

Analysis of the Efficacy of Intense Pulsed Light Combined with Doxycycline in the Treatment of Rosacea

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Abstract: *Objective:* To investigate the clinical efficacy of intense pulsed light combined with doxycycline in the treatment of rosacea. *Methods:* A sample of 60 patients with rosacea admitted to our hospital from January 2021 to December 2023 were selected and grouped into the observation group (n = 30) and the control group (n = 30) by using the randomized numerical table sampling method. The patients in the control group were treated with doxycycline, and the patients in the observation group were treated with intense pulsed light combined with doxycycline. The clinical effective rate and recurrence rate, clinical symptom score, skin barrier function indexes, and the incidence of adverse reactions in the two groups were compared. *Results:* The clinical effective rate of the observation group was higher than that of the control group, and the recurrence rate was lower than that of the control group ($P < 0.05$); the clinical symptom score of the observation group was lower than that of the control group after treatment ($P < 0.05$); the water content of the stratum corneum of the observation group was higher than that of the control group after treatment, and the amount of transepidermal water loss was lower than that of the control group ($P < 0.05$); the incidence of adverse reactions of the two groups did not have any significant difference in comparison ($P > 0.05$). *Conclusion:* The treatment effect of intense pulsed light combined with doxycycline in rosacea patients is remarkable. It can alleviate clinical symptoms and improve the skin barrier function, with a lower recurrence rate after treatment and higher therapeutic safety, which is suitable for popularization and use in healthcare institutions.

Keywords: Intense pulsed light; Doxycycline; Rosacea

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1. Introduction

Rosacea is a common chronic inflammatory skin disease, the causes of which include damage to the skin barrier function, inflammatory response, genetics, etc. The lesions can affect the facial blood vessels, follicles, and sebaceous glands around the unit, and the affected site is mainly in the middle of the face, and it mainly manifests as skin erythema, papules, pustules, capillary dilatation, etc. The lesions worsen with the prolongation of the disease, which can seriously affect the aesthetic of the facial area^[1,2]. Clinical treatment

of rosacea includes drug therapy, physical therapy, etc. Doxycycline is a tetracycline antibacterial drug, which can kill follicular helminth mites and other pathogenic bacteria, thereby alleviating inflammatory reactions and infections, and reducing local symptoms^[3]. Intense pulsed light is a physical therapy that can damage dilated capillaries and repair the damaged skin barrier^[4]. In this study, a sample of 60 patients with rosacea was selected to investigate the clinical efficacy of intense pulsed light combined with doxycycline treatment.

2. General information and methods

2.1. General information

A sample of 60 patients with rosacea admitted to our hospital from January 2021 to December 2023 were selected and grouped into the observation group ($n = 30$) and the control group ($n = 30$) by using the randomized numerical table sampling method. There were 9 males and 21 females in the observation group, with an age range of 25–44 (34.58 ± 3.59) years and a disease duration of 5–16 (10.48 ± 2.06) months. In the control group, there were 10 males and 20 females, the age range was 27–41 (34.65 ± 3.52) years old and the disease duration was 3–17 (10.52 ± 2.09) months. The difference in the results of comparing the general information of patients in the two groups was not statistically significant ($P > 0.05$).

Inclusion criteria: (1) Meet the diagnostic criteria of papulopustular rosacea in the “Chinese Rosacea Diagnosis and Treatment Expert Consensus”; (2) No other skin diseases; (3) Sign the informed consent form. Exclusion criteria: (1) Keloid; (2) Recently received rosacea therapeutic intervention; (3) Combined with skin breakdown or facial infectious skin diseases.

2.2. Methods

Patients in the control group were treated with oral doxycycline, which was taken orally twice a day, with a single dose of 100 mg, for a total duration of 8 weeks.

Based on the control group’s treatment program, patients in the observation group also received intense pulsed light (IPL) therapy, selecting patients to complete one treatment at the end of the 2nd week of oral doxycycline, at the end of the 5th week, and at the end of the 8th week. The treatment was completed using our IPL therapy device, selecting the acne treatment mode, choosing an energy range of 12–18 J, and performing a spot test before the first treatment to select the appropriate energy parameters. Before treatment, the patient’s face was cleaned, no anesthesia was required, and both the physician and the patient wore goggles. An appropriate amount of gel was evenly applied to the treatment area, and the treatment was completed according to the site of the rosacea. If the treatment area produced light to medium red spots, it was considered to be the endpoint of the treatment, and if the patient did not reach the endpoint of the treatment, then the treatment was repeated. After the completion of the treatment, the patient’s face was cleaned in a timely manner, and a collagen mask was applied coldly for 30 minutes. The physician informed the patient that the face could not be washed until 24 hours after the treatment and that cosmetics were prohibited for 48 hours. The patient was advised to pay attention to sunscreen in his daily life and avoid using skin-care products containing allergenic antiseptics, fragrances, and alcohols, as well as cleansing devices, and exfoliating scrubs. A too-hot diet was also avoided, patients were to abstain from smoking and alcohol, and avoid going to the salon to treat the disease.

2.3. Evaluation criteria

- (1) The clinical efficiency of the two groups was evaluated after 8 weeks of treatment, if the symptoms of erythema, papule, and pustule disappear, and the skin lesions are completely repaired, then it is cured;

if the symptoms of erythema, papule, and pustule disappear, and the skin lesions improve, then it is effective; if it does not meet the criteria of cured and effective, it is ineffective; and the sum of the percentage of the patients who are cured and effective is the clinical efficiency. After the treatment, the two groups of patients were followed up for 3 months, and the recurrence rate was counted.

- (2) Before treatment and after 8 weeks of treatment, the erythema, papule, pustule, and capillary dilatation symptom scores of the two groups were evaluated with reference to the criteria of the Chinese Rosacea Expert Consensus, and the scores were 0–4, with higher scores indicating more severe symptoms.
- (3) The skin barrier function indexes of the two groups were evaluated before treatment and after 8 weeks of treatment. The water content of the stratum corneum was measured by using a skin moisture tester, and the amount of transdermal water loss was measured by using a Vapometer.
- (4) The incidence of adverse reactions in the two groups was recorded.

2.4. Statistical methods

SPSS23.0 software was used to analyze the research data, the measurement data [mean \pm standard deviation (SD)] used *t*-test, and the count data % used χ^2 test. $P < 0.05$ was considered to have statistically significant differences.

3. Results

3.1. Clinical effective rate and recurrence rate of the two groups

The clinical effective rate of the observation group was higher than that of the control group, and the recurrence rate was lower than that of the control group ($P < 0.05$), as shown in **Table 1**.

Table 1. Clinical effective rate and recurrence rate of the two groups [n (%)]

Groups	Cured	Effective	Ineffective	Total effectiveness	Recurrence rate
Observation group (n = 30)	21	8	1	29 (96.70)	2 (6.70)
Control group (n = 30)	15	7	8	22 (73.30)	8 (26.70)
χ^2	-	-	-	6.405	4.320
<i>P</i>	-	-	-	0.011	0.037

3.2. Clinical symptom scores of the two groups

The clinical symptom score of the observation group was lower than that of the control group after treatment ($P < 0.05$), as presented in **Table 2**.

Table 2. Clinical symptom scores of the two groups (mean \pm SD)

Groups	Erythema		Papules		Pustules		Capillary dilatation	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Observation group (n = 30)	3.08 \pm 0.45	0.82 \pm 0.14	3.12 \pm 0.48	0.77 \pm 0.12	3.05 \pm 0.64	0.83 \pm 0.15	2.96 \pm 0.51	0.79 \pm 0.12
Control group (n = 30)	3.11 \pm 0.43	1.79 \pm 0.36	3.09 \pm 0.53	1.25 \pm 0.41	3.09 \pm 0.57	1.67 \pm 0.44	2.88 \pm 0.54	1.49 \pm 0.38
<i>t</i>	0.264	13.755	0.230	6.154	0.256	9.897	0.590	9.621
<i>P</i>	0.793	0.000	0.819	0.000	0.799	0.000	0.558	0.000

3.3. Skin barrier function indexes of the two groups

The water content of the stratum corneum of the observation group was higher than that of the control group after treatment, and the amount of transepidermal water loss was lower than that of the control group ($P < 0.05$), as demonstrated in **Table 3**.

Table 3. Skin barrier function indexes of the two groups (mean \pm SD, g/h/cm²)

Groups	Water content of the stratum corneum		Transepidermal water loss	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Observation group (n = 30)	46.81 \pm 4.58	60.12 \pm 5.38	27.94 \pm 4.33	18.12 \pm 2.06
Control group (n = 30)	46.77 \pm 4.64	53.76 \pm 3.19	27.89 \pm 4.29	22.15 \pm 3.82
<i>t</i>	0.034	5.569	0.045	5.086
<i>P</i>	0.973	0.000	0.964	0.000

3.4. Incidence of adverse reactions in the two groups

No serious adverse reactions occurred during the treatment of the two groups of patients. In the observation group, one case had obvious pain during intense pulsed light treatment, and the symptoms disappeared without therapeutic intervention. Two cases in the control group experienced stomach pain during doxycycline administration, and the symptoms disappeared after stopping the drug, and there was no significant difference between the results of the two groups ($P > 0.05$).

4. Discussion

Rosacea is a common chronic inflammatory lesion of skin tissue and its pathogenesis is related to inflammatory response. The main clinical symptoms of patients are erythema, papules, pustules, capillary dilatation, etc., which can affect facial aesthetics, and therefore it is necessary to take an early and effective therapeutic intervention to control the progress of the disease [5,6].

The results of this study confirmed that the clinical effective rate of patients in the observation group was higher than that of the control group, and the recurrence rate was lower than that of the control group, suggesting that the treatment of rosacea patients with intense pulsed light combined with doxycycline was effective with low recurrence rate. Analyzing the specific reasons, the pathogenesis of rosacea correlates with infection and inflammatory response, so it requires anti-inflammatory and anti-infective drugs. Doxycycline is the preferred oral treatment drug for rosacea recommended in the relevant guidelines, which is classified as a tetracycline antibiotic, and its components can bind to the A region of the 30S subunit of the bacterial ribosome, inhibit the bacterial protein synthesis and peptide chain growth, and kill follicle mites, thereby alleviating the local infections and inflammatory reactions [7]. Pharmacological treatment alone has a slow onset of action and is ineffective in some severely ill patients. Intense pulsed light is a physical treatment in which the use of intense photon irradiation of the lesion area during treatment can induce a chemical reaction in the collagen fibers in the dermis, thus achieving the role of cosmetic spot removal [8]. At the same time, intense pulsed light therapy can gather energy in a smaller area, and then directly act on lesions such as erythema, papules, and pustules, gradually restoring the barrier function of the skin tissue [9]. Intense pulsed light combined with doxycycline in the treatment of rosacea can realize the synergistic effect between the two regimens, synchronously complete the intervention of anti-infection and local lesions, and can promote the reconstruction of the skin barrier, significantly reducing the recurrence rate, and its application value is significantly better than the single oral

doxycycline treatment ^[10].

The results of this study showed that the clinical symptom scores of the observation group were lower than those of the control group after treatment, suggesting that intense pulsed light combined with doxycycline treatment can reduce multiple symptoms. Infection and local inflammatory reactions are important factors in the pathogenesis of rosacea, while oral doxycycline can kill pathogenic microorganisms, long-term use of medication easily leads to drug resistance and the treatment efficacy in some patients with severe conditions is poor ^[11]. In intense pulsed light treatment process, photothermal effect and heat conduction can destroy the dilated capillaries and can act on the sebaceous glands, significantly decreasing the total amount of sebum secretion and reducing the symptoms of pustules. The thermal effect produced during the light can kill local pathogens, exert anti-inflammatory effects, and repair the skin barrier function, which can reduce the symptoms of pustules and erythema ^[12,13].

This study confirmed that the water content of the stratum corneum of the observation group was higher than that of the control group after treatment, and the amount of transepidermal water loss was lower than that of the control group, suggesting that intense pulsed light combined with doxycycline treatment can improve the skin barrier function. The skin barrier function of rosacea patients is impaired and external stimuli invade the dermis, leading to aggravation of the condition. Doxycycline is an antimicrobial drug that can kill pathogens, but has limited effect on the improvement of skin barrier function. Intense pulsed light therapy can produce selective photothermal effects, destroy dilated capillaries, and remodel collagen, regulate collagen fiber disorders, restore the elasticity of skin tissues, and repair the skin barrier function ^[14].

In this study, there was no significant difference in the incidence of adverse reactions between the two groups. Compared with other tetracycline antibiotics, doxycycline has a higher medication safety and a slight effect on liver and kidney function. During intense pulsed light treatment, physicians can adjust the energy parameters according to the patient's condition, and the energy is focused on the lesion site, which can avoid damaging healthy skin tissues and have high therapeutic safety ^[15].

5. Conclusion

In conclusion, it can be seen that the treatment effect of intense pulsed light combined with doxycycline in rosacea patients is remarkable, which can alleviate the clinical symptoms and improve the skin barrier function, with a lower recurrence rate after treatment and higher therapeutic safety, which is suitable for popularization and use in healthcare institutions.

Disclosure statement

The authors declare no conflict of interest.

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