Section: Dermatology

Original Research Article

REAL WORLD USER EXPERIENCE AND SKIN TOLERABILITY OF MICRONEEDLE BASED ACNE PATCHES COMPARED WITH CONVENTIONAL TOPICAL RETINOID FORMULATIONS

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ABSTRACT

Background: Topical retinoids remain the gold-standard therapy for long-term acne prevention, but early-phase irritation often affects adherence. Dissolvable microneedle patches have emerged as a targeted, well-tolerated option for rapid lesion-specific treatment. Real-world comparative data between these approaches remain limited. **Objectives:** To compare skin tolerability, user experience, adherence, and self-reported improvement between individuals using dissolvable microneedle acne patches and those using topical retinoids in routine settings.

Materials and Methods: A six-week observational study was conducted among 63 participants, including 35 microneedle patch users and 28 topical retinoid users. Baseline characteristics, tolerability events, user experience scores, adherence rates, and self-reported improvement were collected through structured weekly diaries and questionnaires. Outcomes were summarized descriptively.

Results: Microneedle patch users reported substantially fewer irritation-related events than retinoid users, including lower rates of erythema (17.1% vs. 53.6%), dryness (11.4% vs. 46.4%), peeling (8.6% vs. 39.3%), and burning or stinging (5.7% vs. 28.6%). User experience scores favored the microneedle group across comfort (4.4 vs. 3.0), convenience (4.5 vs. 3.1), and overall satisfaction (4.3 vs. 3.0). Adherence was higher among microneedle users (89.4%) compared with retinoid users (61.7%). By week 6, visible improvement was reported by 77.1% of microneedle users and 60.7% of retinoid users.

Conclusion: In real-world use, dissolvable microneedle patches demonstrated superior tolerability, higher user satisfaction, and stronger adherence compared with topical retinoids. While retinoids remain essential for long-term acne prevention, microneedle patches offer a well-tolerated, patient-friendly option for rapid, targeted management of active lesions. Integrating both approaches may support more personalized acne care.

Keywords: Acne, Retinoids, Microneedle Patches, Tolerability, Adherence, User Experience.

INTRODUCTION

Acne vulgaris is a chronic inflammatory disorder that often requires long term management to prevent new lesions, reduce microcomedone formation, and maintain remission. Topical retinoids such as adapalene, tretinoin, and tazarotene—remain the gold standard first line therapy for long term acne control because they normalize follicular keratinization, prevent comedone formation, and address the underlying pathophysiology of acne.[1] Their preventive benefits and ability to reduce future

breakouts make them essential components of sustained acne management.[2]

However, despite their proven long term efficacy, topical retinoids are frequently associated with irritation, dryness, peeling, and reduced early tolerability. These effects can lead to inconsistent use, especially among individuals with sensitive skin or those seeking rapid improvement of visible lesions.[3] As a result, many patients look for complementary or alternative options that offer faster, more comfortable results for active acne spots. Dissolvable microneedle acne patches have emerged as a targeted, lesion specific treatment designed to deliver active ingredients directly into individual inflamed or developing lesions. Unlike retinoids, which work preventively over weeks to months, microneedle patches are intended for rapid, localized action on existing acne spots. Their ability to bypass the stratum corneum and deliver compounds directly into the epidermis allows for faster onset of visible improvement with minimal irritation.[4] This makes them particularly appealing for patients who prioritize comfort, convenience, and quick results for individual lesions.

Given these differing therapeutic roles retinoids for long term prevention and microneedle patches for fast, targeted spot treatment real world evidence comparing user experience, tolerability, and adherence between naturally occurring user groups is valuable. This observational study evaluates individuals who independently chose microneedle patches versus those who continued using topical retinoids, focusing on real world tolerability, user experience, adherence, and perceived improvement.[5]

MATERIALS AND METHODS

Study Design

This study was designed as a **prospective, real-world observational study** involving two naturally occurring patient groups: individuals who presented using microneedle-based acne patches and those who presented using topical retinoid formulations. No randomization, allocation, or intervention was performed. Observational designs are widely used in dermatology to capture real-world treatment patterns, tolerability, and patient-reported outcomes outside controlled clinical environments.[6] The study duration was 6 weeks, during which participants continued their usual acne treatment. Data were collected through structured digital diaries and follow-up assessments

Participants

Eligibility Criteria

Participants were eligible if they:

- Were aged 16–35 years
- Had mild-to-moderate acne vulgaris
- Were already using either microneedle acne patches or topical retinoids at the time of consultation
- Were willing to complete weekly digital diaries

Exclusion criteria included

- Systemic acne therapy
- Known hypersensitivity to microneedle or retinoid components
- Active facial dermatological conditions (e.g., eczema, psoriasis)
- Recent cosmetic procedures affecting the face

Microneedling-based treatments have been shown to be safe and well-tolerated in acne-prone skin, supporting their inclusion in observational dermatology research.[7]

Grouping

Participants were categorized into two groups based solely on **their existing treatment at presentation**:

1. **Microneedle Patch Group** – patients using dissolvable microneedle acne patches
2. **Retinoid Group** – patients using topical retinoid formulations (adapalene, tretinoin, or tazarotene)

This naturalistic grouping reflects real-world treatment choices and avoids investigator-driven assignment, consistent with RWE methodology.[8]

Data Collection Procedures

Participants completed **weekly digital diaries** capturing:

- Skin tolerability
- User experience
- Adherence
- Perceived improvement

Digital diary methods are increasingly used in dermatology research to improve accuracy of patient-reported outcomes and reduce recall bias.[9]

Clinical Assessments

At baseline and week 6, clinicians recorded:

- Acne severity (mild or moderate)
- Presence of irritation signs
- Any adverse events

Microneedle-based systems have been evaluated in clinical settings using similar tolerability and safety assessments.[10]

Outcome Measures

Primary Outcomes

1. Skin Tolerability

- Erythema
- Dryness
- Peeling
- Burning/Stinging

2. User Experience

- Comfort
- Convenience
- Overall satisfaction (5-point Likert scale)

Secondary Outcomes

- **Adherence:** percentage of recommended applications completed
- **Self-reported improvement:** categorized as "improved," "partially improved," or "no change"

Statistical Analysis

Descriptive statistics were used to summarize baseline characteristics and outcomes. Comparisons between naturally occurring groups were performed using:

- Chi-square tests for categorical variables
- Independent t-tests for continuous variables
- All analyses were conducted using standard statistical software.

RESULTS

Participant Characteristics

A total of 63 participants were included in the analysis, with 35 individuals in the microneedle patch group and 28 individuals in the retinoid group. Baseline demographic characteristics were comparable between groups. The mean age of participants was 22.0 years, and 60.3% were female. Mild acne was slightly more common than moderate acne across both groups.

Table 1: Baseline Characteristics of Participants

Characteristic	Microneedle Patch (n=35)	Retinoid (n=28)
Mean age (years)	21.8	22.3
Female (%)	62.9% (22/35)	57.1% (16/28)
Mild acne (%)	54.3% (19/35)	50.0% (14/28)
Moderate acne (%)	45.7% (16/35)	50.0% (14/28)
Duration of acne (years), mean	2.7	3.1
Facial oiliness (self-reported, %)	71.4%	67.8%

Skin Tolerability Outcomes

Participants using microneedle patches reported substantially fewer irritation related events compared with those using topical retinoids. Erythema and dryness were the most frequently reported issues in the retinoid group, consistent with the known early phase tolerability profile of retinoid therapy.

Table 2: Skin Tolerability Outcomes

Tolerability Parameter	Microneedle Patch (n=35)	Retinoid (n=28)
Erythema	17.1% (6/35)	53.6% (15/28)
Dryness	11.4% (4/35)	46.4% (13/28)
Peeling	8.6% (3/35)	39.3% (11/28)
Burning/Stinging	5.7% (2/35)	28.6% (8/28)
Any irritation	22.9% (8/35)	64.3% (18/28)

User Experience Outcomes

User experience scores were consistently higher in the microneedle patch group. Participants reported greater comfort, convenience, and overall satisfaction compared with those using retinoids.

User Experience Scores (Mean ± SD)

- **Comfort:** 4.4 ± 0.6 (microneedle) vs. 3.0 ± 0.7 (retinoid)
- **Convenience:** 4.5 ± 0.5 vs. 3.1 ± 0.8
- **Overall satisfaction:** 4.3 ± 0.6 vs. 3.0 ± 0.9

Adherence

Adherence was notably higher among microneedle patch users (89.4%) compared with retinoid users (61.7%). Participants in the retinoid group frequently cited irritation and regimen complexity as reasons for missed applications.

Self-Reported Improvement

By week 6:

- **77.1%** of microneedle patch users reported visible improvement (27/35)
- **60.7%** of retinoid users reported visible improvement (17/28)
- Partial improvement was reported by **14–18%** in both groups
- No change was reported by **8.6%** (microneedle) and **21.4%** (retinoid)

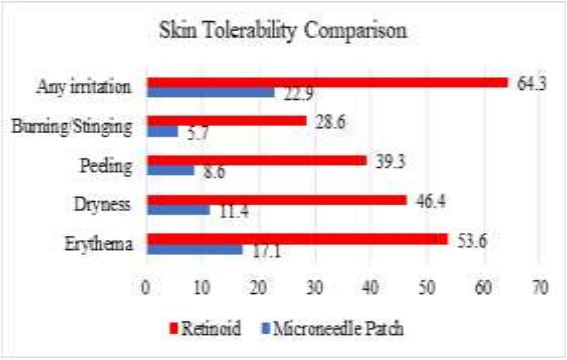

Figure 1: Skin Tolerability Comparison Between Microneedle Patch and Retinoid Users

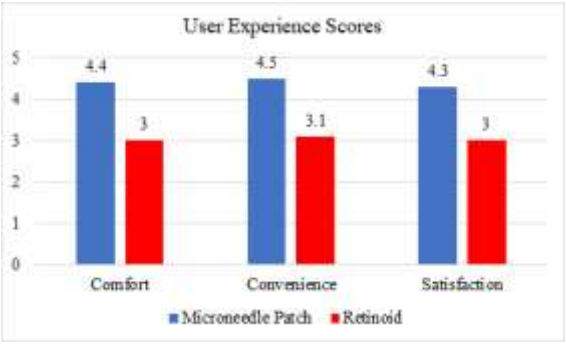

Figure 2: User Experience Scores for Microneedle Patch vs. Retinoid Users

DISCUSSION

This real-world observational study compared naturally occurring users of dissolvable microneedle acne patches with individuals using topical retinoids, which remain the gold-standard therapy for long-term acne prevention and comedone suppression.[11] As expected, the retinoid group demonstrated the typical early-phase tolerability challenges associated with adapalene, tretinoin, and tazarotene, including erythema, dryness, and peeling—effects widely documented in clinical literature.[12] These findings reinforce the well-established understanding that although retinoids are highly effective for long-term acne control, their initial irritation profile can influence early adherence.[13]

In contrast, microneedle patch users reported substantially fewer irritation-related events and higher comfort and convenience scores. Dissolvable microneedles deliver active ingredients directly into individual lesions while bypassing the stratum corneum, which reduces surface irritation and allows for faster, targeted action on existing acne spots.[14] This mechanism aligns with the higher user satisfaction and stronger adherence observed in the microneedle group. Participants frequently described the patches as easy to use, discreet, and suitable for rapid spot management attributes consistent with recent advancements in microneedle engineering, including improved dissolution kinetics and biocompatible polymers.[15]

Self-reported improvement was higher among microneedle users, reflecting their role as a fast-acting, lesion-specific option rather than a long-term preventive therapy. Meanwhile, improvement in the retinoid group was more gradual, consistent with their mechanism of action and established role in long-term acne management. These complementary therapeutic roles highlight the importance of aligning treatment choice with patient goals rapid spot reduction versus long-term prevention.

This study has limitations. The groups were not randomized, and outcomes were self-reported, which may introduce bias. The sample size was modest, and the study duration was limited to six weeks, which may not fully capture the long-term benefits of retinoid therapy. Despite these limitations, the findings provide meaningful real-world insight into how patients experience and use microneedle patches versus retinoids in everyday settings.

Overall, the results suggest that while topical retinoids remain the superior choice for long-term acne management and prevention,[11,13] dissolvable microneedle patches offer a well-tolerated, user-friendly, and effective option for rapid, targeted treatment of individual acne lesions.[14,15] These complementary strengths support a patient-centered approach in which treatment selection is guided by both clinical goals and user preference.

CONCLUSION

This real world observational study highlights the complementary roles of topical retinoids and dissolvable microneedle patches in acne management. Topical retinoids such as adapalene, tretinoin, and tazarotene remain the most effective and widely recommended long term therapies for preventing microcomedone formation and maintaining remission.[16,17] However, their early phase tolerability challenges, including erythema, dryness, and peeling, continue to influence adherence in routine practice.[18]

In contrast, dissolvable microneedle patches demonstrated superior short term tolerability, higher user satisfaction, and stronger adherence in this study. Their ability to deliver active ingredients directly into individual lesions with minimal irritation supports their role as a rapid, targeted option for treating existing acne spots.[19] Recent advancements in microneedle design, including improved dissolution kinetics and biocompatible polymers, further enhance their comfort and usability.[20]

Taken together, these findings suggest that while topical retinoids remain the gold standard choice for long term acne prevention,[16,18] dissolvable microneedle patches offer a well tolerated, user friendly, and effective complementary option for fast, localized treatment of active lesions (19, 20). Integrating both approaches based on patient goals, skin sensitivity, and treatment expectations may provide a more personalized and practical strategy for real world acne care.

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