

The efficacy of microwave therapy combined with focused ultrasound or white spot ointment combined with infrared light in the treatment of female vulvar sclerotic lichen

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Abstract

This study aims to investigate the effectiveness of microwave therapy combined with focused ultrasound or white spot ointment combined with infrared light for treating vulvar sclerosing lichen in females. A retrospective study was conducted on 126 patients with vulvar lichen sclerosus admitted to our hospital between August 2020 and December 2022. The patients were divided into 3 groups: microwave treatment, focused ultrasound, and white spot paste combined with infrared light, each group consisting of 42 cases. The microwave treatment group underwent microwave coagulation using a multifunctional microwave treatment machine, the focused ultrasound group received focused ultrasound treatment, and the white spot paste combined with infrared light group received traditional Chinese medicine white spot paste combined with infrared light irradiation. All groups received additional basic treatment. The study compared the serum levels of interleukin-2 (IL-2), tumor necrosis factor-alpha (TNF- α), C-reactive protein (CRP), human epidermal growth factor (EGF) levels, visual analog pain scale scores, and skin quality of life index (DLQI) scores before and after treatment in the 3 groups. Before treatment, there was no statistically significant difference in CRP and EGF levels among the 3 groups receiving IL-2 and TNF- α (all $P > .05$). After treatment, the levels of IL-2 and TNF- α did not show significant differences across the 3 groups. However, the levels of CRP and EGF were notably reduced, particularly in the group treated with white spot cream combined with infrared light, which exhibited lower levels compared to the other 2 groups with statistical significance (both $P < .05$). Similarly, prior to treatment, there were no statistically significant differences in symptomatology, daily activities, and interpersonal relationship scores among the 3 groups ($P < .05$). Post-treatment, scores for all dimensions significantly decreased in all groups, with the group receiving white spot cream combined with infrared light showing lower scores across all dimensions compared to the other 2 groups, with statistical significance ($P < .05$). The combination of vitiligo cream and infrared light has a significant effect on the treatment of sclerotic lichen of the external genitalia in gynecology. It can reduce the levels of inflammatory factors in the patient's body, improve itching, and improve quality of life.

Abbreviations: CRP = C-reactive protein, EGF = epidermal growth factor, IL-2 = interleukin-2, TNF- α = tumor necrosis factor-alpha, VAS = visual analog pain scale.

Keywords: focused ultrasound, infrared light, lichen sclerosus, microwave therapy, white spot cream.

1. Introduction

Sclerotic lichen of the external genitalia, also known as “white lesions of the external genitalia,” has an unclear etiology and is caused by multiple factors.^[1,2] It belongs to local benign lesions, and Western medicine often utilizes drugs and physical therapy. However, medication alone is not effective and can lead to many side effects, increasing the risk of recurrent attacks. Focused ultrasound, a recent innovation, utilizes ultrasound's thermal effect to penetrate the epidermis, destroy

dermal tissue at the lesion site, enhance local blood microcirculation and nerve endings sensitivity, effectively alleviating symptoms like vulvar spasms, itching, and pain in patients with sclerosing lichen of the external genitalia. It can also restore affected skin's elasticity, color, and texture to normal.^[3,4] Nonetheless, clinical observations show that adverse reactions such as local edema, congestion, and skin burns are common post-treatment, with patients often exhibiting low acceptance levels. Traditional Chinese medicine has shown promising results in treating vulvar sclerosing lichen.^[5–8] In

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The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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a study conducted from August 2020 to December 2022, 126 patients with vulvar sclerosing lichen were treated with white spot cream in combination with infrared light therapy, focused ultrasound therapy, and microwave therapy, and the therapeutic effects of the 3 groups were observed. The results are as follows.

2. Materials and methods

2.1. General information

This study was approved by The Ethics Committee of The Fourth Hospital of Shijiazhuang. Since this study was retrospective, the Ethics Committee exempted patients from informed consent. A total of 126 patients diagnosed with vulvar sclerosing lichen and aged between 21 and 64 years were selected from the gynecology department of our hospital. They were divided into 3 treatment groups based on their different treatment methods: microwave treatment, focused ultrasound, and white spot ointment combined with infrared light. Each group consisted of 42 cases. The microwave treatment group had an average age of 48.1 ± 9.2 years, a disease duration of 6.29 ± 2.17 years, and 19 menopausal cases. The focused ultrasound group had an average age of 49.71 ± 8.97 years, a disease duration of 6.38 ± 2.26 years, and 17 menopausal cases. The white spot cream combined with infrared light treatment group had an average age of 48.9 ± 9.2 years, a disease duration of 6.24 ± 2.19 years, and 24 menopausal cases. All 3 groups presented with sclerotic lichen lesions. The admission criteria included meeting the classification and diagnostic criteria of the International Society of Vulvar Diseases, displaying white lesions on the external genitalia upon pathological examination, ability to comprehend the research content and provide informed consent, and no history of relevant treatment in the past 2 weeks. Exclusion criteria encompassed patients with severe gynecological conditions, pregnant or lactating women, intolerance to focused ultrasound or laser therapy, allergies to treatment drugs, and individuals with blood diseases, immune dysfunction, or tumors. Statistical analysis revealed no significant differences in age, menstrual status, lesion type, or degree of lesion among the 3 groups of patients (all $P > .05$).

2.2. Treatment methods

The microwave treatment group underwent microwave coagulation treatment using a domestically produced ECO-100 multifunctional microwave treatment machine (Nanjing Yigao Microwave System Engineering Co., Ltd., Nanjing, China). The patient's skin lesion site was fixed, routine disinfection was performed, and a 2% lidocaine injection was administered for subcutaneous anesthesia of the rash. A power of 75 to 95 W was used for the mossy area with a set time of 5 seconds, while a power of 50 to 70 W was used for other areas with a set time of 3 seconds. Liquid paraffin was applied to the double needle radiation probe and the surface of the skin lesion to prevent adhesion to the solidified surface, which could cause epidermal tearing and bleeding. The double needle probe was then pressed parallel to the surface of the mossy rash for microwave treatment, repeated 1 to 3 times. Generally, the labia minora and anus were treated once. Treatment was stopped when the surface of the rash turned white, the mossy area shrunk and flattened due to heat, and the base and edges became hard and white. The foot switch was released, the double needle probe was removed, and the solidified surface of the lesion was retained. During the healing period, it was advised to keep the area dry and administer oral antibiotics such as cephalosporin and ciproheptadine for 2 weeks, along with topical Kangfuxin solution. A 4-week treatment course was followed by a 3-month follow-up. The focused ultrasound group was treated

using the German Hamsa focused ultrasound gynecological treatment device, which was performed outpatient. The patient was placed at the bladder lithotomy site, and the external genitalia was routinely disinfected with 2% lidocaine hydrochloride injection (manufacturer: Guilin Nanyao Co., Ltd., Guilin, China, national drug approval number H45020823, specification: 5 mL). After local infiltration anesthesia, the lesion site was continuously scanned. The treatment parameters are power of 3.5 to 4.5 W, frequency of 8 to 12 MHz, speed of 5 to 10 mrds, and radiation time of 10 to 30 min. Scanning should be stopped when the patient's lesion area shows redness, swelling, enlarged pores, and tissue congestion. After treatment, provide cold compress and apply moisturizing cream for care. Inform the patient not to take a bath within 24 hours and avoid intense exercise for 3 days. Loose fitting clothing should be the main focus. The treatment frequency is 2 times per week, with a 4-week course and a 3-month follow-up.

2.3. Observation indicators

The white spot ointment used in combination with infrared light therapy was prepared by a designated teacher from our department. The ingredients were sourced from the New Green Granule Pharmacy of the Affiliated Hospital of Tianjin Academy of Traditional Chinese Medicine. The ointment contains a mixture of various Chinese medicinal herbs. The production process involves grinding the herbs into a fine powder, mixing them with sesame oil and Lin, heating the mixture, and storing it appropriately. Infrared light therapy was administered using an electrocautery therapy device from Dalian Ke'er Medical Equipment Co., Ltd., Dalian, China, model WM-IIIIB. The therapy involved applying the ointment and then using the infrared light for a specified duration and power. The treatment course lasted for 4 weeks with a 3-month follow-up.

2.4. Observation indicators

- 1) 5 mL of fasting venous blood was extracted from patients, centrifuged and left to stand, and the serum levels of interleukin-2 (IL-2) and tumor necrosis factor were detected by ELISA in 3 groups of patients after treatment- α (tumor necrosis factor- α , TNF- α). Evaluate the inflammatory response of patients by measuring the levels of C-reaction protein (CRP) and epidermal growth factor (ECF).
- (2) The Visual Analog Scale/Score (VAS) was used to evaluate the pain level of patients before and after treatment. The scale was evaluated from 4 dimensions: white lesions, dry itching, sexual pain, and skin cracking, with scores ranging from 0 to 10 points for each dimension. The lower the score, the lower the degree of pain.
- (3) The Dermatology Life Quality Index (DLQI) is used to evaluate the quality of daily life of patients. The scale is evaluated from 3 dimensions: symptoms and feelings, daily activities, and interpersonal relationships, with scores ranging from 1 to 6 for each dimension. The higher the score, the worse the quality of daily life.

2.5. Statistical processing

SPSS 22.0 software was utilized for data analysis. Count data was expressed in percentage and inspected using rows χ^2 . Normally distributed econometric data were represented by $\bar{x} \pm s$. Repeated measures ANOVA was employed, and pairwise comparisons were subjected to t tests. A significance level of $P < .05$ was used to indicate statistically significant differences.

3. Results

3.1. Comparison of therapeutic effects among 3 groups of subjects

There was no significant difference in the degree of lesions among the 3 groups ($P > .05$). After treatment, the therapeutic effects of the 3 groups are shown in Table 1. In the microwave treatment group, 42.9% of the cases showed significant improvement in local symptoms. After 3 months of follow-up, 5 cases recurred, with a recurrence rate of 11.9%; The cure rate of the focused ultrasound group was 52.4%, with 11 cases showing significant improvement in local symptoms. After 3 months of follow-up, 9 cases experienced symptom recurrence, with a recurrence rate of 21.4%. The cure rate of the white spot cream combined with infrared light group was 83.3%, and 4 cases showed significant improvement in local symptoms. After 3 months of follow-up, there were 3 cases of symptom recurrence, with a recurrence rate of 7.1%. The 3 groups showed significant differences ($P < .05$; Table 2).

3.2. Three groups of serum L-2 and TNF before and after treatment-α, comparison of CRP and EGF levels

Before treatment, there was no statistically significant difference in CRP and epidermal growth factor (EGF) levels among IL-2 and TNF in the 3 groups (all $P > .05$). After treatment, the levels of IL-2 and TNF in the 3 groups did not show significant differences, while CRP and EGF levels significantly decreased. Furthermore, the focused ultrasound group and microwave treatment group exhibited observable changes in IL-2 and TNF levels. In contrast, the white spot cream combined with infrared light group showed higher levels of CRP and EGF, with statistically significant differences (all $P < .05$), as indicated in Table 3.

3.3. Comparison of VAS scores before and after treatment in 3 groups

Prior to treatment, there were no statistically significant differences in the scores of white lesions, dry itching, sexual pain, and skin cracking among the 3 groups (all $P > .05$). Following treatment, the scores for all dimensions in the 3 groups showed a significant decrease. Additionally, the scores for all dimensions in the focused ultrasound group and the dot matrix

CO₂ laser group were notably lower than those in the drug group, with statistical significance (all $P < .05$), as illustrated in Table 4.

3.4. Comparison of DLQI scores before and after treatment in 3 groups

Prior to treatment, there were no statistically significant differences in symptoms, daily activities, and interpersonal relationship scores among the 3 groups (all $P > .05$). Following treatment, there was a significant decrease in scores across all dimensions within the 3 groups. The microwave treatment group and the focused ultrasound group exhibited higher scores compared to the white spot cream combined with infrared light group, with statistical significance (all $P < .05$), as illustrated in Table 5.

4. Discussions

Mossy skin disease, similar to chronic eczema of the female external genitalia, is a rare condition characterized by itching and skin lesions like papules, lichen changes, inflammation, depigmentation, and atrophy. The causes include allergic constitution, sensitivity to various substances, dampness in the affected area, and long-term use of hormones. It may be related to defects in the skin's outer layer, making it more prone to stimuli and allergies. Current treatments, both oral and topical, have limited effectiveness, especially in cases of lichenization due to the challenge of clearing complex antigens.^[9,10] Microwave thermal therapy, with its ability to target tissues without causing extensive damage, is promising. Complete removal of mossy-like lesions is crucial to prevent recurrence and scarring. Focused ultrasound and infrared light treatments both use heat to kill diseased cells, but variations in heat density and range lead to different therapeutic outcomes.^[11] The results of this study suggest that following dot matrix CO₂ laser treatment, there was a significant decrease in serum levels of IL-2, TNF-α, CRP, and ECF in patients.^[12] This decrease was more pronounced compared to focused ultrasound and drug therapy. The authors speculate that the superior outcomes may be attributed to the more apparent minimally invasive effects, higher heat density, and narrower range of action of infrared light in comparison to focused ultrasound therapy.^[13–15] The efficiency and precision of infrared light are believed to minimize heat damage to normal

Table 1
Comparison of lesion severity among 3 groups of objects.

Group	Example count	Whitening, dryness, and cracking of the skin and mucous membranes of the external genitalia	Periurethral meatus Peridermal adhesions Membrane adhesion	Thin skin	
				Hair hardness and small pubic area Lips are different Degree atrophy	Vaginal opening narrow
Microwave treatment group	42	17	5	17	3
Focused ultrasound group	42	27	10	4	1
White spot cream combined with infrared light group	42	23	8	8	3

Table 2
Comparison of therapeutic effects among 3 groups of subjects.

Group	Cases	Cure	Improvement	Invalid	Recrudescence
Microwave treatment group	42	18	13	0	5
Focused ultrasound group	42	22	11	0	9
White spot cream combined with infrared light group	42	35	4	0	3

Table 3**Serum L-2 and TNF levels before and after treatment in 3 groups of patients- α , comparison of CRP and EGF levels ($\bar{x} \pm s$).**

Group	Example count	IL-2 (ng/mL)	TNF- α (ng/mL)	CRP (mg/L)	EGF (ng/mL)
Microwave treatment group	42				
Before treatment		39.27 \pm 5.89	184.12 \pm 30.71	5.27 \pm 1.13	3.59 \pm 1.03
After treatment		31.74 \pm 3.18*	160.12 \pm 24.16*	4.02 \pm 0.78*	2.84 \pm 0.67*
Focused ultrasound group	42				
Before treatment		38.98 \pm 5.8	188.24 \pm 29.8	5.39 \pm 1.20	3.63 \pm 0.98
After treatment		26.17 \pm 3.22*†	140.23 \pm 23.98*†	3.14 \pm 0.84*†	2.25 \pm 0.72*†
White spot cream combined with infrared light group	42				
Before treatment		39.17 \pm 5.9	186.79 \pm 30.4	5.35 \pm 1.17	3.64 \pm 1.05
After treatment		22.14 \pm 2.98*†	122.17 \pm 24.02*†	2.39 \pm 0.66*†	1.68 \pm 1.05*†

CRP = C-reactive protein, EGF = epidermal growth factor, IL-2 = interleukin-2, TNF- α = tumor necrosis factor- α .*Comparison between groups before treatment, $P < .05$.†Comparison between groups after treatment, $P < .05 < .05$.**Table 4****Comparison of VAS scores in various dimensions of white lesions, dry itching, sexual pain, and skin cracking among 3 groups of patients before and after treatment ($\bar{x} \pm s$).**

Group	Example count	White lesions	Dry itching	Sexual pain	Skin cracking
Microwave treatment group	42				
Before treatment		8.67 \pm 2.21	7.82 \pm 2.94	7.24 \pm 1.85	8.14 \pm 2.07
After treatment		6.12 \pm 1.23*	5.44 \pm 0.98*	5.14 \pm 1.12*	6.03 \pm 0.94*
Focused ultrasound group	42				
Before treatment		8.77 \pm 2.17	7.79 \pm 2.99	7.38 \pm 1.90	8.21 \pm 1.98
After treatment		4.95 \pm 1.17*†	4.23 \pm 1.01*†	4.32 \pm 1.09*†	5.14 \pm 0.97*†
White spot cream combined with infrared light group	42				
Before treatment		8.79 \pm 2.23	7.84 \pm 2.96	7.29 \pm 1.89	8.18 \pm 2.04
After treatment		3.88 \pm 1.20*†	3.11 \pm 0.99*†	3.27 \pm 1.05*†	4.20 \pm 0.89*†

VAS = visual analogue pain rating scale.

*Comparison between groups before treatment, $P < .05$.†Comparison between groups after treatment, $P < .05 < .05$.**Table 5****Comparison of DLQI scores for symptoms and feelings, daily activities, and interpersonal relationships among 3 groups of patients before and after treatment ($\bar{x} \pm s$).**

Group	Example count	Symptoms and feelings	Daily activities	Interpersonal relationship
Microwave treatment group	42			
Before treatment		5.71 \pm 1.22	5.27 \pm 1.14	4.79 \pm 1.42
After treatment		4.03 \pm 0.78*	4.13 \pm 0.75*	3.12 \pm 0.66*
Focused ultrasound group	42			
Before treatment		5.69 \pm 1.19	5.32 \pm 1.09	4.84 \pm 1.39
After treatment		2.55 \pm 0.77*†	3.01 \pm 0.69*†	2.41 \pm 0.71*†
White spot cream combined with infrared light group	42			
Before treatment		5.77 \pm 1.20	5.29 \pm 1.13	4.82 \pm 1.40
After treatment		1.20 \pm 0.75*†	2.13 \pm 0.72*†	1.54 \pm 0.63*†

DLQI = quality of life index for skin diseases.

*Comparison between groups before treatment, $P < .05$.†Comparison between groups after treatment, $P < .05 < .05$.

tissues, lower the risk of inflammation, and alleviate skin cracking pain.^[16,17]

Some scholars argue that repeated local stimulation is a significant contributing factor to this disease. Studies have shown that women with inflammatory conditions in the genital area, such as vaginitis and urethritis, are at a significantly higher risk of developing this disease compared to the general population. It is hypothesized that repeated local stimulation and inflammation can result in the skin becoming rough and thickened. When exposed to inflammatory exudates and secretions, the tissue may undergo a hydration reaction, leading to the loss of pigment in the external genitalia.

Infrared light has been shown in research to significantly reduce patient pain and enhance their quality of life, suggesting

its efficacy as a precise surgical technique.^[18–22] Prior to surgery, it is essential for the operator to clearly define the extent of the lesion, allowing for personalized adjustment of various parameters based on the patient's specific condition during treatment,^[23,24] thereby enhancing the patient's pain tolerance. Post-treatment, the application of cold compresses reduces skin sensitivity, while moist ointment aids in the quick alleviation of redness and swelling, proving to be effective in pain reduction. White lesions of the external genitalia, being a relatively private gynecological condition, can evoke negative emotions such as anxiety, fear, and shame in patients, impacting their daily life. By comparing the DLQI scores of 3 patient groups before and after treatment, it is evident that the combination of white spot cream and infrared light accelerates symptom improvement, reduces

negative emotional responses to the disease, facilitates quicker return to daily life, and enhances interpersonal relationships. The treatment duration and recovery time with the combination of vitiligo cream and infrared light are superior to those of focused ultrasound and microwave therapy. Focused ultrasound's thermal effect results in a sudden rise in skin temperature and acute reactions post-treatment, necessitating nursing care.^[25,26] Studies have demonstrated that ultrasound treatment can lead to pigment deposition in basal layer cells, increased capillaries, and thickening of the external genitalia.

While the results of this study are promising, several limitations must be considered. The retrospective nature of the study introduces potential biases, including selection bias, as patients may have been selected based on specific characteristics that are not representative of the broader population. The lack of randomization in patient assignment also raises concerns about the generalizability of the findings. Furthermore, variability in treatment approaches across patients, particularly with the manual aspects of infrared light therapy and the preparation of white spot cream, may have influenced the outcomes. The operator's technique and the specific adjustments made during treatment could vary, potentially affecting treatment consistency and results. It is essential to note that these factors may contribute to the observed differences in therapeutic outcomes. Future studies, particularly those with randomized controlled designs, could help mitigate these biases and further validate the effectiveness of the combined treatment approach.

While the results of this study indicate that the combination of vitiligo cream and infrared light therapy holds significant promise for the treatment of white lesions of the external genitalia, further research is needed. The combined treatment demonstrates high clinical application potential, but more rigorous, randomized studies are necessary to confirm these findings and refine treatment protocols.

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