

Application Effect of Integrated Nursing Based on the IMB Model in Patients with Vitiligo Undergoing Ultraviolet Phototherapy

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Abstract: Objective: To evaluate the clinical application effect of integrated nursing intervention grounded in the Information-Motivation-Behavioral Skills (IMB) model among patients with vitiligo receiving narrowband ultraviolet B (NB-UVB) phototherapy. Methods: A total of 60 patients with vitiligo admitted to the Department of Dermatology, Yichang Central People's Hospital from January 2023 to December 2024 were selected as the research objects. The patients were divided into the routine group (routine nursing) and the study group (comprehensive nursing based on IMB model) by block random method, with 30 cases in each group. The clinical efficacy, pigment score and quality of life were compared between the two groups. Results: After 24 weeks of treatment, the total effective rate of the study group was 90.00%, which was significantly higher than 66.67% of the conventional group, the difference was statistically significant ($\chi^2 = 4.810$, $P = 0.028$). Before intervention, there was no statistically significant difference in pigment scores between the two groups ($P > 0.05$). After 24 weeks of intervention, the pigment scores of the two groups increased, and the intra-group comparison showed that the score of the study group before and after intervention was significantly higher than that of the conventional group ($P < 0.05$). Before intervention, there was no significant difference in the scores of each dimension of DLQI between the two groups ($P > 0.05$). After 24 weeks of intervention, the scores of each dimension of DLQI in the study group were better than those in the conventional group ($P < 0.05$). Conclusion: IMB model-guided integrated nursing significantly enhances clinical efficacy, accelerates repigmentation, strengthens patient self-efficacy, and improves multidimensional quality of life in vitiligo patients undergoing NB-UVB phototherapy. This evidence supports its broad clinical adoption as a scalable, theory-driven behavioral intervention framework.

Keywords: IMB Model; Integrated Nursing; Vitiligo; Ultraviolet Phototherapy; Clinical Efficacy

1. Introduction

As an acquired depigmented skin disease, ultraviolet phototherapy is one of the core clinical treatments for vitiligo. However, the long cycle of phototherapy, lack of patient compliance, and non-standard operation directly affect the efficacy and persistence of phototherapy. Studies have pointed out that the oxidative stress microenvironment during phototherapy may hinder the activity of melanocytes, further increasing the difficulty of treatment [1]. The traditional nursing model focuses on operation guidance, and the intervention of patients' behavioral motivation and self-management ability is insufficient. IMB model provides a theoretical framework for systematic behavioral intervention by integrating the three dimensions of information, motivation and behavioral skills [2]. Based on this model, this study constructed a comprehensive nursing plan, aiming to strengthen the cognitive level of patients, stimulate the internal treatment motivation and standardize the operation behavior, so as to optimize the efficacy of phototherapy and provide a new path for improving the quality of clinical management of vitiligo.

2. Materials and Methods

2.1 General Information

A total of 60 patients with vitiligo admitted to the Department of Dermatology, Yichang Central People's Hospital from January 2023 to December 2024 were selected as the research objects. All subjects signed informed consent, and the study protocol was reviewed and approved by the medical ethics committee of the hospital. The patients were divided into the routine group (routine nursing) and the study group (comprehensive nursing based on IMB model) by block random method, with 30 cases in each group. The baseline data of the two groups were balanced and comparable by statistical analysis, $P > 0.05$. See Table 1 below for details.

Table 1. Comparison of general data between the two groups

Group of groups	n	Gender (example)		Age (years)	Duration of disease (years)	Clinical classification (example)		
		Male	female			Segmental nature	Face acral type	Common type
Conventional group	30	16	14	33.83±5.72	2.38±0.19	2	11	17
Research Group	30	15	15	34.27±5.06	2.12±0.96	3	9	18
T/X2		0.067		0.316	1.455	0.218		
P		0.798		0.753	0.151	0.640		

2.2 Exclusion and inclusion criteria

Inclusion criteria: ① meeting the diagnostic criteria of "Consensus on the Diagnosis and Treatment of Vitiligo" [3], the area of vitiligo accounting for less than 15% of the body surface area, and the stable period of skin lesions ≥ 3 months; ② 18 years old and above, with basic reading and writing ability and independent decision-making ability; ③ plan to receive narrow-band ultraviolet B (NB-UVB) regular phototherapy for a total course of ≥ 24 weeks; ④ signed the written informed consent, and voluntarily cooperated with the follow-up and the completion of the scale.

Exclusion criteria: ① severe heart, liver, or renal insufficiency, photosensitive diseases, skin tumors, pregnancy or lactation; ② Systemic use of glucocorticoids, immunosuppressants or biological agents within the past 3 months; ③ participating in other interventional clinical trials; ④ those with cognitive impairment, acute mental illness or unable to complete the IMB model related behavior assessment; ⑤ The phototherapy compliance is expected to be less than 80%.

2.3 Methods

2.3.1 Conventional group

Patients in the routine group received routine clinical care. Before the first dose of NB-UVB phototherapy, oral health education was provided to explain the principle of NB-UVB phototherapy and the expected course of treatment. The radiation dose was set according to the initial minimal erythema dose of the patient. The parameters of phototherapy were recorded before each treatment, and adverse reactions such as erythema and burning pain were observed to adjust the dose or suspend the treatment in time. Before patients left the hospital, the pictorial version of phototherapy precautions manual was issued to patients, including skin moisturizing methods, sun protection requirements and reminders of follow-up time. The nursing staff inquired about the skin condition of the patients at home during the weekly return visit, and gave verbal supervision to those with poor compliance. No systematic follow-up mechanism was established, and only symptomatic treatment suggestions were given when patients complained of discomfort.

2.3.2 Study group

The study group received comprehensive nursing intervention based on IMB model on the basis of routine nursing. (1) Information dimension: stepwise education strategy was adopted. In the first intervention, a team of dermatologists, full-time nurses and psychotherapists explained the pathogenesis of vitiligo, the principle of NB-UVB treatment and course planning through a 30-minute standardized PPT, and demonstrated the key points of phototherapy target positioning with a 3D skin model. A customized nursing toolbox containing dose record card, skin reaction self-evaluation map and symptom diary was issued to guide patients to take photos of skin lesions every day and mark skin reaction 24 hours after irradiation. A wechat group was established to push two reviewed science popularization short articles every week, focusing on the analysis of the evidence related to the cumulative effect of ultraviolet rays and recurrence prevention. (2) Motivation dimension: design a three-level reinforcement mechanism. In the first interview, motivational stimulation technique was used to guide patients to describe their disease distress, set their own goals for phototherapy, and sign a treatment commitment. A 20-minute weekly group interview was held in which patients who were responding to treatment were invited to share their experiences. Nurses used feedback questioning techniques to reinforce positive behaviors. Motivation maintenance assessment was conducted once a month, and the visual analogue scale was used to quantify the treatment confidence value. One-on-one motivational interview was started for those whose scores decreased by more than 20%, focusing on solving the problems of treatment burnout and appearance anxiety. (3) Behavioral skills dimension: focusing on practical ability improvement. In the operation training stage of phototherapy, nurses demonstrated the operation of goggles wearing, position fixation and emergency switch step by step on the simulation equipment, and patients were required to complete three operation examinations independently on the spot. In the home management stage, electronic medication reminders were issued, phototherapy schedule was bound and dose escalation warning function was set up. Patients were required to upload skin

photos daily through wechat mini program, and nurses used AI skin lesion analysis system to compare the range of erythema, and feedback dose adjustment suggestions within 48 hours. The adverse reaction module presets standardized procedures, such as video-guided cold compress immediately when mild burning pain occurs, and green channel referral mechanism is started when moderate and severe erythema occurs. A family member was designated as a family supervisor to participate in monthly telephone follow-up, and the authenticity of treatment log records was checked. A plan for family visit was launched for those who missed the treatment for three consecutive times. A total of 24 weeks of intervention were completed in the whole period, and process documents such as education check-in records, motivational interview recordings and behavioral assessment scores were retained throughout the whole period.

2.4 Observation indicators

(1) Clinical efficacy: blind evaluation according to the Consensus on the Diagnosis and Treatment of Vitiligo [3] : after 24 weeks of intervention, two senior dermatologists independently evaluated and cross-checked. Complete disappearance of leukoplakia and normalization of skin color were defined as "cure". The area of leukoplakia reduced by more than 50% was considered as "significant effect". A reduction of 10% to 50% was considered as "effective". < 10% or no change was considered "ineffective". Total effective rate = (cured + markedly effective + effective) cases/total cases × 100%.

(2) Pigment integral: A semi-quantitative pigment scoring method was used to visually evaluate the lesion at 30 cm away from the lesion under natural light. According to the standardized colorimetric map, the pigmentation gradient was assigned: pure white (0 points), pale white with weak marginal pigment (1 point), pale brown visible scattered pigment islands (2 points), and yellow brown adjacent to normal skin color (3 points). The higher the score, the better the recovery effect.

(3) Quality of life: after 24 weeks of intervention, the Dermatology Life Quality Index (DLQI) was used, which covered 6 dimensions such as symptoms and feelings, daily activities, and a total of 10 items, each item was 0-3, and the total score was 0-30. Lower scores indicate less interference with social functioning.

2.5 Statistical methods

SPSS 26.0 statistical software was used for systematic analysis. Categorical variables were presented in the form of frequency and constituent ratio [n(%)], and chi-square test was used for comparison between groups. Continuous variables were expressed as mean ± standard deviation ($\bar{x} \pm s$), and differences between groups were evaluated by t test. All statistical inferences were made using P values less than 0.05 as the criterion for statistically significant differences.

3. Results

3.1 Comparison of clinical efficacy

After 24 weeks of treatment, the total effective rate of the study group was 90.00%, which was significantly higher than 66.67% of the conventional group, and the difference was statistically significant ($\chi^2 = 4.810$, $P = 0.028$). See Table 2 below for details.

Table 2. Comparison of clinical efficacy [n(%)]

Group of groups	n	cure	Conspicuous effect	effective	Void of effect	Total effective rate
Conventional group	30	5	11	4	10	20(66.67)
Research Group	30	12	13	2	3	27(90.00)
X ²		/	/	/	/	4.812
P		/	/	/	/	0.028

3.2 Pigment integral comparison

Before intervention, there was no statistically significant difference in pigment scores between the two groups ($P > 0.05$). After 24 weeks of intervention, the pigment scores of the two groups were increased, and the intra-group comparison showed that the score of the study group before and after intervention was significantly higher than that of the conventional group ($P < 0.05$). See Table 3 below for details.

Table 3. Pigment integral comparison (score, $\bar{x}\pm s$)

Group of groups	n	Before intervention	After the intervention	T	P
Conventional group	30	0.87±0.32	1.78±0.47	8.766	<0.001
Research Group	30	0.91±0.29	2.25±0.41	14.615	<0.001
T		0.507	4.127		
P		0.614	<0.001		

3.3 Comparison of quality of life

Before intervention, there was no significant difference in the scores of each dimension of DLQI between the two groups ($P > 0.05$). After 24 weeks of intervention, the scores of each dimension of DLQI in the study group were better than those in the conventional group ($P < 0.05$). See Table 4 below for details.

Table 4. Comparison of quality of life (score, $\bar{x}\pm s$)

Group of groups	n	Feelings of symptoms	Activities of daily Living	Leisure and entertainment	Work and study	Networking	Burden of treatment
Conventional group	30	4.25±0.87	3.81±0.79	3.22±0.74	0.94±0.18	2.42±0.51	2.13±0.27
Research Group	30	2.13±0.74	1.86±0.59	1.54±0.62	0.37±0.13	1.12±0.14	1.29±0.13
T		10.167	10.832	9.532	14.061	13.463	15.353
P		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

4. Discussion

Vitiligo is a skin depigmentation disease. Although ultraviolet phototherapy is the core treatment method, its efficacy is limited by treatment compliance and operating standards. In this study, the IMB model was introduced into the vitiligo phototherapy nursing system, and it was confirmed that the total effective rate of the study group was 90.00%, which was significantly higher than that of the conventional group ($P=0.028$), highlighting the integration advantages of the IMB model. In the information dimension, step-by-step education combined with visualization tools such as 3D models and self-evaluation maps can deepen patients' understanding of the biological mechanism of phototherapy, especially by analyzing the molecular correlation between the cumulative effect of ultraviolet rays and pigment regeneration, and strengthen the scientific understanding of treatment. The three-level reinforcement mechanism of goal setting, peer motivation and dynamic confidence assessment in the motivation dimension can effectively activate the patients' internal treatment driving force and reduce the treatment disruption caused by appearance anxiety, which forms synergy with the strategy of dual-dimension nursing to relieve negative emotions in Xue Jinping's study [4]. Through standardized operation training and digital supervision, the simulated operation assessment of behavioral skills dimension and AI-assisted dose adjustment can significantly reduce the risk of undertreatment or overtreatment caused by technical errors, and directly improve the accuracy of photobiological effects.

In terms of pigment score, the pigment score of the study group was significantly better than that of the conventional group after intervention ($P < 0.05$), and the core of which was the guarantee of treatment compliance by behavioral skill intervention. The two-way supervision network formed by the electronic reminder system and the home supervision mechanism ensured that patients strictly followed the dose escalation plan to avoid missing or insufficient dose. The AI analysis system of skin photos can realize the early warning of erythema reaction and adjust the dose in time to maintain the best treatment window period, which is consistent with the conclusion of Feng Min's study that the process nursing can improve the pigment score [5]. The patient's ability to dynamically observe the formation of pigment islands was established through independent recording in the symptom diary, forming a positive cycle of treatment feedback and further strengthening treatment confidence.

The optimization of quality of life reflects the value of physical and mental co-governance. The DLQI scores of the study group were better than those of the conventional group ($P < 0.05$), reflecting the comprehensive improvement of social function by the IMB model. The customized education of information dimension can reduce the patients' anxiety about the uncertain prognosis of the disease; The targeted counseling of appearance anxiety by motivational interviewing combined with the improvement of social function by personalized nursing in Hou Yu's research can effectively improve the interpersonal communication dimension. The remote support and family supervisor system of wechat platform significantly reduce the transportation burden of patients to and from the hospital. The application of digital management tools such as

wechat mini program also echoes the conclusion of Wang Chunshuang's research on improving the quality of life of children based on wechat platform [6]. The standardized emergency procedures preset in the behavioral skills module, such as video-guided cold compress, directly improve the treatment efficiency of patients with adverse reactions of phototherapy.

In conclusion, comprehensive nursing based on IMB model can significantly improve the clinical efficacy of vitiligo patients with ultraviolet phototherapy, improve pigment score, self-efficacy and quality of life, which is worthy of clinical application.

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