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Research Article

Clinical Characteristics and Treatment of Acne with Sensitive Skin

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Background. Acne is a prevalent skin disorder that primarily affects seborrheic areas. It occurs due to hair follicle obstruction and subsequent inflammation. Patients with acne often exhibit compromised skin barrier function and sensitivity, making treatment challenging. *Objectives*. This study aimed to investigate the occurrence of acne complicated by sensitive skin and explore the associated physiological changes. *Methods*. The lactic acid test and capsaicin test were employed to identify subjects with simple acne and those with acne and sensitive skin. Physiological characteristics were assessed in both groups. Two random groups were selected from the subjects with acne and sensitive skin. One group received treatment for acne alone, while the other group received combined treatment for acne and sensitive skin care. The efficacy and physiological function of the two groups were compared after treatment. *Results*. Among 170 acne patients, 99 were identified as having acne with sensitive skin. Patients with acne and sensitive skin exhibited significantly higher scores on the lactic acid test and capsaicin test compared to those with simple acne. They also showed increased transepidermal water loss (TEWL), decreased skin cuticle hydration (SCH), thinner epidermis, and thicker blood vessels. The group receiving combined treatment demonstrated a more significant reduction in the number of skin lesions and IGA scores compared to the group receiving treatment for acne alone. They also exhibited lower scores on the lactate and capsaicin tests, along with decreases in TEWL and increases in SCH. *Conclusions*. Acne with sensitive skin is highly prevalent and is associated with distinct physiological characteristics. Combined treatment targeting both acne and sensitive skin yields excellent clinical outcomes and improves skin's physiological function. These findings underscore the importance of considering sensitive skin in the clinical management of acne.

1. Introduction

Acne is a prevalent chronic inflammatory skin disease affecting the hair follicles and sebaceous glands, with negative impacts on patients' physical and mental well-being. Dermatologists have traditionally focused on treating erythema, pigmentation, and postacne scars, often overlooking the increasingly significant issue of acne with sensitive skin [1, 2].

Acne itself can damage the skin barrier. Patients with acne exhibit decreased levels of free fatty acids, increased squalene, and reduced sebum membrane stability on the skin surface, leading to barrier impairment [3]. In addition, the presence of Propionibacterium acne on the skin surface, along with microbial imbalances, further compromises the skin's protective barrier [4]. Furthermore, Propionibacterium acnes triggers the production of inflammatory factors such as IL-6, IL-8, and TNF-α, activating and aggregating inflammatory cells and causing harm to keratinocytes, thereby exacerbating skin barrier damage [5]. Oral and topical acne medications such as isotretinoin, benzoyl peroxide, chemical exfoliants, and laser treatments can also contribute to skin barrier impairment [6]. Inadequate skincare practices and changes in the mental state of acne patients can further impact the skin barrier [7, 8]. As a result of these factors, acne combined with sensitive skin becomes a common occurrence.

Clinically, acne patients with sensitive skin present with comedones, papules, pustules, nodules, and cysts on the face [9]. When exposed to various triggers such as mental, physical, and chemical factors (e.g., humid environments, sun exposure, and stress), the skin becomes prone to symptoms such as burning [10], intermittent redness,

tingling, itching, tightness, and in some cases, persistent erythema and telangiectasia. Managing acne combined with sensitive skin poses challenges when selecting treatment plans, as neglecting to address sensitive skin can worsen skin barrier damage and contribute to recurring breakouts.

In this study, we conducted a screening process using the lactic acid test and capsaicin test to identify subjects with acne and sensitive skin. We investigated the incidence rate of acne combined with sensitive skin and evaluated changes in physiological function indicators. By assessing the effectiveness of combined treatment for acne and sensitive skin, our study provides a theoretical foundation and potential improvements for the clinical diagnosis and treatment of acne combined with sensitive skin.

2. Materials and Methods

2.1. Study Subjects. A total of 170 Chinese subjects with acne were recruited from the Dermatology Department of Hangzhou Third People's Hospital, consisting of 20 males and 150 females. The average age of the participants was 27.62 ± 7.73 years (range: 11–45 years), and the average duration of acne was 18 ± 6 months (range: 1–180 months). The study received approval from the institutional review board at Hangzhou Third People's Hospital (code number: 2021KA019). Participants' information was registered, and they were informed about the purpose of the study before providing signed informed consent. They also consented to the publication of their pictures. The subjects were divided into two groups based on their skin perception, and objective measurements were taken. Group 1 comprised subjects with simple acne, scoring <3 points on the lactic acid test and <3 points on the capsaicin test. Group 2 included subjects with acne and sensitive skin, scoring ≥3 points on the lactic acid test and/or ≥3 points on the capsaicin test. All measurements were conducted in the same room without daylight, and ambient conditions were controlled at 22–24°C with 50–60% relative humidity. Prior to the test, each subject was instructed to cleanse their face and take a 20-minute break.

2.2. Clinical Measurements. A 10% lactic acid solution was applied to the right nasolabial groove and any cheek area without acne lesions. The subjects' reported sensations were assessed at 2.5 and 5 minutes using a 4-point scale (0 = no stinging, 1 = mild stinging, 2 = moderate stinging, and 3 = severe stinging). A total score exceeding 3 indicated a positive lactic acid test.

A $1 * 10^{-4}$% capsaicin solution was applied to the nasolabial sulcus at room temperature, and the subjects' sensations were scored accordingly (1 = barely perceptible, 2 = mild perceptible, 3 = moderate perceptible, 4 = severe perceptible, and 5 = pain). A positive capsaicin test was confirmed when the total score exceeded 3 points.

The GPSkin Barrier® (GPOWER Inc, Seoul, South Korea) device was used to measure subjects' transepidermal water loss (TEWL) and skin cuticle hydration (SCH) [11]. Three measurements were taken for each parameter in each area, and the average values were recorded.

The epidermal thickness of the subjects was measured using reflectance confocal microscopy (RCM) [12]. Epidermal thickness was determined by measuring the height from the first visible layer of the cuticle to the top of the dermal papilla. Three different areas of the cheek were measured, and the average value was calculated.

Digital dermatoscopic images of the acne lesions were captured using a FotoFinder Medicam 1000 (FotoFinder Systems GmbH, Bad Birnbach, Germany) [13]. Five blood vessels of different sizes in the center of each image were randomly selected, and their average diameter was measured using FotoFinder Universe 2019 software.

2.3. Clinical Therapy and Observation. Twenty subjects were randomly selected from Group 2 and further divided into the Single Treatment Group (Group 3) and Combination Treatment Group (Group 4). Group 3 received treatment with oral isotretinoin and topical lincomycin gel, while Group 4 received treatment with topical barrier extreme cream (Beitaini Bio-technological Co., China), which has anti-inflammatory and barrier repair effects, in addition to the treatment received by Group 3. Yellow and red light treatments were administered once a week to subjects in Group 4. Efficacy was assessed based on the count of total, comedonal (open and closed comedones), and inflammatory lesions (papules, pustules, nodules, and cysts), as well as the Investigator Global Assessment (IGA) scoring system, at the beginning (D0) and end (D56) of the study. Lactate and capsaicin test results, TEWL, and SCH were measured at D0 and D56 for Group 3 and Group 4, respectively.

2.4. Statistical Analysis. Statistical analysis was performed using SPSS 19.0 software. The data were compared using the chi-square test, *t*-test, Mann–Whitney *U* test, or Wilcoxon signed rank test. A significance level of $P < 0.05$ was considered statistically significant.

3. Results

3.1. Incidence Rate of Acne with Sensitive Skin. Out of the 170 subjects with acne, 71 cases had simple acne (Group 1) and 99 cases had acne with sensitive skin (Group 2). The basic information is presented in Table 1. The results revealed that more than 58% of acne subjects had sensitive skin, indicating a high incidence rate of acne with sensitive skin. Group 2 had a slightly higher percentage of women compared to Group 1 (Figure 1), although the difference was not statistically significant ($p > 0.05$), likely due to disparities in the recruitment of male and female participants.

3.2. Characteristics of Acne with Sensitive Skin. The lactic acid test score in Group 1 was only 1.38 ± 0.78, whereas Group 2 had a significantly higher lactic acid test score of 3.43 ± 0.73, indicating a substantial difference between the two groups ($p \leq 0.001$). Similarly, the capsaicin test score of acne with sensitive skin was significantly higher than that of acne alone ($p \leq 0.001$) (Figure 2).

Table 1: Basic information of subjects in each group.

	Number	Age	Female [Nnt (%)]
Simple acne (group 1)	71	27.46 ± 9.01 (11~45)	60 (85)
Acne with sensitive skin (group 2)	99	27.74 ± 6.72 (14~44)	90 (91)
Single treatment (group 3)	10	29.2 ± 3.56 (23~34)	7 (70)
Combination treatment (group 4)	10	26.4 ± 7.31 (17~37)	8 (80)

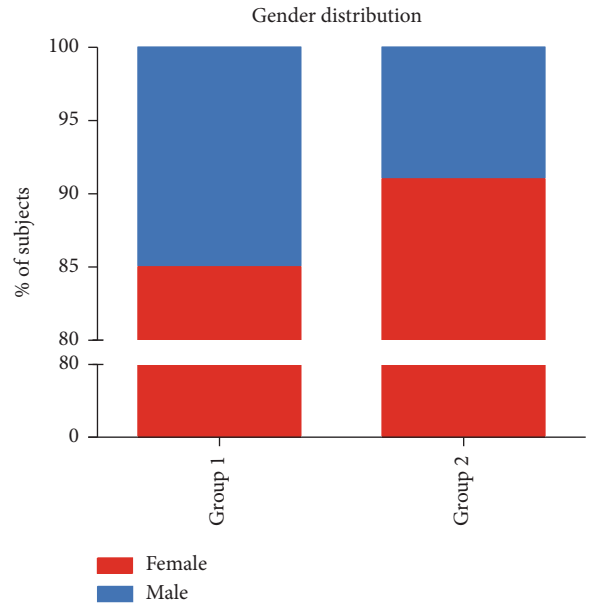


Figure 1: Gender distribution in the simple acne (group 1) and acne with sensitive skin (group 2) groups.

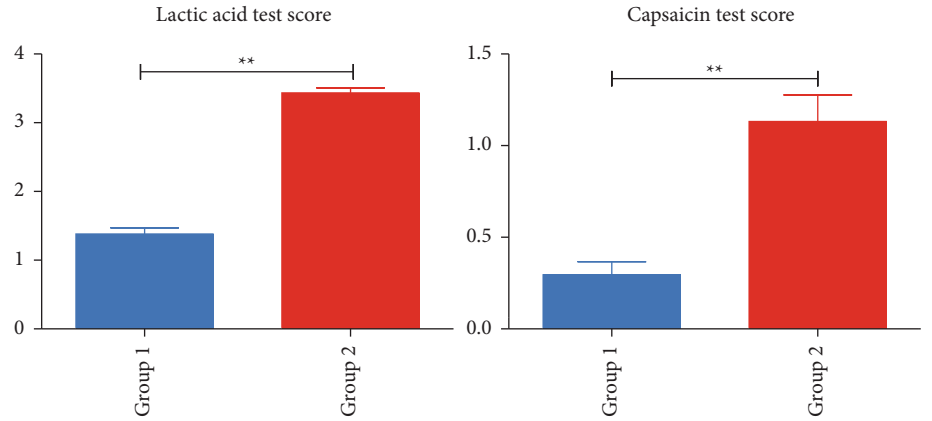


Figure 2: Lactic acid test and capsaicin test score in the simple acne (group 1) and acne with sensitive skin (group 2) groups.

In terms of transepidermal water loss (TEWL), Group 2 showed an increase to 17.77 ± 7.65 compared to Group 1 and the difference between the two groups was statistically significant ($p \leq 0.001$). Although Group 1 had slightly higher skin hydration, there was no significant difference observed between the groups ($p > 0.05$) (Figure 3).

As anticipated, analysis of skin imaging techniques revealed significant changes in the physiological function of acne with sensitive skin. There was a notable difference in reflectance confocal microscopy (RCM) between the two groups ($p \leq 0.001$). The epidermal thickness in Group 1 was 49.07 ± 10.26, whereas in Group 2, it decreased to 38.69 ± 5.09 (Figure 4). Similarly, dermoscopy demonstrated increased and thickened blood vessels in acne with sensitive skin subjects (Figure 5). The blood vessel diameter in Group 2 significantly increased to 0.13 ± 0.06 compared to 0.08 ± 0.03 in Group 1 ($p \leq 0.001$) (Figure 4).

3.3. Clinical Therapeutic Efficacy of Acne with Sensitive Skin. Table 1 presents the basic information of the subjects in Groups 3 and 4. After 56 days of treatment, both groups exhibited a significant decrease in the number of comedonal lesions, inflammatory lesions, and total lesions ($p < 0.05$ for

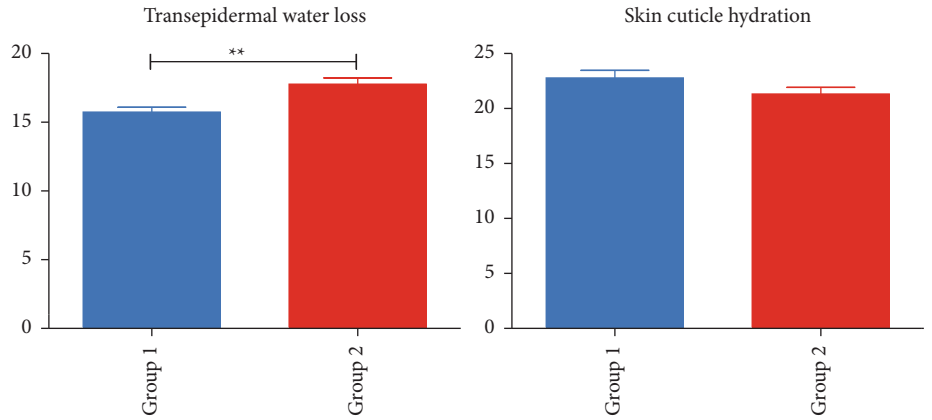


Figure 3: Transepidermal water loss and skin cuticle hydration in the simple acne (group 1) and acne with sensitive skin (group 2) groups.

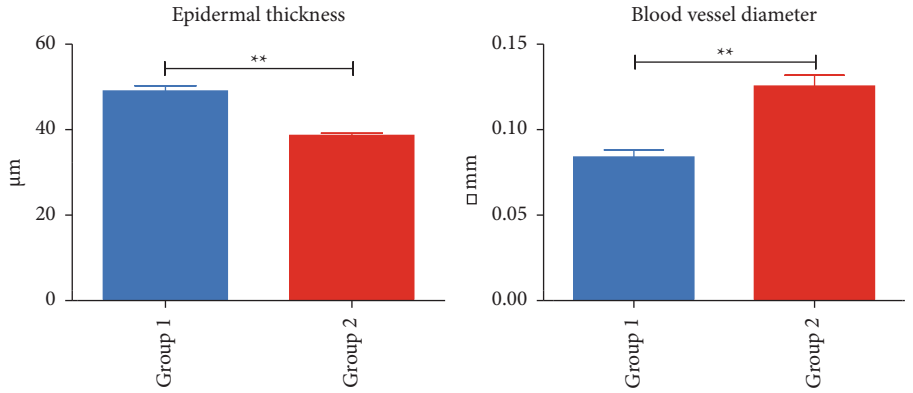
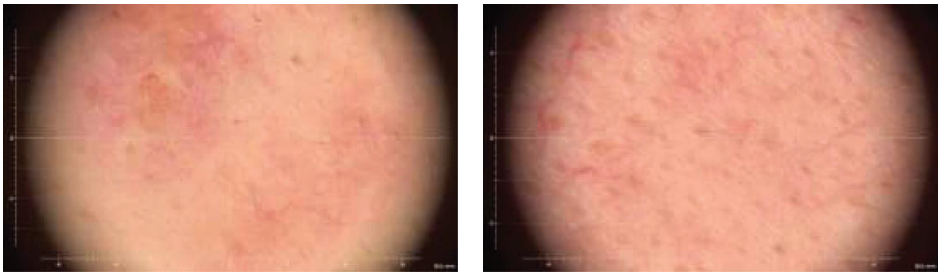


Figure 4: Epidermal thickness and blood vessel diameter in the simple acne (group 1) and acne with sensitive skin (group 2) groups.



(a) (b)

Figure 5: Dermoscopic feature in the simple acne (a) and acne with sensitive skin (b) groups.

all). Furthermore, at the end of the treatment, Group 4 demonstrated significantly lower counts of inflammatory and total lesions compared to Group 3 ($p < 0.05$ for all) (Figure 6).

The Investigator Global Assessment (IGA) scores decreased in each group after 56 days of treatment ($p \leq 0.001$ for all). Notably, there was a significant difference between the two groups in terms of the decline in IGA scores ($p < 0.05$) (Figure 7).

Prior to treatment, all 10 subjects in Group 3 showed positive results in the lactic acid test and 2 of them also showed positive results in the capsaicin test. In Group 4, 9 subjects were positive in the lactic acid test and 4 subjects were positive in the capsaicin test. There was no significant difference between the two groups. After treatment, the number of subjects with positive results in the lactic acid test in Group 4 decreased to 5, and the number of subjects with positive results in the capsaicin test decreased to 2. However, the number of subjects with positive results in the capsaicin test increased to 4 in Group 3. The lactic acid test score and capsaicin test score in Group 4 were significantly reduced after treatment ($p < 0.05$ for all), while the scores in Group 3 increased. At day 56, there was a significant difference in the lactic acid test and capsaicin test scores between Group 3 and Group 4 ($p < 0.05$ for all) (Figure 8).

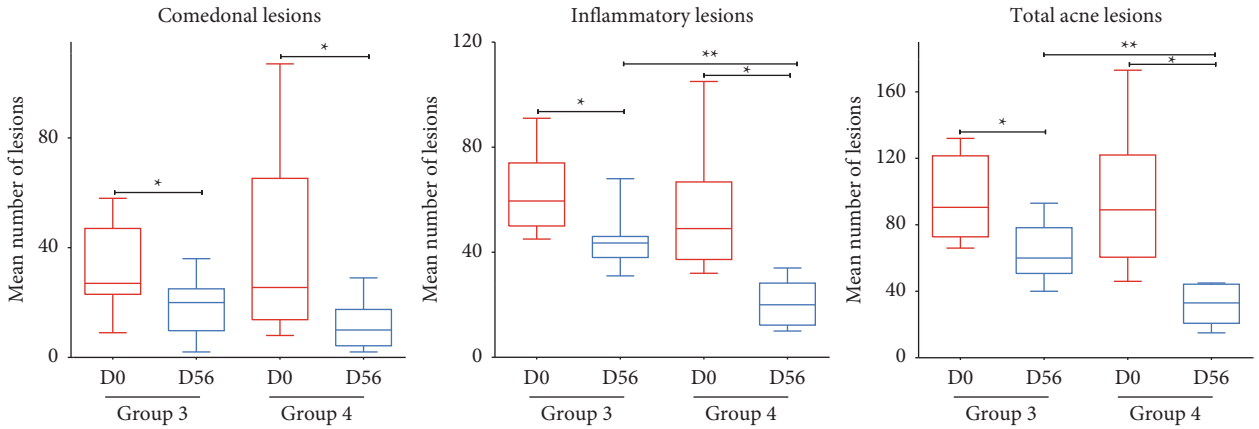


Figure 6: Changes of number of acne lesions before and after treatment in single treatment (group 3) and combination treatment (group 4) groups.

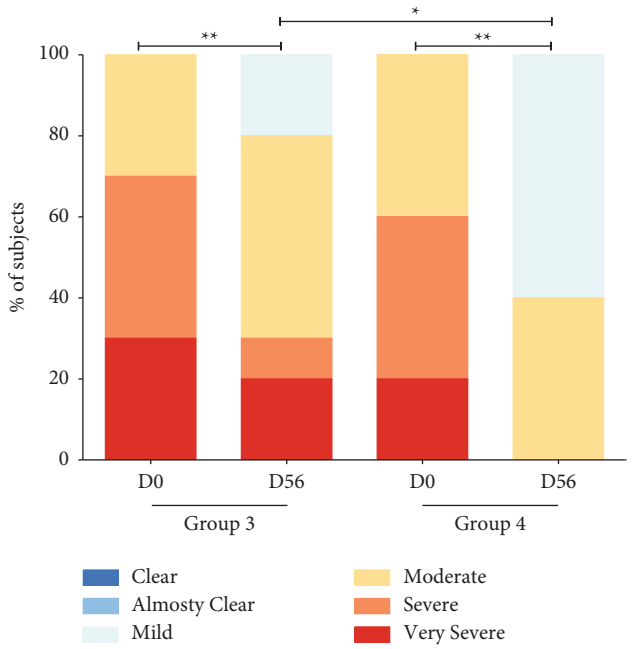


Figure 7: Changes of IGA scores before and after treatment in single treatment (group 3) and combination treatment (group 4) groups.

Finally, significant differences were observed in physiological functions between the two groups after different treatments ($p < 0.05$ for all). In Group 3, TEWL increased and SCH significantly decreased ($p \leq 0.001$), while in Group 4, TEWL decreased and SCH increased (Figure 9).

Figure 10 illustrates a representative photograph demonstrating the clinical improvement of acne with sensitive skin through comprehensive treatment. It depicts a 21-year-old woman at D0 and D56, with an improved IGA score from 3 to 1 and an improved lactic acid test score from 5 to 3. Figure 11 displays the clinical results of acne with sensitive skin after single treatment. It shows a 25-year-old woman whose IGA score dropped from 4 to 3 but without any improvement in the lactic acid test and capsaicin test.

4. Discussion

Acne, a common chronic inflammatory skin disorder, can be accompanied by compromised skin barrier function [14]. Furthermore, certain oral and topical medications, chemical exfoliation, and laser treatments used in acne management can exacerbate skin barrier damage [15]. When the skin barrier is impaired, the skin becomes more sensitive and reactive. This sensitivity is observed in other skin conditions with compromised barriers, such as rosacea and atopic dermatitis [16].

In individuals with sensitive skin, exposure to rapid changes in physical and chemical conditions or variations in environmental temperature can lead to the rapid expansion of skin microvessels and increased blood flow, resulting in flushing of the skin [17]. In addition, the accelerated blood flow enhances the absorption of external irritants, increasing the likelihood of uncomfortable sensations such as itching, burning, or tingling [18]. Studies have demonstrated that the prevalence of sensitive skin is approximately 36.1% in China and around 50% in Japan, Europe, and the United States [19]. The high prevalence and intrusive nature of sensitive skin significantly impact affected individuals, causing considerable distress.

Our survey revealed that as many as 58% of acne patients have sensitive skin. This high incidence rate warrants the attention of dermatologists, who should exercise caution when selecting treatment options. Previous research has also indicated that women are more prone to developing sensitive skin. Consistent with these findings, our study demonstrates that female acne patients are more likely to exhibit sensitive skin, which may be attributed to women having thinner skin and their hormone levels rendering them more susceptible to inflammation [20, 21].

The skin barrier plays a vital role in maintaining normal skin physiology [22]. It serves as a protective barrier against external harmful substances and prevents excessive water loss through the epidermis. Transepidermal water loss (TEWL) is an indicator of skin barrier function, while skin cuticle hydration (SCH) reflects skin dryness and is another important measure of barrier

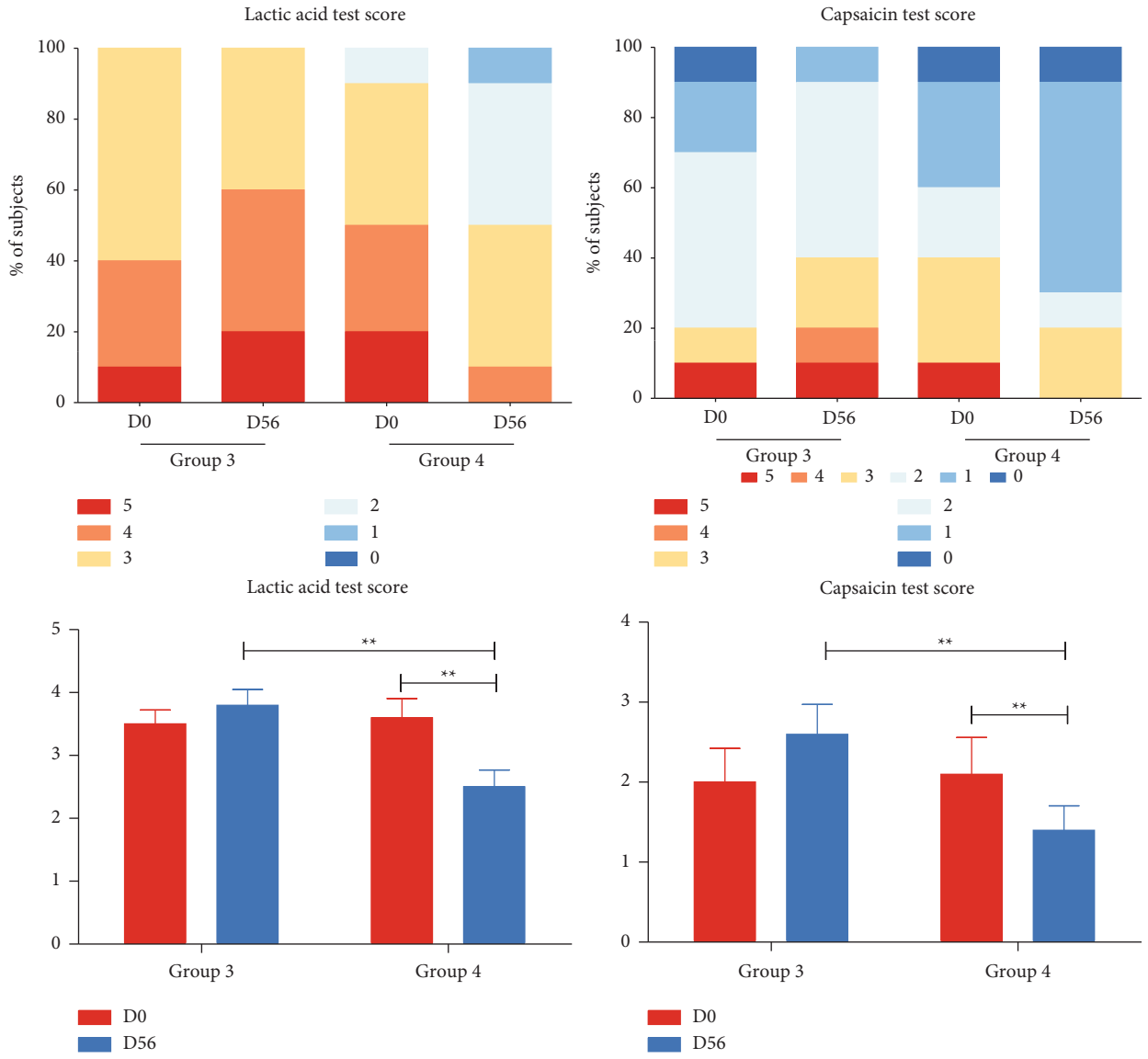


Figure 8: Changes of lactic acid test and capsaicin test scores before and after treatment in single treatment (group 3) and combination treatment (group 4) groups.

function [23]. Reflectance confocal microscopy (RCM) analysis demonstrated that patients with acne and sensitive skin had significantly thinner facial skin. Physiological function tests revealed significantly increased TEWL and reduced SCH in these patients, indicating more severe barrier damage compared to those with simple acne. Consequently, their skin displayed decreased resistance to external stimuli, heightened skin permeability, and heightened susceptibility to chemical stimuli, resulting in facial discomfort and significantly higher lactic acid test scores. When the skin barrier is compromised, the neuroendocrine immune function's homeostasis is disrupted, leading to reduced protective effects on the transient receptor potential (TRP) pathway of nerve endings. Activation of the TRPV-1 receptor by mediators like capsaicin triggers the transmission of pain and itching sensations, thereby causing elevated capsaicin test scores in patients with acne and sensitive skin [24]. In addition, overexpression of the TRPV-1 receptor induces mast cells to release endothelin, which further stimulates the secretion of TNF-α and IL-6, promotes vascular endothelial growth factor production, and increases vascular reactivity, resulting in vascular dilation. Dermoscopy findings also demonstrated a significant increase in blood vessel diameter in patients with acne and sensitive skin [25].

Therefore, it is crucial to address both acne and skin sensitivity in patients with acne and sensitive skin. The use of barrier extreme cream can help repair the skin barrier, while also providing anti-inflammatory and moisturizing effects. In addition, yellow and red light therapy can reduce inflammation and facilitate cellular repair. These interventions effectively alleviate and treat skin sensitivity in patients with acne and sensitive skin, leading to improved physiological skin function.

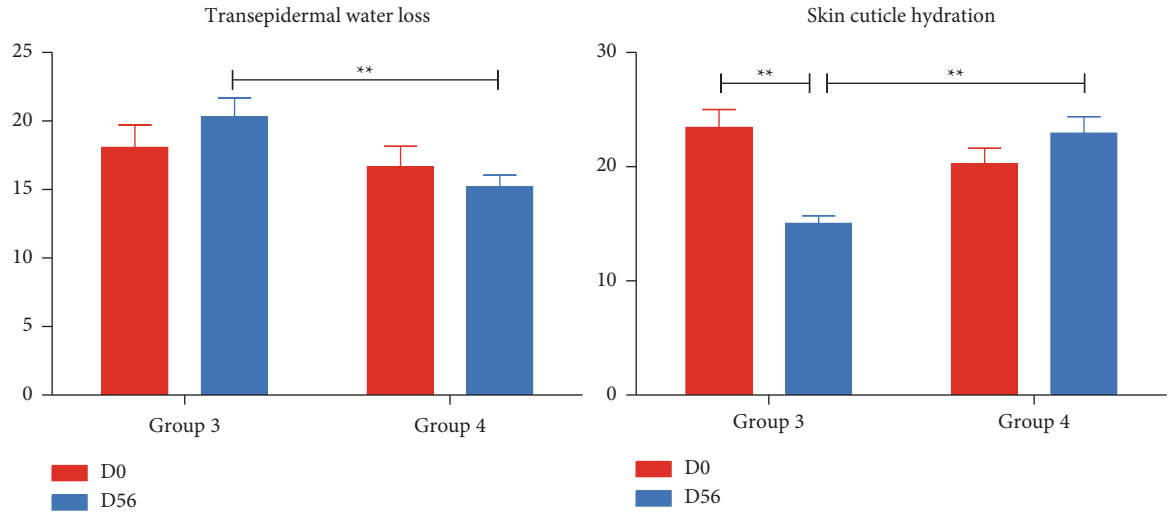


Figure 9: Changes of transepidermal water loss and skin cuticle hydration before and after treatment in single treatment (group 3) and combination treatment (group 4) groups.

(a) (b)

Figure 10: Typical clinical features of acne with sensitive skin subject after combined treatment at D0 (a) and D56 (b).

(a) (b)

Figure 11: Typical clinical features of acne with sensitive skin subject after single treatment at D0 (a) and D56 (b).

5. Conclusion

This study identified a substantial proportion of acne patients (over 58%) who also had sensitive skin. These patients exhibited notable physiological changes in their skin. Furthermore, the combination treatment approach for both acne and sensitive skin yielded excellent clinical outcomes and improved skin physiological function, surpassing the

results achieved through single treatment methods. Given the increased incidence of acne with sensitive skin and the accompanying alterations in skin physiology, dermatologists should be attentive to these factors. By selecting appropriate treatment measures tailored to individual acne patients, it is possible to prevent and manage sensitive skin while enhancing the overall effectiveness of acne treatment.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

Acknowledgments

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