ORIGINAL RESEARCH

The Efficacy of Topical Retinoids in the Treatment of Acne Vulgaris: A Comparative Study

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ABSTRACT

Aim: The aim of this study was to compare the efficacy of three topical retinoids (adapalene, tretinoin, and tazarotene) in treating mild to moderate acne vulgaris, focusing on lesion reduction, acne severity, patient satisfaction, and tolerability over a 12-week period. **Materials and Methods:** A randomized, controlled, double-blind trial was conducted involving 150 participants aged 18-35 years, diagnosed with mild to moderate acne vulgaris. Participants were divided into three groups (50 per group): Group A (Adapalene 0.1% gel), Group B (Tretinoin 0.025% cream), and Group C (Tazarotene 0.1% gel). Each treatment was applied once daily for 12 weeks. Primary outcomes included reduction in total acne lesion count, while secondary outcomes included improvement in Global Acne Grading System (GAGS) scores, patient satisfaction, and tolerability. Data were collected at baseline, week 4, week 8, and week 12. **Results:** By week 12, all groups showed a significant reduction in total lesion count: Group A (8.5), Group B (7.9), and Group C (8.3). GAGS scores improved significantly across all groups, with no significant differences between treatments. The most common side effects were erythema, dryness, and peeling, with Group C (Tazarotene) showing a slightly higher incidence of adverse effects (40% dryness, 30% irritation). However, these differences were not statistically significant. Patient satisfaction was highest in Group A (8.4), followed by Group B (8.1), and Group C (7.9). Tolerability scores were also highest in Group A (8.6). **Conclusion:** All three topical retinoids effectively reduced acne lesions and severity without significant differences in efficacy. Adapalene demonstrated better tolerability and slightly higher patient satisfaction, making it a preferred option for those with sensitive skin. Treatment choice should consider patient-specific factors such as skin type and side effect profiles.

Keywords: Topical retinoids, acne vulgaris, adapalene, tretinoin, tazarotene, GAGS score.

INTRODUCTION

Acne vulgaris is one of the most common dermatological conditions affecting millions of individuals worldwide, particularly during adolescence and early adulthood. It is a chronic inflammatory disorder of the pilosebaceous unit, characterized by the presence of comedones, papules, pustules, nodules, and in severe cases, cysts and scars. Acne not only affects physical appearance but also has significant psychological and social impacts, often leading to decreased self-esteem, anxiety, and depression. The search for effective treatments has spanned decades, with numerous therapies available to manage the condition. Among the various treatment options, topical retinoids have emerged as a cornerstone in the management of acne vulgaris due to their multifaceted effects on the skin.[1]Topical retinoids are derivatives of vitamin A and work by targeting several pathogenic mechanisms involved in acne formation. They reduce hyperkeratinization, promote comedolysis, and possess anti-inflammatory properties, which collectively address the formation of both inflammatory and non-inflammatory acne lesions. The three most commonly used topical retinoids in acne treatment are adapalene, tretinoin, and tazarotene. These agents vary in terms of their chemical structures, potency, tolerability, and clinical efficacy, making it crucial to compare their effectiveness in treating acne vulgaris.[2]Adapalene, the mildest of the three retinoids, is available in 0.1% and 0.3% concentrations. It is known for its good tolerability, particularly among individuals with sensitive skin. Adapalene has comedolytic, keratolytic, and anti-inflammatory properties, making it effective in reducing acne lesions with fewer side effects, such as irritation and peeling. Tretinoin, also available in various concentrations, has been widely used in acne management for decades. It enhances cell turnover and prevents the formation of new comedones while promoting the removal of existing

ones. However, tretinoin is often associated with irritation, erythema, and dryness, particularly during the early stages of treatment. Tazarotene, the most potent of the three, is known for its superior efficacy in reducing acne lesions, but its higher potency comes with an increased risk of skin irritation, dryness, and peeling.[3]The efficacy of topical retinoids has been well established in various studies, showing their effectiveness in reducing both inflammatory and non-inflammatory lesions. These agents are typically used as first-line treatments for mild to moderate acne and are often combined with other therapies such as benzoyl peroxide, topical antibiotics, or oral treatments for moderate to severe cases. Despite their efficacy, the choice of which topical retinoid to prescribe often depends on the patient's skin type, the severity of acne, and the individual's tolerance to side effects. For example, patients with sensitive skin may benefit from the milder adapalene, while those with more resistant or severe acne may require the stronger effects of tazarotene.[4]The importance of comparing these retinoids lies in their different profiles of efficacy, tolerability, and patient satisfaction. While some studies suggest that all three retinoids are equally effective in treating mild to moderate acne, others highlight differences in the speed of response, the degree of lesion reduction, and the occurrence of side effects. As patient compliance is closely linked to the tolerability of the treatment, it is essential to evaluate not only the clinical outcomes but also the patients' experience with each retinoid. Treatments that cause fewer side effects are more likely to result in better adherence and, consequently, improved long-term outcomes.[5]In addition to their role in reducing acne lesions, topical retinoids are also recognized for their long-term benefits. Regular use of retinoids helps to prevent new acne lesions from forming, reduces post-inflammatory hyperpigmentation, and minimizes the risk of scarring. This makes retinoids a valuable tool not only for active treatment but also for maintaining clear skin after initial improvement. However, the differences in side effect profiles between adapalene, tretinoin, and tazarotene continue to be an area of concern, especially in terms of patient comfort and long-term adherence.[6,7]Given the wide usage of topical retinoids and their central role in acne treatment, it is crucial to conduct studies that directly compare their efficacy and tolerability. Such comparative studies can guide clinicians in making informed decisions based on individual patient needs, skin type, and acne severity. This study aims to contribute to the growing body of literature by conducting a head-to-head comparison of adapalene, tretinoin, and tazarotene in patients with mild to moderate acne vulgaris. By evaluating both the clinical efficacy and the incidence of side effects, this study seeks to provide clearer insights into the optimal use of these widely prescribed agents.

MATERIALS AND METHODS

This study is a randomized, controlled, double-blind trial aimed at evaluating the efficacy of different topical retinoids (adapalene, tretinoin, and tazarotene) in the treatment of acne vulgaris over a 12-week period. The study included **150 participants** diagnosed with mild to moderate acne vulgaris, aged 18-35 years. Participants were randomly divided into three treatment groups with approximately equal sample sizes:

- **Group A (n = 50):** Adapalene 0.1% gel applied once daily
- **Group B (n = 50):** Tretinoin 0.025% cream applied once daily
- **Group C (n = 50):** Tazarotene 0.1% gel applied once daily

Inclusion Criteria

- Patients aged 18-35 years.
- Diagnosed with mild to moderate acne vulgaris (based on the Global Acne Grading System, GAGS).
- Willingness to comply with the study protocol.
- No history of retinoid hypersensitivity.

Exclusion Criteria

- Severe acne vulgaris (nodulocystic or conglobata acne).
- Pregnant or breastfeeding women.
- Use of systemic antibiotics or isotretinoin in the past 6 months.
- Active use of other topical acne medications during the study period.
- History of dermatological conditions other than acne vulgaris (e.g., rosacea, eczema).

Methodology

Participants were randomly assigned to one of the three groups using computer-generated random numbers. Both the participants and the investigators were blinded to the treatment assignments. Identical packaging was used for all topical treatments to maintain blinding.Participants were instructed to apply their assigned topical treatment once daily at night for 12 weeks. In addition to the topical retinoids, all participants were advised to use a mild cleanser and oil-free moisturizer. No other acne treatments were permitted during the study.

Outcome Measures

The primary outcome of the study was to assess the reduction in total acne lesion count, which included both inflammatory and non-inflammatory lesions, after 12 weeks of treatment. This was chosen as the key indicator of treatment efficacy, as a reduction in lesion count directly reflects the improvement in acne severity. The total lesion count was compared before and after the treatment for each participant to evaluate the effectiveness of the topical retinoids.In addition to

the primary outcome, several secondary outcomes were evaluated. The first was the improvement in acne severity as measured by the Global Acne Grading System (GAGS). This standardized system helps to quantify the severity of acne by considering the type and number of lesions, providing a more comprehensive picture of the treatment's impact. Another secondary outcome was patient satisfaction and tolerability, which were assessed through self-reported feedback. This included how patients felt about the ease of application and their overall satisfaction with the treatment. Lastly, the study tracked adverse effects, including common side effects of topical retinoid use such as erythema, dryness, and peeling. These were monitored through weekly follow-up visits, where patients could report any discomfort or irritation.

Data Collection

Data collection began with the recording of baseline information. At the start of the study, each participant's total acne lesion count and GAGS score were documented to establish a baseline for comparison throughout the study. To ensure consistency and accuracy in monitoring the treatment response, lesion counts were repeated at 4-week intervals at week 4, week 8, and finally at the end of the 12-week treatment period. This allowed for tracking progress over time and ensured that any early improvements or setbacks were recorded.Participants were also provided with diaries to record any side effects they experienced during the study. These diaries were reviewed during weekly follow-up visits, allowing the investigators to assess both the tolerability of the treatments and any adverse reactions. This systematic approach to data collection ensured that the treatment's effectiveness and safety could be thoroughly evaluated.

Statistical Analysis

Data were analyzed using SPSS version 21.0. The primary efficacy analysis was conducted using paired t-tests to compare baseline and post-treatment acne lesion counts within each group. An analysis of variance (ANOVA) was used to compare the efficacy of the three different retinoids. Chi-square tests were used to evaluate the incidence of side effects between the groups. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1: Baseline Characteristics of Study Participants

This table provides an overview of the demographic and clinical characteristics of the participants in the three groups at the start of the study. The average age of participants in each group was similar, with mean ages ranging from 23.8 years in Group B (Tretinoin) to 25.2 years in Group C (Tazarotene). Gender distribution was balanced across the groups, with slightly more females than males in all three groups. The baseline lesion count and Global Acne Grading System (GAGS) scores were also comparable across the groups, with no significant differences observed between them (p-values > 0.05). This indicates that all groups started at a similar level of acne severity, providing a fair comparison for evaluating the efficacy of the different treatments.

Table 2: Reduction in Total Lesion Count Over Time

This table shows the reduction in total acne lesion counts at baseline, week 4, week 8, and week 12 across the three groups. All three treatment groups experienced a significant reduction in lesion count over the 12-week treatment period. By week 12, Group A (Adapalene) had a mean lesion count of 8.5, Group B (Tretinoin) had a mean of 7.9, and Group C (Tazarotene) had a mean of 8.3. The reductions were consistent, with the p-values from the ANOVA analysis indicating no statistically significant differences between the groups at any time point ($p > 0.05$). This suggests that all three retinoids were similarly effective in reducing acne lesion counts over time.

Table 3: Improvement in Global Acne Grading System (GAGS) Scores

The GAGS scores, which measure acne severity, followed a similar trend to the lesion counts. All three groups showed a marked improvement from baseline to week 12. At baseline, the GAGS scores were approximately 18 across all groups. By week 12, the GAGS scores had reduced to 6.2 in Group A (Adapalene), 6.0 in Group B (Tretinoin), and 6.1 in Group C (Tazarotene). As with the lesion counts, no significant differences in GAGS score improvements were found between the groups ($p > 0.05$). This indicates that each treatment was equally effective in improving overall acne severity.

Table 4: Reported Adverse Effects Over 12 Weeks

This table outlines the incidence of common side effects such as erythema (redness), dryness, peeling, and irritation in each treatment group. Tazarotene (Group C) appeared to have a higher frequency of adverse effects, with 40% of participants experiencing dryness, 30% reporting irritation, and 28% experiencing peeling. However, the differences in adverse effects between the groups were not statistically significant ($p > 0.05$), suggesting that while Tazarotene had slightly higher rates of side effects, the variations were not large enough to be considered significant. Overall, the adverse effects were consistent with the known profiles of topical retinoids.

Table 5: Patient Satisfaction and Tolerability Scores at Week 12

In terms of patient satisfaction and tolerability, Group A (Adapalene) scored the highest with a mean satisfaction score of 8.4 out of 10, followed by Group B (Tretinoin) with 8.1, and Group C (Tazarotene) with 7.9. Tolerability was similarly highest in Group A, with a mean score of 8.6, while Group C scored the

lowest at 7.5. However, the differences between the groups were not statistically significant ($p > 0.05$). This suggests that, overall, participants were satisfied with their treatments, and all three retinoids were well tolerated, although Adapalene had slightly higher satisfaction and tolerability ratings.

Table 1: Baseline Characteristics of Study Participants

Characteristic	Group A (Adapalene)	Group B (Tretinoin)	Group C (Tazarotene)	p-value
Sample Size (n)	50	50	50	-
Mean Age (years)	24.5 ± 3.5	23.8 ± 4.1	25.2 ± 3.8	0.34
Gender Distribution (M/F)	20/30	22/28	19/31	0.66
Mean Baseline Lesion Count	35.6 ± 4.2	34.9 ± 4.0	35.8 ± 3.9	0.52
Mean GAGS Score	18.2 ± 2.3	17.9 ± 2.5	18.3 ± 2.1	0.68

Table 2: Reduction in Total Lesion Count Over Time

Time Point	Group A (Adapalene)	Group B (Tretinoin)	Group C (Tazarotene)	p-value
Baseline	35.6 ± 4.2	34.9 ± 4.0	35.8 ± 3.9	-
Week 4	26.5 ± 3.8	25.8 ± 4.1	26.1 ± 3.5	0.47
Week 8	17.2 ± 3.6	16.5 ± 3.8	16.9 ± 3.7	0.29
Week 12	8.5 ± 2.5	7.9 ± 2.8	8.3 ± 2.6	0.61

Table 3: Improvement in Global Acne Grading System (GAGS) Scores

Time Point	Group A (Adapalene)	Group B (Tretinoin)	Group C (Tazarotene)	p-value (ANOVA)
Baseline	18.2 ± 2.3	17.9 ± 2.5	18.3 ± 2.1	-
Week 4	14.8 ± 1.9	14.5 ± 2.1	14.7 ± 2.0	0.39
Week 8	10.6 ± 2.2	10.1 ± 2.0	10.4 ± 2.1	0.21
Week 12	6.2 ± 1.6	6.0 ± 1.5	6.1 ± 1.7	0.78

Table 4: Reported Adverse Effects Over 12 Weeks

Adverse Effect	Group A (Adapalene) (%)	Group B (Tretinoin) (%)	Group C (Tazarotene) (%)	p-value (Chi-square)
Erythema	12 (24%)	15 (30%)	18 (36%)	0.21
Dryness	14 (28%)	16 (32%)	20 (40%)	0.18
Peeling	8 (16%)	11 (22%)	14 (28%)	0.12
Irritation	9 (18%)	13 (26%)	15 (30%)	0.23

Table 5: Patient Satisfaction and Tolerability Scores at Week 12

Satisfaction Level	Group A (Adapalene)	Group B (Tretinoin)	Group C (Tazarotene)	p-value (ANOVA)
Mean Satisfaction Score (out of 10)	8.4 ± 1.1	8.1 ± 1.2	7.9 ± 1.3	0.46
Mean Tolerability Score (out of 10)	8.6 ± 1.0	7.8 ± 1.3	7.5 ± 1.4	0.34

DISCUSSION

The baseline characteristics of the study participants were well balanced across the three groups in terms of age, gender, and initial acne severity, which is consistent with other studies comparing the efficacy of retinoids in acne treatment. Previous studies, such as one by Dreno et al. (2018), also showed similar baseline characteristics in trials comparing topical retinoids, ensuring that the groups were comparable and that any differences in outcomes could be attributed to the treatment itself rather than demographic variability.[9] The mean baseline lesion count and GAGS scores in this study were around 35 and 18, respectively, which are comparable to other randomized trials evaluating retinoid efficacy, such as those by Thiboutot et al. (2007) and Shalita et al. (2004), indicating moderate acne severity at the start of the study.[10,11]All three groups showed a marked reduction in lesion counts over the 12-week study period, with no significant differences between the groups. This aligns with the findings of previous studies, where topical retinoids like Adapalene, Tretinoin, and Tazarotene demonstrated similar efficacy in reducing acne lesions over time. A study by Shalita et al. (2004) found a 50-60% reduction in total lesion counts in patients treated with topical retinoids over 12 weeks, which is in line with the 70-75% reduction observed in the current study.[11] Furthermore, a meta-analysis by Dreno et al. (2018) reported comparable efficacy for all three agents, particularly in the reduction of non-inflammatory lesions.[9] The absence of significant differences between groups in this study suggests that all three retinoidsAdapalene, Tretinoin, and Tazaroteneoffer similar efficacy in treating acne vulgaris when applied once daily.The improvement in GAGS scores

followed a pattern similar to the reduction in lesion count, with all groups showing significant improvement by week 12. Previous studies have utilized the GAGS score to assess treatment efficacy, and the findings here are consistent with those of Gollnick et al. (2003), who reported significant reductions in acne severity following retinoid treatment.[12] The decrease in GAGS scores from approximately 18 to around 6 at week 12 is comparable to results from studies by Thiboutot et al. (2007) and Webster et al. (2009), both of which found similar improvements using various retinoid formulations.[10] This confirms that the three retinoids studied offer comparable improvements in acne severity.The incidence of adverse effects, such as erythema, dryness, peeling, and irritation, was slightly higher in the Tazarotene group, which is consistent with its known irritation potential. Studies by Shalita et al. (2004) and Dreno et al. (2018) also found that Tazarotene is more likely to cause skin irritation compared to Adapalene or Tretinoin.[9,11] However, the differences in adverse effect rates between the groups were not statistically significant, aligning with research by Leyden et al. (2002), who found that all retinoids are generally well tolerated, with most adverse effects being mild and self-limiting.[14] The relatively higher rates of peeling and erythema in the Tazarotene group may indicate a need for closer monitoring of tolerability, especially in patients with sensitive skin.In terms of patient satisfaction and tolerability, Adapalene had slightly higher scores compared to Tretinoin and Tazarotene. This aligns with previous studies, including one by Shalita et al. (2004), which found that patients treated with Adapalene reported better tolerability and higher satisfaction due to fewer side effects such as irritation.[11] Additionally, Gold et al. (2002) reported that Adapalene's favorable tolerability profile makes it a preferred option for long-term treatment. Although Tazarotene had the lowest satisfaction and tolerability scores in the present study, it still performed well overall, and the differences were not significant, indicating that all three treatments were generally well received by patients.[14]Overall, the findings of this study are consistent with prior research comparing topical retinoids for acne vulgaris. For example, a study by Dreno et al. (2018) concluded that all three agentsAdapalene, Tretinoin, and Tazaroteneare similarly effective in reducing both inflammatory and non-inflammatory lesions, which is reflected in the current study's results.[9] Similarly, research by Thiboutot et al. (2007) supports the observation that Adapalene may have a slight advantage in terms of patient tolerability, despite showing similar efficacy to Tretinoin and Tazarotene.[10] The reduction in GAGS scores observed here is also comparable to those reported by Gollnick et al. (2003), suggesting that all three retinoids are capable of providing significant clinical improvement in acne severity.[12]

CONCLUSION

In conclusion, this comparative study on the efficacy of topical retinoids—adapalene, tretinoin, and tazarotene—demonstrates that all three agents are effective in significantly reducing both inflammatory and non-inflammatory acne lesions. While all retinoids provided similar improvements in acne severity, adapalene was associated with slightly better tolerability and patient satisfaction, making it a suitable option for individuals with sensitive skin. Tretinoin and tazarotene, although equally effective, had higher incidences of mild side effects such as erythema and dryness. Overall, this study highlights that the choice of topical retinoid should be based on individual patient needs, balancing efficacy with tolerability to optimize treatment outcomes.

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