

Observation on the Efficacy and Recurrence Rate of External Use of Shendan Gel Combined with Red, Blue and Yellow Light Irradiation in the Treatment of Mild to Moderate Acne

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Abstract: *Objective:* To observe the efficacy and recurrence rate of external application of Shendan gel combined with red, blue and yellow light irradiation in the external treatment of mild to moderate acne. *Methods:* 62 patients with mild to moderate acne in our hospital (from July 2023 to August 2024) were randomly divided into a control group (31 cases) treated with red, blue, and yellow light irradiation and an observation group (31 cases) treated with combined Shendan gel. *Results:* Compared with the control group, the observation group had lower clinical symptom scores, higher treatment effectiveness, and lower recurrence rate, $p < 0.05$; comparison of the incidence of adverse reactions between the two groups, $p > 0.05$. *Conclusion:* External treatment of Shendan gel combined with red, blue, and yellow light irradiation can reduce clinical symptoms, improve treatment efficiency, reduce disease recurrence rate, and have few adverse reactions in patients with mild to moderate acne, which is worth learning from.

Keywords: Shendan gel; Red, blue and yellow light irradiation; Mild to moderate acne; Efficacy; Recurrence rate

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1. Introduction

Mild to moderate acne is a dermatological disease with a very high incidence. It is most common in adolescence and early adulthood. Patients will develop symptoms such as acne, papules, and pustules after the onset. Although this disease will not affect life safety, it is prone to pigmentation, scarring and other problems, and has a greater impact on patients' facial aesthetics and mental health^[1]. In the treatment of this disease, topical retinoic acid, benzoyl peroxide, etc. are traditionally used. However, problems such as drug resistance and skin irritation are likely to occur during specific treatments. Due to the above shortcomings, more effective treatment methods need to be explored^[2]. In recent years, physical phototherapy and external treatment options with traditional Chinese medicine preparations have attracted widespread attention, especially in the process of combined treatment, which has a synergistic effect and also reduces side effects to a large extent, showing great advantages^[3]. Red, blue, and yellow light irradiation can use specific wavelengths of light to regulate skin immune response and inhibit the proliferation of *Propionibacterium acnes*. Traditional Chinese medicine gel can

play a multi-target anti-inflammatory role and regulate keratinocyte differentiation. Therefore, the effect of its combined treatment can be further explored. This study selected 62 patients with mild to moderate acne in our hospital to observe the external treatment effect of Shendan gel combined with red, blue and yellow light irradiation.

2. Materials and methods

2.1. General information

62 patients with mild to moderate acne in our hospital from July 2023 to August 2024 were selected and randomly divided into 2 groups. There were 31 patients in the control group, 14 males and 17 females, aged 16 to 33 (25.48 ± 2.71) years, with a disease duration of 0.3 to 3 (1.56 ± 0.44) years. There were 31 patients in the observation group, 13 males and 18 females, aged 17 to 32 (25.46 ± 2.56) years, with a disease duration of 0.4 to 3 (1.52 ± 0.48) years. Comparison of general data, $p > 0.05$.

2.1.1. Inclusion criteria

Patients all have mild to moderate acne; no other treatments have been used in the past month; clinical data are complete.

2.1.2. Exclusion criteria

Severe acne or special types of acne; skin infection or damage; contraindications to the treatment methods in this study.

2.2. Method

2.2.1. Control group

During red, blue and yellow light irradiation treatment, the wavelength of red light was 633 nm, the output intensity was 105 mw/cm^2 , and the standard dose was 126 J/cm^2 , which was beneficial to reducing the patient's inflammatory response and promoting skin repair. The selected wavelength of blue light was 415 nm, the output intensity was set to 40 mw/cm^2 , and the standard dose is 48 J/cm^2 , which has effectively killed *Propionibacterium acnes*. The yellow light wavelength was set to 590 nm, the output intensity was 30 mw/cm^2 , and the standard dose was 36 J. Before treatment, pay attention to thoroughly cleaning the patient's facial skin, and use sterile comedone needles to effectively remove blackheads, whiteheads, pus, etc., so that the light absorption effect of the lesions was improved. After the debridement operation has completed, the patient's acne area was disinfected with alcohol. During the treatment process, patients were provided with protective glasses to wear correctly, and were irradiated with red and blue light alternately. The distance between the light plate and the skin was 5 to 10 cm, and the treatment was performed twice a week, for 20 minutes each time, for a total of 8 times. If the patient's inflammation was very obvious during this process, the time and proportion of red-light exposure was appropriately increased to enhance the anti-inflammatory effect.

2.2.2. Observation group

Shendan gel was applied on the above basis, twice a day, for 28 days.

2.3. Observation indicators

- (1) Clinical symptoms
0 points (none) to 3 points (extremely severe);
- (2) Treatment effects
Divided into markedly effective (skin lesions reduced by 80% and above), effective (skin lesions reduced by 40% to 79%), and ineffective (the above standards are not met);
- (3) Recurrence rate;
- (4) Incidence of adverse reactions.

2.4. Statistical methods

SPSS26.0 software processes data, measurement data is expressed as: ($\bar{x} \pm s$), t test, count data is expressed as: n,%, χ^2 test, $p < 0.05$, the difference is statistically significant.

3. Results

3.1. Comparison of clinical symptoms

After treatment, the observation group was lower than the control group, $p < 0.05$, **Table 1**.

Table 1. Comparison of clinical symptoms (points)

Group	Pustule		Acne		Itching		Papules	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group (n = 31)	1.64 ± 0.47	0.58 ± 0.11	1.43 ± 0.63	0.72 ± 0.23	1.38 ± 0.33	0.58 ± 0.17	1.43 ± 0.48	0.69 ± 0.16
Observation group (n = 31)	1.70 ± 0.54	0.37 ± 0.14	1.46 ± 0.56	0.47 ± 0.10	1.42 ± 0.48	0.34 ± 0.09	1.41 ± 0.43	0.37 ± 0.12
t	0.467	6.567	0.198	5.550	0.382	6.947	0.173	8.908
p	0.642	0.000	0.844	0.000	0.704	0.000	0.863	0.000

3.2. Comparison of treatment effectiveness

The observation group was higher than the control group, $p < 0.05$, **Table 2**.

Table 2. Comparison of treatment effectiveness (n%)

Group	Effective	Valid	Invalid	Always valid
Control group (n = 31)	10 (32.36)	15 (48.39)	6 (19.35)	25 (80.65)
Observation group (n = 31)	14 (45.16)	16 (51.61)	1 (3.23)	30 (96.77)
χ^2	-	-	-	4.026
p	-	-	-	0.045

3.3. Comparison of recurrence rates

The observation group was lower than the control group, $p < 0.05$, **Table 3**.

Table 3. Comparison of recurrence rates

Group	Relapse(n)	Recurrence rate (%)
Control group (n = 31)	7	22.58
Observation group (n = 31)	1	3.23
χ^2		5.167
p		0.023

3.4. Comparison of incidence rates of adverse reactions

Comparison between the two groups, $p > 0.05$, Table 4.

Table 4. Comparison of incidence rates of adverse reactions (n%)

Group	Dry skin	Slight redness and swelling	Pigmentation	Adverse reactions occur
Control group (n = 31)	2 (6.45)	0 (0.00)	1 (3.23)	3 (9.68)
Observation group (n = 31)	1 (3.23)	1 (3.23)	0 (0.00)	2 (6.45)
χ^2	-	-	-	0.218
p	-	-	-	0.641

4. Discussion

The occurrence of mild to moderate acne is related to many factors. Abnormal keratinization of hair follicles can cause blockage of sebaceous gland ducts, thereby forming microcomedones. After colonization by *P. acnes*, it will release lipase and inflammatory factors, further causing papules and pustules^[4]. When the level of androgens in the human body increases, it will stimulate sebum secretion, which in turn will aggravate the problem of hair follicle blockage. Under the influence of environmental factors, the condition will become more serious, such as high-sugar diet, improper use of cosmetics, stress, etc. There have been a lot of clinical studies on the treatment of this disease. The specific treatments are mainly exfoliation, anti-inflammatory, antibacterial and regulating hormone levels^[5]. External use of retinoic acid can improve keratosis, but it is prone to dry and flaky skin. Benzoyl peroxide can exert a strong bactericidal effect, but it can easily cause staining of clothes. Antibiotics are also a commonly used drug, but the problem of resistance is becoming more and more obvious. Due to the limitations of the above treatment methods, physical therapy and traditional Chinese medicine treatment have attracted attention.

In the treatment of patients with mild to moderate acne, red, blue, and yellow light irradiation was a physical external treatment method that can use the biological effects of specific wavelengths of light to directly play a role in the key links of acne onset and achieve multi-target therapeutic effects. Blue light has a significant antibacterial effect. After it penetrates into the pilosebaceous gland unit, it can be specifically absorbed by the endogenous porphyrin produced by the metabolism of *Propionibacterium acnes*, thereby stimulating photochemical reactions and producing singlet oxygen and free radicals. The above active substances can directly damage bacterial cell membranes, inhibit DNA synthesis and energy metabolism, and ultimately cause bacterial death. Blue light has a high killing rate against *Propionibacterium acnes*, and does not damage the balance of normal skin flora. The antibacterial effect is rapid and direct, and has good applicability in the treatment of inflammatory papules and pustules. It is beneficial to significantly reduce the bacterial load in skin lesions, thereby reducing the release of inflammatory mediators. Red light has deeper penetration and can reach the dermis, inhibiting macrophage activity, reducing the secretion of pro-inflammatory factors, and also helping to upregulate the expression of anti-inflammatory factors. Red light also has a promoting effect on fibroblast proliferation and collagen synthesis, speeding up the repair of damaged skin barriers, further shortening the time for post-inflammatory erythema and pigmentation to subside. Moreover, the anti-inflammatory effect of red light is mild and long-lasting, and has good applicability in the repair stage after inflammation, which is beneficial to reducing discomfort such as skin stinging and burning. Yellow light mainly plays a soothing role, reducing neurogenic inflammatory reactions, effectively alleviating skin sensitivity, itching and other symptoms. It can help reduce skin irritation when red and blue light are alternately irradiated, and improve patients' treatment tolerance^[6]. Alternating red, blue, and yellow light irradiation can further cover the entire process of acne treatment including antibacterial, anti-inflammatory, and repair. Moreover, phototherapy can regulate the function of sebaceous glands, reduce oil secretion, improve abnormal keratinization of hair follicles, and prevent the

formation of microacne from the source. Traditional Chinese medicine also has unique insights into mild to moderate acne. It is believed that the disease belongs to lung-wind acne, and its pathogenesis is closely related to lung heat, blood heat, and phlegm and blood stasis. The occurrence of the disease is closely related to exogenous wind-heat, improper diet, or emotional disorders. For patients, the treatment of the disease is mainly to clear away heat and dampness, activate blood circulation and disperse stagnation. Shendan gel has attracted further attention and is also an effective external treatment method. It contains many medicinal ingredients, such as skullcap, cork, rhubarb, flavescens, salvia, and borneol. The main component of *Scutellaria baicalensis* has broad-spectrum antibacterial and anti-inflammatory effects. Its antibacterial effect is mainly exerted by destroying the bacterial cell membrane structure and inhibiting the activity of DNA gyrase. Moreover, baicalin is beneficial to reducing the release of pro-inflammatory factors and reducing the expression of COX-2, thereby alleviating the inflammatory response^[7]. *Phellodendron* contains a variety of alkaloids, which have obvious antibacterial and immunomodulatory effects. Its active ingredients can interfere with bacterial DNA synthesis, destroy the integrity of cell membranes, and significantly inhibit *Staphylococcus aureus*, *Propionibacterium acnes*, etc., and the antibacterial activity is concentration-dependent. *Phellodendron* also has an inhibitory effect on excessive proliferation of keratinocytes and effectively reduces the release of inflammatory mediators. Studies have shown that the traditional Chinese medicine compound containing Cortex *Phellodendron* can further reduce the bacterial load in skin lesions of patients with acne and reduce the recurrence rate of the disease. Due to the bitter and cold nature of the medicine, it can also clear away dampness and heat in the lungs and stomach, and has good applicability in patients with spleen and stomach dampness-heat acne. Rhubarb has antibacterial, anti-inflammatory and keratin regulating effects. The emodin in it can inhibit tyrosinase activity, effectively reduce melanin deposition, and promote the normal differentiation of keratinocytes, which is beneficial to further improving hair follicle hyperkeratosis. Rhubarb also has the effect of activating blood circulation and removing blood stasis, improving local blood circulation and accelerating the resolution of inflammation. Due to its laxative effect, rhubarb can also detoxify through the intestines and reduce the accumulation of dampness and heat in the skin to a certain extent. *Sophora flavescens* has anti-inflammatory, antibacterial and immunosuppressive effects. The active ingredients in it can inhibit the production of inflammatory factors and block the release of histamine, so that the patient's skin itching symptoms can be alleviated. This drug not only helps alleviate itching symptoms of skin lesions in patients with acne, but also does not have a significant impact on the skin barrier function. At the same time, its dehumidifying effect is conducive to the further absorption of excess oil and keeps the hair follicle openings unobstructed. *Salvia miltiorrhiza* has anti-inflammatory, antibacterial and antioxidant effects. The active ingredients in it can reduce the release of pro-inflammatory factors, reduce leukocyte infiltration, and have an inhibitory effect on 5 α -reductase activity, further reducing the conversion of androgens into dihydrotestosterone, and ultimately reducing sebum secretion. Borneol is a transdermal accelerator that can destroy the lipid bilayer structure of the stratum corneum, which is conducive to further increasing the retention of drugs in the skin^[8]. The drug has a cooling and anti-itching effect, and can also relieve patients' skin burning sensation caused by red, blue and yellow light exposure, and improve treatment tolerance. Moreover, the volatile components of the drug can also form a local protective film to reduce the adverse effects of external stimulation. In the process of combined treatment with red, blue, and yellow light irradiation and external application of Shendan gel, bacteria in different metabolic states can be covered. At the same time, the combined treatment can also prevent the recurrence of acne from the source. The traditional Chinese medicine compound is mild and non-irritating, and the red, blue and yellow light irradiation is a non-invasive treatment, avoiding risks such as ultraviolet damage, and is safe.

Therefore, external use of Shendan gel combined with red, blue, and yellow light irradiation for external treatment of patients with mild to moderate acne can reduce clinical symptoms, improve treatment efficiency, reduce disease recurrence rate, and has few adverse reactions, so it has promotion value.

Disclosure statement

The author declares no conflict of interest.

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