pore reduction. This suggests SSA as a safer alternative for acne management [4]. For the treatment of mild to moderate AV, A. Gern *et al.* [5] evaluated the safety, effectiveness and tolerability of a unique 3 step skincare routine in comparison to BPO in their randomised, doubl-blinded, clinical research. According to the study, although BPO was quite effective at lowering *P. acnes*, 44% of participants stopped using it within six months due to its adverse effects on sensitive skin.

A study by W. Chen *et al.* [6] found that the prevalence of sensitive skin in the adult population is greater than 71% with women being more likely to report it, suggesting the need for new OTC regimens with comparable efficacy and greater tolerability compared to existing BPO therapies. B.S. Dikicier [7] examined the effectiveness, side effects, and adherence rates of topical acne treatments in 250 patients, primarily female (71.2%). The most prescribed treatments were antibacterial BPO combinations and topical retinoids. Nearly half discontinued therapy due to unresponsiveness and side effects, with severe acne patients more likely to discontinue treatment. Salicylic acid (SA) is a beta-hydroxy acid with keratolytic properties, effective in both comedonal and inflammatory acne. It is used in solutions, creams, and gels with low concentrations depending on the skin [8]. SA acts against both non- inflammatory and inflammatory lesions in active acne vulgaris. Moreover, in a study by R. Sarkar *et al.* [9], SA peels were compared with glycolic acid (GA) peels for treating grade 2 AV. Both peels were found effective in reducing lesions and improving post-acne hyperpigmentation. SA was more effective in addressing comedones, papules, and pustules, however, SA peels have low water solubility.

A systematic review by K. Sattar *et al.* [10] evaluated the efficacy and safety of adapalene and BPO combination therapy for acne vulgaris. The study's results showed that combination of adapalene and BPO is a safe and effective therapeutic option for managing acne and reducing acne lessions. AV has been a common dermatological disease that has important effects on the personal health and well-being of people. Despite the availability of various topical treatments, there is a lack of comprehensive and comparative research analysing their effectiveness. There has been a lack of research focusing on these aspects regarding the efficacy of these treatments, including the possible effects on acne lesion count and skin intensity.

The current literature provides a clear correlation between acne and age as well as gender. Most of the teenagers and young adults are faced with hormonal changes which are essential in growth especially during puberty hence leading to acne [11, 12]. AV is a common skin condition that affects populations worldwide, however, only a few studies have compared its treatment responses between different populations or regions, such as Pakistan. There has been a considerable gap in research regarding the comparative effectiveness of commonly used topical treatments for mild to moderate acne in the Pakistani demographic, considering unique genetic, environmental, and lifestyle factors. This study was designed with the purpose of filling this gap by comparing the effectiveness of Benzoyl peroxide, Retinoid, and salicylic acid in Pakistan.

The aim of this study was to evaluate and determine comparative efficacy of benzoyl peroxide, Retinoid, and SA used topically in patients with mild to moderate acne. This paper represented a corss-sectional observational design that aimed to establish an effective positive therapeutic outcome that might help clinicians to make more informed decisions on acne management practices.

Materials and Methods

Study Design

The study has employed a cross sectional observation design to asses and compare the effectiveness of three treatments: retinoid (tretinoin), benzoyl peroxide and salicylic acid in the patients with mild to moderate acne. The study was conducted on the patients from three dermatological clinics of Pakistan with the span of 8 weeks. Participants were randomly assigned to each treatment group, with all three groups receiving specific assigned treatment method. The effectiveness of each treatment was evaluated at the end of 8-week period, with outcomes assessed based on specific clinical parameters. This design allowed for a comprehensive comparison of the

three treatments within the same timeframe, providing valuable insights into their relative efficacies.

Participants

For the observational study, 60 participants aged 15 to 50 years were selected. Of these, 35% were men (21 participants) and 65% were women (39 participants). The age distribution was as follows: 41.7% were 19 years old and younger, 36.7% were aged 20-29, 16.7% were aged 30-39 and 5.0% were aged 40-50. The majority of participants were under the age of 30, indicating a younger cohort. The gender distribution was skewed towards women, who made up the majority of the sample, as shown in Figure 1.

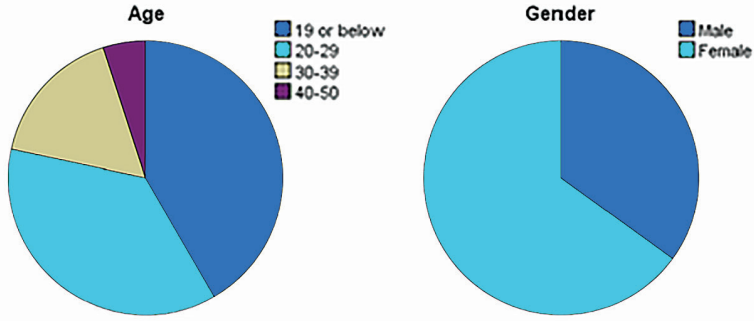

Figure 1. Demographics of the study participants

Source: developed by the authors

Figure 1 demonstrates a disparity in age distribution between males and females, with a greater proportion of females falling within the younger age groups (19 or below and 20-29). This demographic profile provided context for interpreting the treatment outcomes.

The participants were randomly assigned to specific treatment method, dividing 20 participants in each group without any limitation of age or severity of the acne. Consent forms were obtained from each patient and treatments were administered to each patient with the permission of both doctors and patients.

Inclusion and exclusion criteria

The participants were included and excluded by the following criteria.

Inclusion criteria:

- age of participants between 15 and 50;
- patients diagnosed with mild to moderate acne;
- patients that were capable and allowed for the application of treatment method;
- patients that were interested to follow up the treatment method properly and attend follow-up appointments;
- patients with no history of skin allergies or sensitivity to reactions.

Exclusion criteria:

- patients with severe acne or other related medical conditions;
- patients that were allergic to retinoid, salicylic or benzoyl peroxide;
- other medical conditions that might affect their follow-up appointments or treatment method;
- females that were pregnant or on breast feeding period.

Interventions

The study has implemented three distinct interventions for each treatment group. The first group received a 2.5% gel of benzoyl peroxide, which was applied once daily to effected area. The second group was treated with tretinoin lotion, also known as all-trans retinoic acid, which is a topical medication derived from vitamin A with the concentration of 0.05% once daily in the morning. The third group received SA in a 2%gel formulation which was applied twice daily. These interventions were selected to evaluate the effectiveness of mild to moderate acne patients.

Data collection

The data was collected through physical and online questionnaires. Observations were recorded before the treatment and 8 weeks after the treatment. Each participant was assigned to one of three treatment groups. The variables assessed included non-inflammatory lesions (comedones) and inflammatory lesions (papules, pustules, and nodules) [13], the severity of acne using the GAGS (Glycosaminoglycans) score [14], acne scarring [15], and skin texture and appearance [16]. The scales for these observations were clearly defined to ensure consistency and accuracy in the data collection process, providing a comprehensive assessment of the treatment efficacy over the study period. An additional questionnaire of the review process has been undertaken by the patients to analyse the treatment experience of each patient.

Data collection tools and variables

To ensure a comprehensive evaluation of the treatment outcomes, standardised scales and questionnaires were utilised for data collection. These tools assessed various parameters, including non-inflammatory and inflammatory lesions, GAGS scores, acne scarring, skin texture, and treatment satisfaction. The following section details the measurement scales (Table 1) and pre- and post-treatment questionnaires (Table 2 and 3) used to gather participant data systematically.

Table 1. Measurement scales for variables in acne evaluation

Variable	Scale (Range)
Non-inflammatory lesions	1 = 0-20 (mild)
	2 = 21-40 (moderate)
	3 = 41-60 (severe)
	4 = 61 + (extremely severe)
Inflammatory lesions	1 = 0-5 (mild)
	2 = 6 - 20 (moderate)
	3 = 21 - 50 (severe)
	4 > 50 (very severe)
GAGS (glycosaminoglycans) score	1 = 0 - 18 (mild)
	2 = 18 - 30 (moderate)
	3 = 31 - 38 (severe)
	4 > 38 (very severe)
Acne scarring	1 = Macular
	2 = Mild
	3 = Moderate
	4 = Severe
Skin texture	0 = None
	1 = Minimal
	2 = Moderate
	3 = Severe
	4 = Extreme

Source: developed by the authors

Table 2. Pre-treatment questionnaire

Question	Response options
1. Age	19-25 26-35 36-45 46-50
2. Gender	Male Female
3. Do you use sunscreen regularly?	Yes No
4. If yes, what is the SPF of the sunscreen you use?	SPF 15 or lower SPF 16-30 SPF 31-50 SPF 51 or higher
5. Do you use any additional skin care products (e.g., moisturizer, exfoliator)?	Yes (please specify): No
6. How often do you apply these additional skin care products?	Daily Weekly Monthly Rarely
7. Do you have any known hormonal issues (e.g., polycystic ovary syndrome, thyroid issues)?	Yes (please specify): No
8. Are you currently taking any medications other than for acne?	Yes (please specify): No
9. Are you currently on any hormonal treatments or birth control?	Yes (please specify): No
10. Do you experience significant stress or lifestyle changes regularly?	Yes No
11. Do you have a history of any skin conditions (e.g., eczema, psoriasis)?	Yes (please specify): No
12. Have you had any recent changes in your skin condition?	Yes (please specify): No
13. Do you have any known allergies?	Yes (please specify): No
14. Are you currently pregnant or breastfeeding?	Yes No

Continued Table 2

Question	Response options
15. How often do you experience acne flare-ups?	Daily Weekly Monthly Rarely
16. On average, how many hours per day do you spend outdoors?	Less than 1 hour 1-2 hours 2-4 hours More than 4 hours
17. Do you use any specific acne or skin treatments, such as over-the-counter medications or home remedies?	Yes (please specify): No
18. On a scale of 1 to 10, how would you rate the overall condition of your skin prior to starting treatment?	1 (Very poor) to 10 (Excellent)

Source: developed by the authors

Table 3. Post-treatment questionnaire

Question number	Question	Options/scale
Participant information		
1	Participant ID	
2	Age	
3	Gender	Male, female, other
Baseline assessment		
4	Non-inflammatory lesions (comedones) count	0-20 (mild), 21-40 (moderate), 41-60 (severe), 61+ (extremely severe)
5	Inflammatory lesions (papules, pustules, nodules) count	0-5 (mild), 6-20 (moderate), 21-50 (severe), >50 (very severe)
6	GAGS (glycosaminoglycans) score	0-18 (mild), 18-30 (moderate), 31-38 (severe), >38 (very severe)
7	Acne scarring	Macular, mild, moderate, severe
8	Skin texture and appearance	0 (none), 1 (minimal), 2 (moderate), 3 (severe), 4 (extreme)
8-week follow-up assessment		
9	Non-inflammatory lesions (comedones) count	0-20 (mild), 21-40 (moderate), 41-60 (severe), 61+ (extremely severe)
10	Inflammatory lesions (papules, pustules, nodules) count	0-5 (mild), 6-20 (moderate), 21-50 (severe), >50 (very severe)
11	GAGS (glycosaminoglycans) score:	0-18 (mild), 18-30 (moderate), 31-38 (severe), >38 (very severe)
12	Acne scarring:	Macular, mild, moderate, severe
13	Skin texture and appearance:	0 (none), 1 (minimal), 2 (moderate), 3 (severe), 4 (extreme)
Treatment experience and satisfaction		
14	How satisfied are you with the treatment overall?	1 (very dissatisfied) — 5 (very satisfied)
15	Did you experience any side effects during the treatment?	Yes, no
16	If yes, please describe the side effects experienced:	
17	How would you rate the ease of use of the treatment?	1 (very difficult) — 5 (very easy)
18	Would you recommend this treatment to others?	Yes, no
19	How has the treatment impacted your confidence and social interactions?	1 (no impact) — 5 (significant impact)
20	Any additional comments or feedback on the treatment:	

Source: developed by the authors

Ethical considerations

Consent forms were obtained from each patient and treatments were administered to each patient with the permission of both doctors and patients. Additionally, approval for the study was granted by the three dermatology clinics in Pakistan involved in the research. However, per their request, the names of these clinics have been kept confidential to respect their privacy policies. All procedures adhered to ethical guidelines to protect the participants' rights, safety, and well-being throughout the study in accordance with the rules of the Declaration of Helsinki [17].

Reliability of the study

The reliability of the study was assessed by determining the internal consistency of the questionnaire by using Cronbach's Alpha. It was found that for a 10-item scale, the Cronbach's Alpha was 0.409. This suggested a fair degree of internal consistency though implying that some modification might be made to improve reliability with respect to this scale. However, rigorous methodology was observed throughout the investigation of questionnaire and treatments validation by dermatological experts and consideration of ethical issues thereby enhancing dependability and trustworthiness of results.

Outcome Measures

The outcomes of each treatment group were measured as primary and secondary outcomes. The primate outcomes included the changes in the inflammatory and non-inflammatory lesions count and the improvements in the GAGS score. Secondary outcomes of the treatment groups included the improvement in skin smoothness and reduction in the acne scarring. These outcomes were measured to determine the comparative analysis of each treatment and the determination of an effective treatment for the patients with mild to moderate acne.

Statistical Analysis

The study used SPSS for data analysis, utilising descriptive statistics to summarise baseline demographics and study endpoints. The Paired T-test was used to compare pre- and post-treatment outcomes within each treatment group, assessing the effectiveness of each treatment method in reducing acne severity over an 8-week period. ANOVA was used to compare mean outcome measures across the three treatment groups, identifying the most effective treatment method (Benzoyl Peroxide, Tretinoin, or Salicylic Acid) in improving acne outcomes. This statistical test provided a comprehensive understanding of the relative efficacy of each treatment, ensuring observed differences were not due to chance.

Results and Discussion

Acne Vulgaris: Pathophysiology, treatment challenges, and hormonal influences

Acne vulgaris (AV) is a chronic inflammatory skin disease affecting around 80% of young adults and adolescents [1, 7]. AV affects the pilosebaceous unit and is characterised by both inflammatory and non-inflammatory lesions, scarring, and pigmentation that persist throughout life [18]. It has been characterised by open and closed comedones, lesions with inflammatory nodules, pustules, and papules, typically affecting the face, chest, and back [5].

Another human commensal bacterium that inhabits the skin's pilosebaceous ducts is *Propionibacterium acnes*, or *P. acnes*. The pathophysiology of acne vulgaris is significantly influenced by *P. acnes,* a bacterium that colonises the sebaceous glands and hair follicles. Its proliferation triggers inflammation, leading to the development of acne lesions and contributing to both physical discomfort and emotional distress [19]. Notably, the rise in *P. acnes*-related infections, such as shoulder infections after surgery, underscores the growing challenge of managing this bacterium. Compounding the issue is the increasing incidence of antibiotic resistance, which limits the effectiveness of traditional treatments [20].

Treatment adherence is a significant issue, especially for topical treatments, as it can lead to side effects and prolonged treatment time, resulting in acne recurrence, patient dissatisfaction, and increased medical costs [7]. International treatment guidelines recommend a topical retinoid plus antimicrobial as the first-line therapy for most acne patients. Topical Retinoid, such as tretinoin and adapalene, were essential for acne management, but they are often primarily effective in comedonal acne and associated with significant cutaneous irritation [21]. Benzoyl peroxide (BPO) is a widely used topical therapy for acne vulgaris, with its bactericidal effect on *P. acnes* being well documented.

Androgens are hormones that are present in both male and female, play a pivotal role in the development of acne, particularly during puberty when their levels rise rignificantly. This hormonal surge stimulates an increase in sebum production, contributing to pore formation and the subsequent onset of acne [22]. The condition of acne, is caused by increased androgen production by the gonads and adrenal glands and increased sensitivity to androgen receptors. This leads to blockage of the pilosebaceous canal, follicular hyperkeratinisation, sebaceous gland enlargement, and keratinocyte shedding, resulting in a follicular plug all influenced by androgens. This blockage creates a microcomedo, which progresses into a visible comedo as sebum flow is obstructed [23]. Although acne is commonly associated with adolescence, it may be severe in adulthood, especially among women because of hormonal fluctuations caused by the menstrual cycle, pregnancy, or Polycystic Ovary Syndrome (PCOS) [24]. Understanding these demographic characteristics is crucial in delivering suitable acne therapies and setting the appropriate anticipations for each group of patients.

Results of acne treatment according to the severity of the disease

The acne grading system is an essential part of dermatological practice aimed at classifying acne according to its severity, offering therapy options, and providing prognostic estimations. It consists of several measurements: the non-inflammatory lesions scale, the inflammatory lesions scale, the GAGS (glycosaminoglycans) score, the acne scarring scale, and the skin texture scale. One scale measures various aspects of acne and ranges from mild to extremely severe ensuring that every aspect is considered.

Non-inflammatory acne lesions include comedones, which are divided into open (blackheads) and closed (whiteheads). They occur due to the blockage of hair follicles by sebum, dead epidermal cells, and microorganisms, with no signs of inflammation such as redness or pain. The main causes are hyperkeratinisation and increased sebum production, which create a favourable environment for the growth of *P. acnes*. These lesions typically do not cause

discomfort but may progress to an inflammatory stage without proper care. Figure 2 shows the distribution of non-inflammatory lesions in three groups before therapy. Most patients in all groups had moderate to severe non-inflammatory lesions, with moderate category being the most prevalent. Figure 3 shows the post treatment results of all groups for non-inflammatory lesions. This highlights a common issue that treatment aims to address.

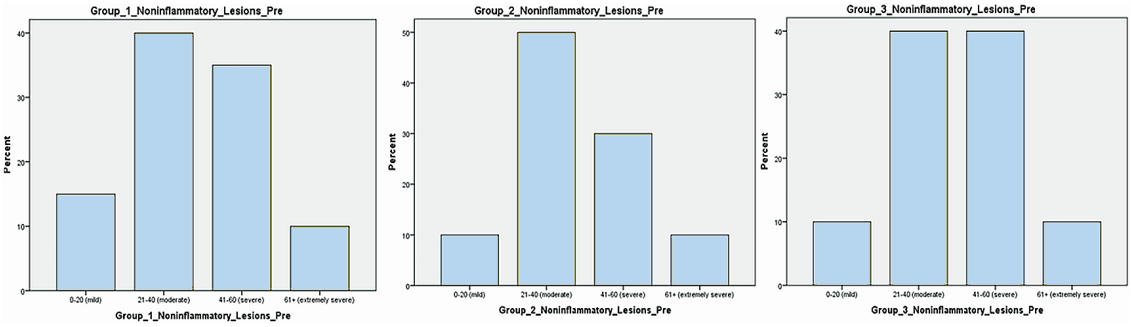

Figure 2. Non-inflammatory lesions – all 3 groups (pre-treatment)

Source: developed by the authors

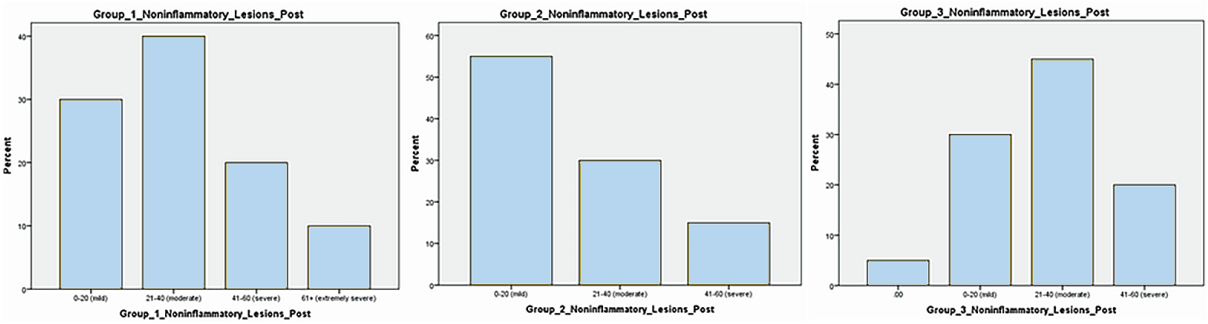

Figure 3. Non-inflammatory lesions – all 3 groups (post-treatment)

Source: developed by the authors

The analysis found that in all three groups, after treatment, there was a tendency to reduce the percentage of patients with severe and extremely severe lesions. This indicates the overall effectiveness of the treatment. In parallel with the decrease in the number of severe cases, the number of patients with mild or moderate lesions increased. Despite the overall trend towards improvement, there are certain differences in the dynamics of changes between the groups. In particular, Group 3, which used salicylic acid, showed the greatest treatment effectiveness. In particular, after treatment, no extremely severe cases were detected at all, and the number of severe cases was halved. Inflammatory lesions are skin conditions causing redness, swelling, and pain due to the body's immune response to perceived threats. Examples include acne, eczema, psoriasis, and dermatitis, with severity ranging from mild to severe. Figure 4 shows the results of the distribution of inflammatory skin lesions before treatment in the three experimental groups. In particular, in all groups, the majority of participants had moderate to severe inflammatory lesions. Figure 5 shows the results of treatment of inflammatory lesions.

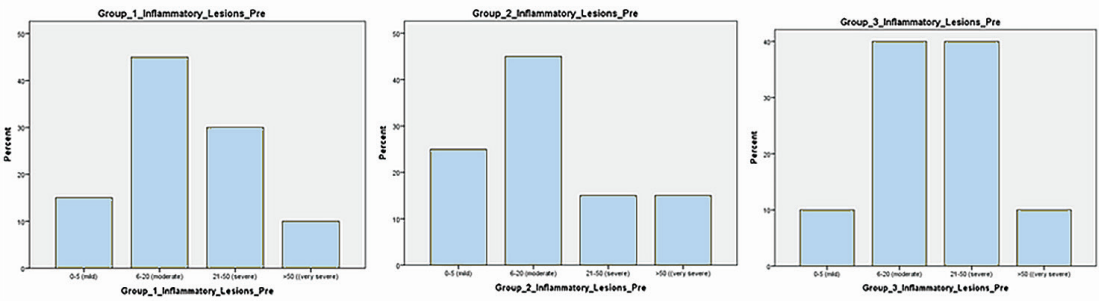

Figure 4. Inflammatory lesions – all 3 groups (pre-treatment)

Source: developed by the authors

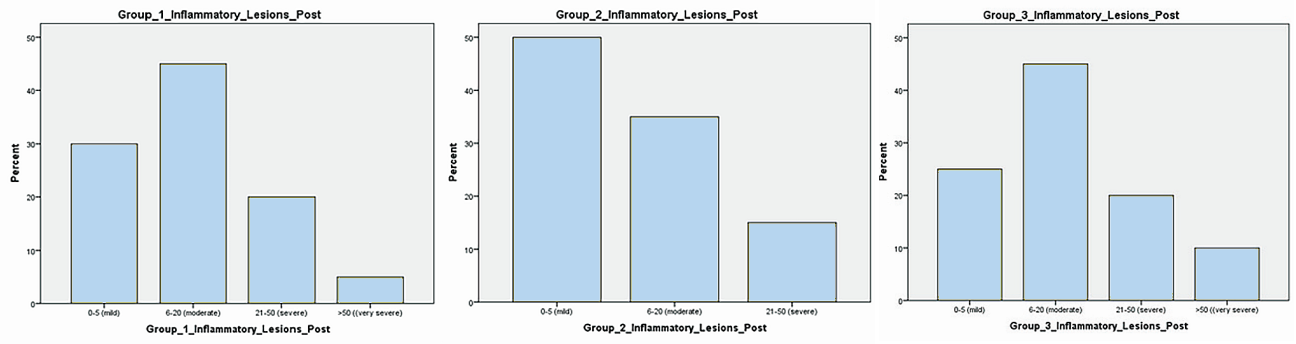

Figure 5. Inflammatory lesions – all 3 groups (post treatment)

Source: developed by the authors

The results showed improvement in all groups. In particular, the number of patients with mild lesions increased and the number of severe and very severe lesions significantly decreased. In Group 1 (benzoyl peroxide), the number of patients with mild lesions doubled to 30%, and the number of patients with very severe lesions decreased by half. Group 2 (retinoids) showed the most significant improvement: 50% of participants had mild cases (which is 2 times more than before treatment), and no very severe cases were recorded. Group 3 (salicylic acid) showed a significant increase in mild cases and a halving of severe cases (from 40 to 20%). however, the number of very severe lesions remained the same. Thus, while all groups showed a reduction in disease severity, treatment with retinoids (group 2) produced the most significant reduction in inflammation.

GAGS Score. To evaluate the effectiveness of the drugs, it is important to analyse the distribution of disease severity in patients in all three groups. For this purpose, we used the Global Acne Grading System (GAGS), a quantitative scoring system used to assess the severity of acne vulgaris. It measures the severity of acne in six areas of the face, chest and back, ranging from 0 to 4. The total score of all six areas determines the severity of acne. The total score is then used to classify acne as mild, moderate, severe or very severe. The GAGS can be used for clinical monitoring, epidemiological studies and clinical trials. Figure 6 shows the overall results of the GAGS score before treatment.

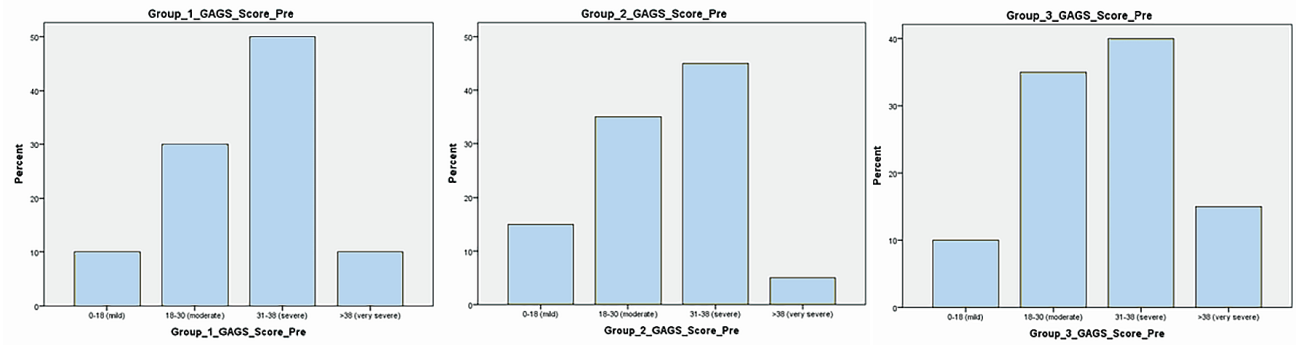

Figure 6. GAGS score – all 3 groups (pre-treatment)

Source: developed by the authors

Figure 6 shows the GAGS score distribution for three groups before treatment. Most participants had moderate or severe acne, with fewer cases of mild or very severe acne. In Group 1, about 50% had severe acne, 30% moderate, 10% very severe, and 10% mild. Group 2 had around 45% with severe acne, 35% moderate, 15% mild, and a small percentage very severe. Group 3 had 40% severe, 35% moderate, 10% mild, and 15% very severe cases. This suggests that moderate to severe acne was the most common. These results indicated a predominance of moderate to severe GAGS scores in all groups prior to treatment. Post-treatment data should reveal changes in these categories to assess the effectiveness of each treatment in reducing GAGS severity (Fig. 7).

In Figure 7, the GAGS score post-treatment showed that group 1 (BPO) had a higher number of severe cases compared to pre-treatment, suggesting it may not have been as effective in reducing GAGS severity. group 2 (Retinoid) showed modest improvement, while group 3 (SA) showed a slight reduction in very severe cases but overall stability. Thus, the most significant improvement was shown by group 2, which was treated with tretinoin lotion.

Acne scarring is a condition where the skin's healing process is disrupted, leading to excessive or insufficient

collagen production. This can be caused by factors like acne severity, picking, delayed treatment, hormonal changes, and men developing more severe acne. It's crucial to address acne promptly to prevent scarring. Causes include cysts or nodules burst, and picking or squeezing acne can also contribute to scarring [25].

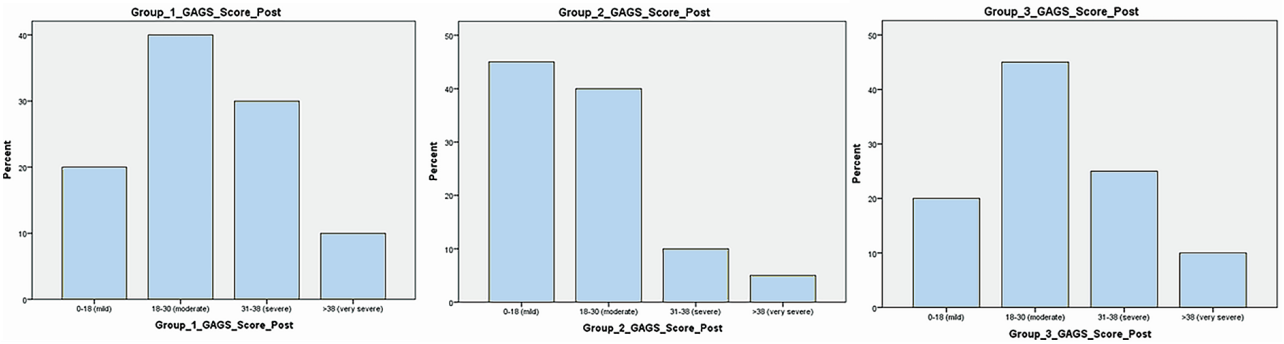

Figure 7. GAGS score – all 3 groups (post treatment)

Source: developed by the authors

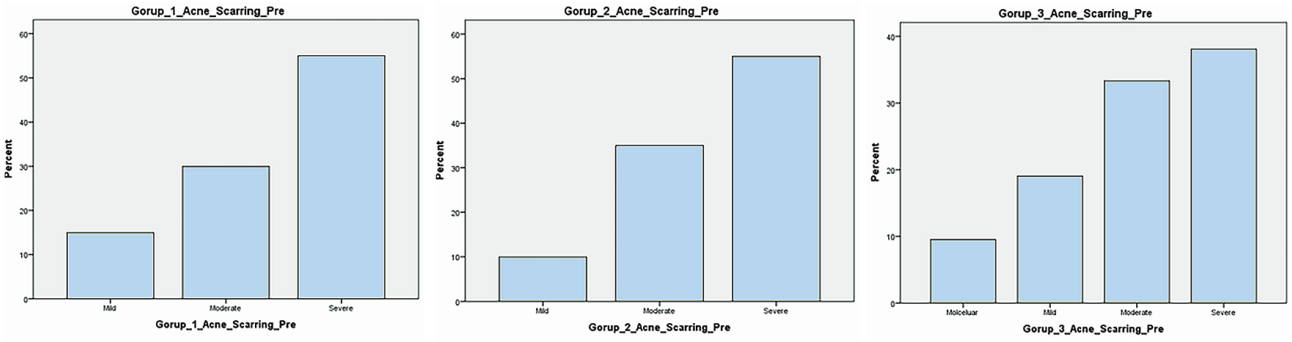

Figure 8. Acne scarring – all 3 groups (pre-treatment)

Source: developed by the authors

Figure 8 shows the distribution of acne scarring severity across three treatment groups before treatment. The data suggests that moderate and severe scarring were the most common types among participants, with fewer cases of mild or molecular scarring. All three groups show a similar pattern, where the proportion of severe scarring is notably higher than the mild category. This indicates that most participants had significant acne-related scarring prior to treatment. The differences in scarring severity across groups provide a baseline for assessing how well each treatment reduces acne scars in the post-treatment phase (Fig. 9).

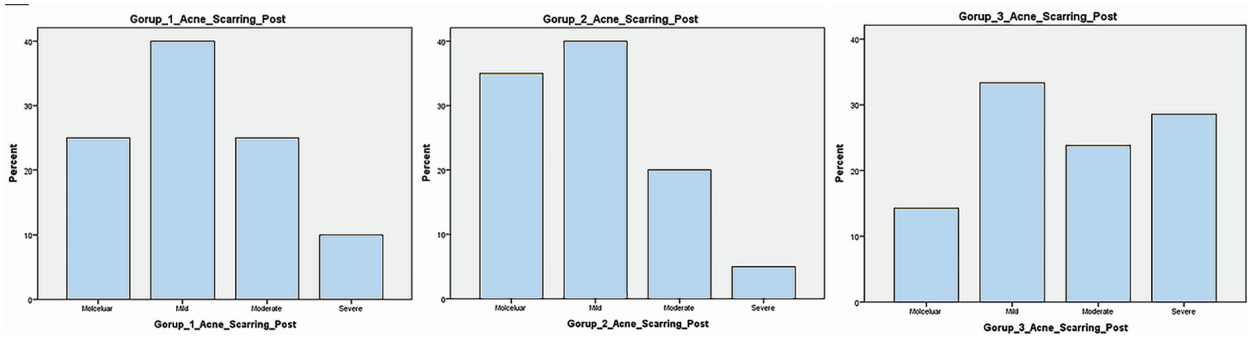

Figure 9. Acne scarring – all 3 groups (post treatment)

Source: developed by the authors

Figure 9 shows the post treatment results for acne scarring which demonstrates that Group 1 (Benzoyl Peroxide) showed most significant shift, with a notable rise in mild scarring and a reduction in severe cases. Group 2 (Retinoid) showed the best improvement, showing the highest proportion of molecular and mild scarring, indicating

effective scar healing. Group 3 (Salicylic Acid) showed some improvement but retained a higher percentage of severe scarring. Overall, Retinoids were the most effective in reducing acne scars, followed by Benzoyl Peroxide, while Salicylic Aci showed limited impact.

Skin Texture. Skin texture issues result from inflammation, scarring, and irregular healing processes. Common complications include rough patches, enlarged pores, and raised scars. Factors such as hormonal imbalances, and environmental pollutants contribute to the deterioration [26]. The analysis of the skin texture of the participants by group showed the following results (Fig. 10). In all groups, a large number of severe and very severe skin texture problems were recorded. However, in the first group, the number of moderate, severe and very severe cases was almost the same (30, 30 and 35%, respectively). In the second and third groups, severe cases significantly prevailed. However, Group 3 had the highest proportion of severe skin texture problems before treatment.

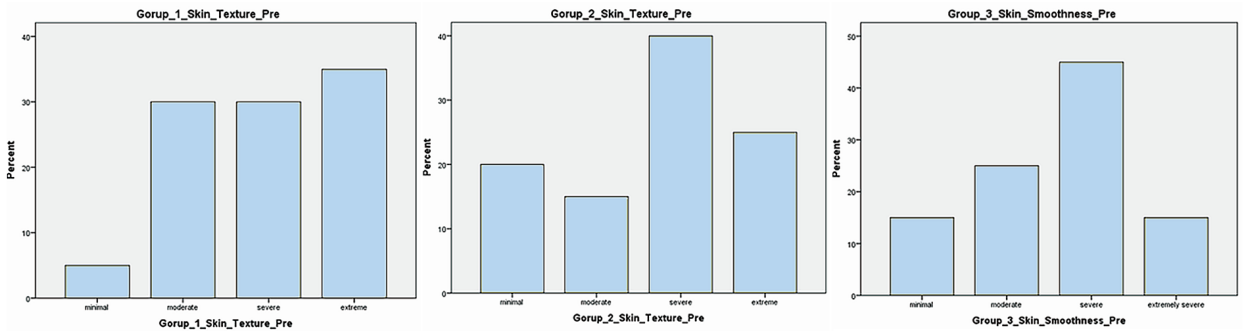

Figure 10. Skin texture – 3 groups (pre-treatment)

Source: developed by the authors

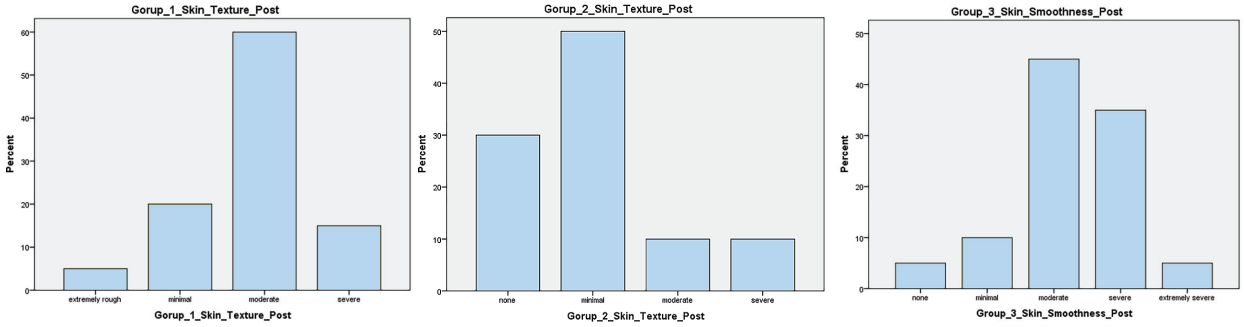

Figure 11. Skin texture – all 3 groups (post treatment)

Source: developed by the authors

Figure 11 shows the results of the skin treatment for all groups. The analysis showed that all groups achieved an improvement in the patients' skin texture. At the same time, after treatment, at least 5% of patients in each group were found to be completely free of problems. There were two times fewer severe cases and no extremely severe cases in groups 1 and 2. Group 3 showed improvement in skin texture, however, retained severe textures than Groups 1 and 2. BPO and Retinoid treatments showed better outcomes, with many achieving moderate or minimal improvements, suggesting they may be more effective than SA.

Assessing the safety and effectiveness of topical acne treatments

Paired Sample T-test

The paired T-test is a statistical method used to compare the mean values of two related samples, particularly before and after a given intervention. In this study, paired sample t-test was conducted to evaluate the safety and efficacy of topical the treatment for mild to moderate acne. The analysis compared pre-treatment and post-treatment outcomes to assess significant differences in spasticity reduction and functional improvement. This approach allows for an objective evaluation of each treatment's effectiveness and enables conclusions to be drawn about their impact.

Benzoyl Peroxide Group

Table 4 shows the paired sample t-test statistics for Group 1 (Benzoyl Peroxide) which showed that skin texture improved significantly, with a mean score reduction from 2.95 (pre-treatment) to 1.85 (post-treatment), a mean difference of 1.100. Other parameters did not exhibit significant changes: non-inflammatory lesions (mean difference = 0.300), inflammatory lesions (mean difference = 0.350), and acne scarring (mean difference = 0.100). GAGS scores even increased by 0.250, which may indicate a deterioration in the overall condition of the skin.

Table 4. Benzoyl Peroxide group-paired samples statistics

Paired samples statistics					
		Mean	N	Std. deviation	Std. error mean
Pair 1	Non_Inflammatory_Lesions_Pre	2.40	20	.883	.197
	Non_Inflammatory_Lesions_Post	2.10	20	.968	.216
Pair 2	Inflammatory_Lesions_Pre	2.35	20	.875	.196
	Inflammatory_Lesions_Post	2.00	20	.858	.192
Pair 3	GAGS_Score_Pre	2.35	20	.933	.209
	GAGS_Score_Post	2.60	20	.821	.184
Pair 4	Acne_Scarring_Pre	2.30	20	.923	.206
	Acne_Scarring_Post	2.20	20	.951	.213
Pair 5	Skin_Texture_Pre	2.95	20	.945	.211
	Skin_Texture_Post	1.85	20	.745	.167

Source: developed by the authors

Table 5 shows the paired sample t-test statistics for Group 1 (BPO) which indicated the following outcomes: ehe skin texture showed a statistically significant value of p = 0.000, reflecting a significant improvement after treatment. However, non-inflammatory lesions showed p = 0.083, and inflammatory lesions p = 0.149, neither of which reached statistical significance. That is, the treatment did not have a confirmed effect. GAGS scores (p = 0.309) and acne scarring (p = 0.725) showed no statistically significant changes. The most notable improvement was in skin texture, highlighting its effectiveness in this area.

Table 5. Benzoyl Peroxide group-paired sample test

Paired samples test									
		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. erro r mea n	95% Confidence interval of the difference				
					Lower	Upper			
Pair 1	Non_Inflammatory_Lesions_Pre - Non_ Inflammatory_Lesions_Post	.300	.733	.164	-.043	.643	1.831	19	.083
Pair 2	Inflammatory_Lesions_Pre - Inflammatory_Lesions_Post	.350	1.040	.233	-.137	.837	1.505	19	.149
Pair 3	GAGS_Score_Pre - GAGS_Score_Post	-.250	1.070	.239	-.751	.251	- 1.04	19	.309
Pair 4	Acne_Scarring_Pre - Acne_Scarring_Post	.100	1.252	.280	-.486	.686	.357	19	.725
Pair 5	Skin_Texture_Pre - Skin_Texture_Post	1.100	.912	.204	.673	1.527	5.395	19	.000

Source: developed by the authors

The analysis reveals that BPO significantly improves skin texture post-treatment, with a mean difference of 1.100. However, changes in non-inflammatory and inflammatory lesions did not reach statistical significance. Reductions in GAGS scores and acne scarring showed no significant impact. These findings highlight the targeted effectiveness of BPO in improving skin texture, while other acne-related measures showed limited or nonsignificant changes.

Retinoid Group

Table 6 shows the paired sample t-test statistics for Group 2 (Retinoid) which showed the following outcomes: Non-inflammatory lesions improved significantly, with a mean reduction of 0.80 (p = 0.000), indicating substantial effectiveness in reducing these lesions. Inflammatory lesions also decreased by 0.55 (p = 0.002), demonstrating a significant improvement. GAGS scores increased by 0.15 (p = 0.375), reflecting no significant change. Acne scarring worsened slightly by 0.35 (p = 0.168), and skin texture showed a significant improvement with a mean reduction of 1.70 (p = 0.000). The most notable improvements were observed in non- inflammatory lesions and skin texture, suggesting the effectiveness of Retinoid in these areas.

Table 6. Retinoid group-paired samples statistics

Paired samples statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Non_Inflammatory_Lesions_Pre	2.40	20	.821	.184
	Non_Inflammatory_Lesions_Post	1.60	20	.754	.169
Pair 2	Inflammatory_Lesions_Pre	2.20	20	1.005	.225
	Inflammatory_Lesions_Post	1.65	20	.745	.167
Pair 3	GAGS_Score_Pre	2.25	20	.851	.190
	GAGS_Score_Post	2.40	20	.821	.184
Pair 4	Acne_Scarring_Pre	1.75	20	.851	.190
	Acne_Scarring_Post	2.10	20	.968	.216
Pair 5	Skin_Texture_Pre	2.70	20	1.081	.242
	Skin_Texture_Post	1.00	20	.918	.205

Source: developed by the authors

Table 7 shows the paired sample t-test results for Group 2 (Retinoid) which demonstrates significant improvements in several areas. Non-inflammatory lesions were significantly reduced, demonstrating a statistically significant difference of $p = 0.001$. Inflammatory lesions also improved, showing a significant reduction $p = 0.037$. GAGS scores showed a minor decrease ($p = 0.614$), which was not significant. That is, the treatment did not have a significant effect on the overall acne severity scale. Acne scarring slightly worsened ($p = 0.309$), but the change was not statistically significant, that is, the acne scars have not changed significantly Skin texture changes showed a statistically significant difference $p = 0.000$, indicating significant improvement after treatment. The most pronounced improvements were in non-inflammatory lesions and skin texture.

Table 7. Retinoid group-paired sample test

Paired samples test									
		Paired differences					t	df	Sig. (2-tailed (p)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
					Lower	Upper			
Pair 1	Non_Inflammatory_Lesions_Pr e - Non_ Inflammatory_Lesions_P ost	.800	.951	.213	.355	1.245	3.760	19	.001
Pair 2	Inflammatory_Lesions_Pre - Inflammatory_Lesions_Post	.550	1.099	.246	.036	1.064	2.238	19	.037
Pair 3	GAGS_Score_Pre - GAGS_Score_Post	-.150	1.309	.293	-.763	.463	-.513	19	.614
Pair 4	Acne_Scarring_Pre - Acne_Scarring_Post	-.350	1.496	.335	- 1.050	.350	- 1.046	19	.309
Pair 5	Skin_Texture_Pre - Skin_Texture_Post	1.700	1.031	.231	1.217	2.183	7.373	19	.000

Source: developed by the authors

The test showed that Retinoids effectively reduce both non-inflammatory and inflammatory rashes ($p < 0.05$). At the same time, the overall acne severity score (GAGS Score) and the condition of the scars did not change significantly after treatment ($p > 0.05$). The most pronounced improvements were observed in skin texture ($p < 0.001$), which may be an important cosmetic effect. In general, retinoids show significant efficacy in the treatment of acne, especially in reducing rashes and improving skin texture, but do not significantly affect existing scars.

Salicylic Acid Group

Table 8 shows the paired sample t-test statistics results in the SA group which indicated the following outcomes: Non-inflammatory lesions decreased significantly by 0.70, reflecting improvement. Inflammatory lesions also showed a reduction of 0.35. GAGS scores increased slightly by 0.25 ($p = 0.299$), indicating a minimal change or slight deterioration in the condition. Acne scarring worsened by 0.35, but this change was not significant. Skin texture improved by 0.35 ($p = 0.125$), showing a modest enhancement. The most significant improvements were observed in non-inflammatory lesions, while other measures showed minimal or no significant change. Table 9 shows the paired sample t-test results for the SA group which revealed the following outcomes: Salicylic acid statistically significantly reduced the number of non-inflammatory rashes ($p = 0.000$), indicating a notable improvement. The inflammatory lesions showed a result of $p = 0.110$, i.e. this change was not statistically significant. GAGS scores increased slightly ($p = 0.367$), showing minimal change. Acne scarring worsened ($p = 0.286$), which was not significant. The skin texture improved significantly, as evidenced by the p value of 0.005. The most notable results were the significant reduction in non-inflammatory lesions and improvement in skin texture.

Table 8. Salicylic acid-paired samples statistics

Paired samples statistics					
		Mean	N	Std. deviation	Std. error mean
Pair 1	Non_Inflammatory_Lesions_Pre	2.50	20	.827	.185
	Non_Inflammatory_Lesions_Post	1.80	20	.834	.186
Pair 2	Inflammatory_Lesions_Pre	2.50	20	.827	.185
	Inflammatory_Lesions_Post	2.15	20	.933	.209
Pair 3	GAGS_Score_Pre	2.35	20	.875	.196
	GAGS_Score_Post	2.60	20	.883	.197
Pair 4	Acne_Scarring_Pre	2.25	20	.910	.204
	Acne_Scarring_Post	2.60	20	1.046	.234
Pair 5	Skin_Texture_Pre	2.60	20	.940	.210
	Skin_Texture_Post	2.25	20	.910	.204

Source: developed by the authors

Table 9. Salicylic Acid group-paired sample test

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
					Lower	Upper			
Pair 1	Non_Inflammatory_Lesions_Pre- Non_ Inflammatory_Lesions_Post	.700	.657	.147	.393	1.007	4.765	19	.00
Pair 2	Inflammatory_Lesions_Pre- Inflammatory_Lesions_Post	.350	.933	.209	-.087	.787	1.677	19	.110
Pair 3	GAGS_Score_Pre-GAGS_Score_Post	-.250	1.209	.270	-.816	.316	-.925	19	.367
Pair 4	Acne_Scarring_Pre- Acne_Scarring_Post	-.350	1.424	.319	- 1.017	.317	- 1.099	19	.286
Pair 5	Skin_Texture_Pre - Skin_Texture_Post	.350	.489	.109	.121	.579	3.199	19	.005

Source: developed by the authors

Salicylic acid is effective in reducing the number of non-inflammatory breakouts and improving skin texture, which is confirmed by statistically significant results ($p < 0.01$). At the same time, its effect on inflammatory rashes, general acne condition (GAGS Score) and acne scars is not statistically significant, and in some cases, there is even a tendency to worsen. Thus, salicylic acid can be an effective treatment for patients with comedonal acne, but its use in the treatment of inflammatory acne and post-acne scars requires additional research or a combined approach with other therapeutic methods.

One-way ANOVA for comparing gender and treatment measures

A one-way ANOVA analysis was conducted to evaluate the impact of gender on various acne treatment outcomes, including non-inflammatory lesions, inflammatory lesions, GAGS score, acne scarring, and skin texture. Table 10 shows the results of the ANOVA analysis, which shows whether there is a statistically significant difference between the groups (men and women) for each acne treatment indicator. A p-value of < 0.05 is statistically significant and indicates that gender has an effect on this indicator. A P-value ≥ 0.05 means that there is no such effect.

Table 10. Results of one-way ANOVA analysis

		Sum of Squares	df	Mean Square	F	Sig.
Non_Inflammatory_Lesions_Pre	Between Groups	.059	1	.059	.085	.772
	Within Groups	40.674	58	.701		
	Total	40.733	59			
Non_Inflammatory_Lesions_Post	Between Groups	.165	1	.165	.216	.643
	Within Groups	44.168	58	.762		
	Total	44.333	59			
Inflammatory_Lesions_Pre	Between Groups	.514	1	.514	.633	.429
	Within Groups	47.136	58	.813		
	Total	47.650	59			

Continued Table 10

		Sum of Squares	df	Mean Square	F	Sig.
Inflammatory_Lesions_Post	Between Groups	.847	1	.847	1.145	.289
	Within Groups	42.886	58	.739		
	Total	43.733	59			
GAGS_Score_Pre	Between Groups	.405	1	.405	.526	.471
	Within Groups	44.579	58	.769		
	Total	44.983	59			
GAGS_Score_Post	Between Groups	.003	1	.003	.004	.949
	Within Groups	40.930	58	.706		
	Total	40.933	59			
Acne_Scarring_Pre	Between Groups	.264	1	.264	.312	.578
	Within Groups	49.136	58	.847		
	Total	49.400	59			
Acne_Scarring_Post	Between Groups	4.344	1	4.344	4.643	.035
	Within Groups	54.256	58	.935		
	Total	58.600	59			
Skin_Texture_Pre	Between Groups	1.653	1	1.653	1.724	.194
	Within Groups	55.597	58	.959		
	Total	57.250	59			
Skin_Texture_Post	Between Groups	6.336	1	6.336	7.032	.010
	Within Groups	52.264	58	.901		
	Total	58.600	59			

Source: developed by the authors

The results of ANOVA analysis showed no significant gender-related differences in the severity of non-inflammatory lesions pre- or post-treatment, suggesting minimal variability between genders. Inflammatory lesions showed no significant gender-related differences pre- or post-treatment, suggesting no statistically meaningful differences between genders. The GAGS scores also showed no significant gender differences pre- or post-treatment, indicating no significant variability between genders. However, a notable gender-related difference was observed in post-treatment acne scarring, indicating that gender significantly affects the outcomes for acne scarring. Gender differences were also significant for skin texture post-treatment, suggesting that gender significantly influences the improvement of skin texture after treatment. These findings highlight the importance of considering gender-specific factors when assessing treatment efficacy for acne scarring. Table 11 displays the reliability test findings for the study's items. The Case Processing Summary shows that all 60 cases (100%) were legitimate, with no exclusions, resulting in a complete dataset for study. In Reliability Statistics, the Cronbach's Alpha score for 10 items is 0.709, suggesting satisfactory internal consistency. A Cronbach's Alpha greater than 0.7 indicates good reliability, implying that the questions included in the questionnaire are relatively consistent, however minor changes might potentially increase reliability even further.

Table 11. Reliability test

Case Processing Summary			
		N	%
Cases	Valid	60	100.0
	Excluded[a]	0	.0
	Total	60	100.0
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics	
Cronbach's Alpha	N of Items
.709	10

Source: developed by the authors

The study evaluated the efficacy of three topical treatments for acne by Benzoyl Peroxide, Retinoid, and SA in five parameters including non-inflammatory and inflammatory lesions, GAGS scores, acne scarring, and skin texture. BPO showed significant improvement only in skin texture, with a mean reduction of 1.10 ($p = 0.000$), while other parameters, including non-inflammatory and inflammatory lesions, GAGS scores, and acne scarring, did not show statistically significant changes.

The paired sample t-test analysis revealed that all three treatment groups demonstrated significant improvements in certain areas. For the BPO group, significant

enhancement was observed in skin texture (p = 0.000), but no significant changes were found in non-inflammatory lesions, inflammatory lesions, GAGS scores, or acne scarring. The Retinoid group showed significant reductions in non-inflammatory lesions (p = 0.001) and inflammatory lesions (p = 0.037), along with improved skin texture (p = 0.000). The SA group exhibited significant reductions in non-inflammatory lesions (p = 0.000) and improvements in skin texture (p = 0.005). These findings highlight the efficacy of each treatment in improving specific acne-related parameters. In general, the results show that the choice of drug depends on the type of acne, and each drug has its own advantages for specific patient groups.

Discussion

This study highlights the comparative efficacy of three commonly used topical treatments for mild-to-moderate acne, namely benzoyl peroxide, retinoids, and salicylic acid. The findings not only emphasise the strengths of each treatment but also underscore the need for personalised approaches to acne management, particularly considering the unique profiles and responses of the study participants. Studies conducted by H. Baldwin *et al.* [27], P. Szczuraszek *et al.* [28] have shown that Retinoid derived from vitamin A works by unclogging pores, reducing inflammation and preventing the formation of new acne lesions in the treatment of AV and psoriasis by altering cellular protein that affects multiple pathways involved in the pathogenesis of acne. This is confirmed by the results of the current study. The results of this study aligned with J.C. Harper *et al.* [29] and D. Pariser & E. Guenin [30] demonstrating that Tretinoin 0.05% lotion was significantly more effective than vehicle in achieving treatment success and reducing inflammatory and non-inflammatory lesions.

According to S.K. Tyring *et al.* [31], lotion comprising 0.05% Tretinoin improved quality of life for patients with moderate-to-severe acne after 12 weeks of treatment, with clinical improvements in acne symptoms specifically in female with moderate or severe acne if used once in daily routines. Moreover, G. Han *et al.* [32] showed that this lotion effectively reduced non-inflammatory acne lesions in an Asian population, improving quality of life without any adverse events or concerns about skin dryness, irritation, or hyperpigmentation.

The American Academy of Dermatology (AAD) recommends using topical benzoyl peroxide and retinoid as the first treatment for mild acne, followed by oral antibiotics for moderate- grade disease [2]. T. Matin & M.B. Goodman [33] noted Benzoyl peroxide is an effective topical treatment for AV due to its antibacterial, irritant, and anti-inflammatory properties. The results of the current study also coincide with the findings of the following authors. According to B. Dréno *et al.*, [34] topical benzoyl peroxide 2.5% gel effectively reduces atrophic acne scars and acne lesions in moderate to severe acne patients, with up to 48 weeks of treatment being safe and well- tolerated. The 2.5% gel formulation of benzoyl peroxide was found to be more effective by H. Tanizaki *et al.* [35] in preventing the worsening of scars in Japanese patients with AV.

Benzoyl peroxide, being a popular acne treatment can cause skin irritation, bleaching effects, allergic reactions, antibiotic resistance, and increased sun sensitivity [36]. Due to these complications, several studies has demonstrated the combination of other agents with benzoyl peroxide to improve the effeteness of the treatment method for acne patients. M.P. Amrutha *et al.* [37] suggested that the combination gel of 0.1% adapalene and 2.5% benzoyl peroxide is more effective for treating mild-to-moderate acne vulgaris, with comparable tolerability. However, G. Kosmoski *et al.* [38] suggested that a daily regimen of benzoyl peroxide (2.5%) in the morning and retinol (0.1%) in the evening effectively reduces acne count, severity, and lesions, while improving skin complexion and quality of life without causing facial irritation. Although the current study did not investigate combination treatments for acne, the authors agree that combining different drugs that demonstrate specific positive effects on different problems can be effective.

SA effectively treats AV by suppressing the AMPK/SREBP1 pathway and NFB pathway in human sebocytes. This is confirmed by the study by J. Lu *et al.* [39]. According to S.E. Dal Belo *et al.* [40], DC-Eff, a multi-targeted salicylic acid-based dermocosmetic cream, is as effective as benzoyl peroxide 5% in improving mild-to-moderate acne, with better tolerance and high appreciation. Due to several limitations of using SA along such as skin irritation, dryness, peeling, and increased sun sensitivity, especially during initial treatment has suggested the combination of SA with other agents for effective outcomes. For instance, T. Zhang *et al.* [3] suggested that Poly (ionic liquid)-based microneedles containing SA showed potential in improving acne treatment by effectively delivering therapeutics through the skin barrier. Moreover, D. Ye *et al.* [41] revealed that the low-dose oral isotretinoin combined with 30% SA chemical peeling effectively and safely treats AV in Asian patients.

The ANOVA analysis conducted in the current study showed that gender did not significantly affect the overall severity of non-inflammatory and inflammatory lesions. However, significant gender differences were found in the treatment of scars and skin texture, which is supported by numerous studies. Gender differences in acne treatment outcomes can be influenced by hormonal fluctuations, treatment response, and side effects. Women experience more hormonal fluctuations due to menstrual cycles, pregnancy, and menopause, which can affect acne [24]. Research of K.D. Gardner [42] suggested that women may respond differently to acne treatments, benefiting from hormonal therapies like oral contraceptives. Women may also experience different side effects from topical treatments, such as irritation and dryness, which can influence adherence to treatment regimens and potentially affect overall outcomes [43]. Overall, these researches highlighted the need for tailored treatment plans that consider individual patient characteristics, including skin type, acne severity, and potential side effects, to achieve optimal outcomes in acne management.

Conclusions

The study successfully achieved its goal of evaluating the comparative efficacy of benzoyl peroxide, retinoids, and salicylic acid in managing mild-to-moderate acne. Using a robust cross-sectional design, the research analysed outcomes across parameters such as non-inflammatory and inflammatory lesions, skin texture, and acne scarring. Each treatment demonstrated unique strengths. Retinoids showed superior efficacy in improving non-inflammatory and inflammatory lesions and enhancing skin texture. Benzoyl peroxide significantly improved skin texture, but its effect on inflammatory and non-inflammatory rashes was less pronounced, and no statistically significant changes were observed. Salicylic acid demonstrated a positive effect on non-inflammatory rashes and skin texture, but its effect on inflammatory lesions and acne scars was less pronounced and not statistically significant. This indicates the need for a combined approach in the treatment of complex forms of acne.

The study results also demonstrated that the effectiveness of treating inflammatory and non-inflammatory acne lesions does not depend on gender. At the same time, it was emphasised that gender is important in terms of the impact of acne treatment on scarring and skin texture, highlighting the role of hormonal influences on the course of treatment. Women showed more pronounced improvements in skin texture, while men showed less of an effect on scarring, indicating the need for individualised treatment approaches depending on gender. While gender-related differences were observed, age-related variations and hormonal fluctuations were not extensively explored. Thus, for optimal treatment of acne and its consequences, it is necessary to take into account the type of drug, gender differences and the specificity of skin lesions.

The study's short follow-up period may limit long-term outcomes assessment and treatment durability. Further research is needed to explore the long-term effectiveness and safety of these treatments, considering larger, more diverse populations and extended follow-up periods. Factors like age, hormonal changes, and individual factors could provide more comprehensive insights for treatment tailoring.

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Conflict of Interest

None.

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Оцінка засобів місцевого лікування вугрів легкого та помірного ступеня: перехресне дослідження

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Анотація. *Acne vulgaris* (AV) – це хронічне запальне захворювання шкіри, яке вражає 80 % молодих людей і підлітків, спричиняючи ураження, рубці та пігментацію волосисто-сальних відділів. Ефективне лікування AV має вирішальне значення для покращення якості життя пацієнтів і запобігання довгостроковим дерматологічним ускладненням. Це дослідження було спрямоване на оцінку ефективності трьох широко використовуваних місцевих методів лікування AV: лікування пероксидом бензоїлу, ретиноїдом і саліциловою кислотою в лікуванні вугрів легкого та середнього ступеня тяжкості за допомогою плану перехресного обсерваційного дослідження. Проаналізовано ефективність бензоїлпероксиду, ретиноїду та саліцилової кислоти для лікування акне легкого та середнього ступеня тяжкості протягом 8-тижневого періоду. Учасників віком від 15 до 50 років випадковим чином розподілили на три групи лікування, а результати оцінювали за допомогою фізичних обстежень і опитувальників. Змінні, які оцінювали, включали кількість уражень, тяжкість акне за допомогою балів GAGS, рубці та текстуру шкіри, а дані аналізували за допомогою SPSS, парних Т-тестів та дисперсійного аналізу для визначення найбільш ефективного лікування. Дослідження показало, що пероксид бензоїлу значно покращив текстуру шкіри та усунув важкі запальні процеси. Ретиноїди продемонстрували найбільше зменшення незапальних і запальних уражень, причому у 55 % учасників після лікування спостерігалися лише легкі ураження. Ретиноїди також зменшили серйозні рубці від прищів і покращили текстуру шкіри. Саліцилова кислота викликала помірне поліпшення, зменшуючи незапальні ураження та покращуючи структуру шкіри. Перекис бензоїлу та ретиноїди значно покращили структуру шкіри, однак пероксид бензоїлу продемонстрував неоднозначні результати щодо утворення рубців. Т-тести парних зразків підтвердили значні покращення текстури шкіри та незапальних уражень як для груп пероксиду бензоїлу, так і для ретиноїдів. Отримані дані показали, що ретиноїди є більш ефективними для незапальних уражень від вугрів, а пероксид бензоїлу – для важких запальних випадків, що дозволяє складати індивідуальні плани лікування. Цей підхід пропонує цінну інформацію для покращення результатів лікування акне. Дослідження може допомогти дерматологам у виборі ефективних методів лікування акне на основі типу та тяжкості ураження

Ключові слова: *Acne Vulgaris*; ретиноїд; бензоїл пероксид; саліцилова кислота; текстура шкіри