

Review Article

Optimizing vitiligo treatment: examining the role of narrow-band ultraviolet B phototherapy

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ABSTRACT

Vitiligo is a common autoimmune-pigment disorder associated with skin depigmentation. Narrow-band ultraviolet B phototherapy (NB-UVB) has become an effective treatment option for this disease, resulting in significant pigmentation in patients, especially those with facial lesions and dark skin tones. However, the best treatment plan is still under discussion, and more research is needed to assess long-term safety, including the risk of skin cancer. In addition, alternative options such as current immunomodulators and herbal therapies are promising but need further studies. This study reviewed the existing literature on NB-UVB phototherapy's efficacy and safety profile for treating vitiligo. The study focused on factors affecting the treatment response and the potential benefits of combining NB-UVB with other treatments. NB-UVB phototherapy is safe and effectively reduces depigmentation in vitiligo patients. Factors such as disease duration, skin type, and scope of vitiligo lesions may influence treatment results. Using NB-UVB with other treatments can increase results. Although UVB NB phototherapy is a safe and effective option for vitiligo treatment, more research is needed to optimize its use and improve treatment outcomes, especially in different patient groups.

Keywords: Vitiligo, Autoimmune-pigment disorder, Narrow-band ultraviolet B phototherapy, Depigmentation, Treatment efficacy and safety

INTRODUCTION

Vitiligo is a common autoimmune pigment disease associated with skin depigmentation.¹ It appears as a white patch on the skin due to the destruction of melanocytes producing melanin, which leads to an unpredictable and visible presentation.² It can be localized or generalized, with 80 percent of cases being generalized.² The visible nature of the condition can lead to significant stigmatization, resulting in severe deformities and adverse effects on the patient's quality of life.³ Vitiligo can affect

several aspects of patients' lives and significantly impact their psychological well-being.² The disease life quality index (DLQI) measures patients' quality of life with vitiligo. It shows that all quality of life is affected when more than 10% of the body's surface is affected.² Dark skin type, chest vitiligo, and previous treatments have a negative impact on psychosocial quality of life.⁴ The prevalence of Vitiligo worldwide is 0.1% to 2.28% and 0.5% to 2% worldwide, according to various population-based studies and clinical populations studies.⁵ The children/adolescent population ranges from 0.0 percent to 2.1 percent.⁵

The prevalence of vitiligo worldwide ranges from 0.1% to 2.28%, with a worldwide range of 0.5% to 2%, according to various population-based and clinical population studies.⁵ In children/adolescents populations, it ranges from 0.0% to 2.16%.⁵ The prevalence of vitiligo is relatively high in Africa and female patients.⁶ In the United States, the prevalence of vitiligo ranges from 0.76% to 1.11% in adults, with approximately 40% of adults with vitiligo remaining undiagnosed.⁷ In Korea, the incidence and prevalence of vitiligo are increasing, especially among younger patients, with many comorbidities such as alopecia areata, psoriasis, rheumatoid arthritis, systemic lupus erythematosus, Crohn's disease, diabetes mellitus showing higher odds ratios in patients with vitiligo than controls.⁸

Narrowband ultraviolet B (NB-UVB) phototherapy is a treatment option for vitiligo that has shown satisfactory repigmentation in Malaysian and global patients. It involves exposing patients to a specific wavelength of UVB light, which stimulates melanocytes in the skin, leading to the repigmentation of depigmented areas. This treatment effectively achieves >75% repigmentation in patients with vitiligo, particularly those with facial lesions and darker skin tones and who respond early in treatment. Even in children, treatment with NB-UVB is well-tolerated and safe, although long-term risks like photocarcinogenesis and photoaging should be considered.⁹⁻¹²

Vitiligo is a psychosocial problem that significantly affects the quality of life, especially in younger patients.¹³ The treatment of vitiligo is still one of the most difficult dermatological challenges, although there are many therapeutic options.¹⁴ NB-UVB phototherapy is considered an accepted therapy for vitiligo.¹⁰ Researching and improving the effectiveness of narrowband UVB phototherapy for vitiligo treatment is essential to improve patient's quality of life and decrease the disease's psychosocial burden. Additionally, vitiligo is a prevalent condition in India, affecting 2-5% of the population and often appearing in early life.¹³ Thus, improving the treatment options for vitiligo can have significant public health benefits in countries like India.

METHODS

This narrative review aimed to comprehensively examine the effectiveness of narrowband UVB phototherapy for treating vitiligo by synthesizing and summarizing existing evidence from relevant literature. Unlike a systematic review, a narrative review provides a qualitative literature analysis without applying a formalized search strategy or specific inclusion/exclusion criteria for studies.

Literature search

A comprehensive literature search was performed in reputable medical databases, including PubMed, MEDLINE, Embase, and Cochrane Library. The search

encompassed articles published from the databases' inception until the review date. The following keywords and phrases were used in various combinations: "vitiligo," "narrowband uvb," "phototherapy," "skin repigmentation," "NB-UVB efficacy," and "treatment outcomes in vitiligo".

Inclusion and exclusion criteria

Given the narrative nature of this review, studies were selected based on relevance to the topic and contribution to understanding the effectiveness of narrowband UVB phototherapy in vitiligo treatment. Both prospective and retrospective studies, randomized controlled trials, case series, and case reports were included. Studies that focused on narrowband UVB phototherapy as a primary or adjunctive treatment for vitiligo were considered for inclusion.

Data extraction and synthesis

Information pertinent to the review's objective, such as study design, sample size, treatment protocols, repigmentation outcomes, follow-up duration, and adverse events, were extracted from the selected studies. The data were then synthesized to provide an overview of the findings and identify trends or patterns in the effectiveness of narrowband UVB phototherapy for vitiligo treatment.

Quality assessment

Given the diverse nature of the included studies, a formal quality assessment still needed to be performed. However, the narrative review aimed to present a balanced discussion of the strengths and limitations of the evidence, acknowledging potential biases and study limitations when interpreting the findings.

Ethical considerations

Ethical approval was not required as this review used data from previously published studies.

Limitations

It is essential to recognize that narrative reviews are subjective and do not provide the same rigor as systematic reviews. The lack of a formal search strategy can lead to selection biases, although efforts have been made to include various studies. In addition, the results of the review may be influenced by the author's interpretation of the literature.

EFFICACY OF NARROWBAND UVB PHOTOTHERAPY

UVB-narrowband phototherapy is an effective treatment option for vitiligo patients, as shown by several studies, showing successful repigmentation with few side effects. Even so, there are still crossed opinions about the optimal treatment regimen and its long-term efficacy, which makes

us wonder, what are the key factors that contribute to the effectiveness of narrowband UVB phototherapy in treating vitiligo?

Patients who show lesions on the face and through an early response to treatment have a higher chance of achieving complete repigmentation after NB-UVB phototherapy have a higher chance of achieving satisfactory repigmentation patients with phototypes III to V have a higher chance of achieving greater than 75% repigmentation on the face.¹⁰ As one might think, early diagnosis and the absence of a family history of vitiligo showed a better response to NB-UVB treatment.¹⁵ The frequency of twice-weekly treatment for at least one year with an average total dose of 201.28 J/cm² has effectively induced repigmentation.¹⁵

Narrowband ultraviolet B (NB-UVB) phototherapy is considered the most effective and safe initial treatment for moderate-to-severe vitiligo.¹⁶ However, phototoxicity and possible carcinogenicity are the reported side effects of NB-UVB phototherapy.¹⁶ The incidence of adverse effects was also noted during a study comparing systemic PUVA vs. narrowband UVB in the treatment of vitiligo, where lesser adverse effects were observed within the NB-UVB group compared to oral psoralen UVA (PUVA) group (7.4% versus 57.2%).¹⁷ Therefore, although NB-UVB phototherapy is effective, it has potential side effects, and targeted NB-UVB phototherapy and UVA phototherapy can be alternative treatments, especially for localized vitiligo.¹⁸ It is crucial to weigh each treatment option's effectiveness and potential side effects before choosing the most suitable one for individual patients.

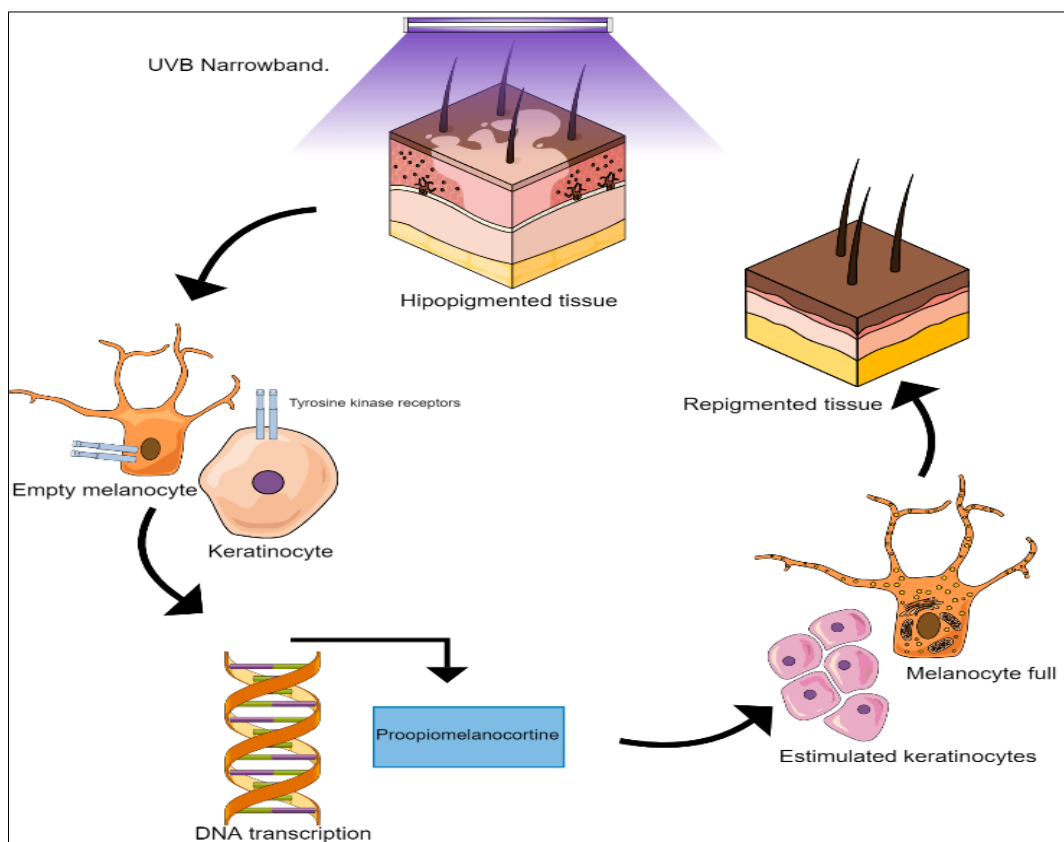


Figure 1: Concomitant use of topical steroids may improve response to NB-UVB phototherapy.⁹

The optimal treatment regimen for narrowband UVB phototherapy in vitiligo patients is currently debated. While narrowband UVB is considered an accepted therapy for vitiligo, there is no standardized protocol for treatment and follow-up data.¹⁵ Treatment frequency varies between studies, and different studies have reported varying degrees of repigmentation success.^{10,17} Some factors identified as predictive of response to phototherapy include lesions on the face, darker phototypes, and early response to treatment.¹⁰ In addition, longer-term follow-up data is needed to assess the stability of repigmentation after treatment cessation.¹⁰ Ultimately, future studies comparing treatment protocols and adequate follow-up

will be needed to determine the optimal treatment regimen for narrowband UVB phototherapy in vitiligo patients.

SAFETY OF NARROWBAND UVB PHOTOTHERAPY

Another critical theme in the literature is the safety of narrowband UVB phototherapy for vitiligo patients. While narrowband UVB is generally considered a safe therapy, there are concerns about the potential for skin cancer, particularly in long-term users. Many studies have addressed these concerns, finding that the risk of skin cancer is low overall and outweighed by the benefits of

treatment. A retrospective analysis of 26 cases suggests that narrowband UVB phototherapy is a well-tolerated, effective, and safe treatment option in children, especially those unresponsive to topical treatment and those with widespread lesions.^{10,12,19}

According to a systematic review and meta-analysis there was no significant difference in the risk of skin cancer between patients from Europe and those from East Asia, and the risk was not affected by the number of narrowband UVB phototherapy sessions.²⁰ However, a separate study suggests that NB-UVB phototherapy in Asian skin may increase the risk of skin malignancy, especially in psoriasis patients, and the risk is positively correlated with the cumulative and maximum dose of phototherapy as well as previous systemic treatments.²¹ Despite the increased risk, skin malignancies remain low, especially for vitiligo patients. Therefore, while there may be some variations in risk based on skin type or ethnicity, NB-UVB phototherapy for vitiligo is generally considered a safe treatment option regarding skin cancer risk.

Based on a nationwide population-based retrospective cohort study and a multicenter retrospective cohort study, long-term narrowband UVB phototherapy is not associated with an increased risk of skin cancer in patients with vitiligo and is considered a safe treatment.^{22,23} However, a study including Asian patients showed that NB-UVB phototherapy increases the risk of skin malignancy, positively correlated with cumulative, maximum doses of phototherapy and previous systemic treatments.²¹ Therefore, it is still recommended to monitor patients undergoing NB-UVB phototherapy for the development of actinic keratosis, Bowen disease, non-melanoma skin cancer, or melanoma, and to limit the cumulative and maximal dose of phototherapy.^{21,22} Patients with a history of skin cancer or predisposing factors for developing skin cancer should be carefully evaluated and monitored closely during NB-UVB phototherapy.²² Clinicians should also discuss the potential risks and benefits of phototherapy with patients and follow guidelines for sun protection and skin cancer prevention.²³

Further long-term studies are needed to fully understand the safety of narrowband UVB phototherapy and address concerns about skin cancer risk. Although some studies suggest that there is no significant increase in skin cancer risk associated with long-term narrowband UVB phototherapy in psoriasis patients, additional studies are needed to investigate the risk in other populations, including those with different skin types and medical conditions.^{24,25} Additionally, research should examine the optimal duration and frequency of treatments to minimize potential risks while maximizing treatment efficacy.^{10,19}

FACTORS AFFECTING TREATMENT RESPONSE

Studies have also examined the various factors affecting treatment response to narrowband UVB phototherapy.

These include skin type, disease duration, and the extent of the vitiligo. While some studies have found that these factors are not significant predictors of treatment success, others have found that specific patient populations may benefit more from alternative treatment options. Further research is needed to understand these factors better and optimize treatment for individual patients.

Skin type can affect the response to narrowband UVB phototherapy in vitiligo patients. A study found that Fitzpatrick skin types I-III had a better response than types IV-VI, with a median repigmentation of 55% for types I-III and 27% for types IV-VI after six months of treatment. However, the difference was not statistically significant.¹⁷ In another pilot study, five patients with Fitzpatrick skin phototypes IV-VI with vitiligo received targeted UVB phototherapy, and photoadaptation was observed in some patients.²⁶ However, there is a need for phototherapy guidelines for the treatment of vitiligo in patients with skin of color.²⁷ Thus, while there may be differences in response based on skin type, further research, and guidelines are needed to determine specific outcomes for each skin type.

According to a study evaluating the effect of disease duration on clinical response to narrowband UVB phototherapy in vitiligo patients, it was found that patients with recent vitiligo had a higher prevalence of higher grades of response than those with long-standing disease, and there was a statistically significant difference in overall response between these two groups of disease duration ($p=0.023$).²⁸ They concluded that the early treatment of generalized vitiligo may enhance the chance of successful repigmentation. Another study found that patients who responded in the first month of treatment were more likely to achieve better repigmentation rates, and repigmentation was stable in 14.3% of patients four years after cessation of treatment.¹⁰ However, a follow-up trial investigating the duration and permanency of treatment-induced repigmentation found that only five out of 31 patients (16%) experienced >75% stable repigmentation two years after cessation of up to 1 year of narrowband UVB therapy.²⁹

The extent of vitiligo in a patient can impact their response to narrowband UVB phototherapy. In a study of 70 patients with vitiligo, patients with lesions on the face were more likely to achieve >75% repigmentation than patients with lesions on the body.¹⁰ Patients with phototypes III to V also had a greater chance of achieving greater than 75% repigmentation on the face.¹⁰ Additionally, patients who responded to treatment in the first month had a better chance of achieving higher repigmentation rates.¹⁰ The response to NB-UVB phototherapy may be limited based on disease severity, with only moderate to excellent repigmentation achieved in a retrospective study of 18 Malaysian patients.⁹ Furthermore, a retrospective study of 32 patients with localized vitiligo found that only 12.5% of patients showed visible repigmentation, and the therapeutic effectiveness of targeted broadband UVB

phototherapy is limited and depends on the location of vitiligo lesions.³⁰ However, further research is needed to determine the specific limitations to the effectiveness of NB-UVB phototherapy based on disease severity.

Some evidence suggests that alternative treatment options, such as topical immunomodulators and herbal-based therapies, may be effective for treating vitiligo. One study found that topical immunomodulators were more effective than topical steroids in inducing repigmentation in patients with vitiligo.³¹ Another study found that a topical cream that selectively filters non-therapeutic UVB wavelengths from natural sunlight effectively treated acrofacial vitiligo.³² Additionally, some medicinal herbs commonly used in traditional herbal medicine have shown promise in treating vitiligo. However, further research is needed and there is a systematic review looking at nutrition, supplement, and herbal-based adjunctive therapies for vitiligo.^{33,34} However, more research is needed to determine the efficacy of these alternative treatment options for specific patient populations or under certain conditions.

DISCUSSION

Overall, the literature on narrowband UVB phototherapy for treating vitiligo suggests that this treatment option effectively reduces the depigmentation of skin associated with this condition. Numerous studies have demonstrated its effectiveness in inducing repigmentation and providing satisfactory results for patients.^{9,10,15} However, the literature also notes that the effectiveness of this treatment can vary depending on factors such as disease duration, skin type, location of the affected areas, and patient-specific factors. Therefore, while narrowband UVB phototherapy can be an effective treatment option, it may not suit all individuals with vitiligo.

Furthermore, the literature highlights the potential benefits of integrating narrowband UVB phototherapy with other treatment options, such as topical agents or systemic treatments. For instance, some studies suggest that combining narrowband UVB phototherapy with topical tacrolimus or corticosteroids may lead to a more significant improvement in skin repigmentation.⁹ These findings suggest that a multidisciplinary approach to treating vitiligo, including UVB phototherapy, may be beneficial.

Regarding the value this research gives to society, it is clear that the findings have significant clinical implications for individuals with vitiligo. Vitiligo can be a debilitating condition that can cause significant psychological distress for affected individuals. Therefore, a safe and effective treatment option such as narrowband UVB phototherapy can significantly impact the quality of life of individuals with this condition.¹⁶

Regarding areas for further research, the literature highlights the need for more studies focusing on

narrowband UVB phototherapy's long-term effects. While several studies have reported short-term benefits, more research is needed to determine the longer-term effects of this treatment and its safety profile, particularly concerning the risk of skin cancer.²⁰⁻²² Furthermore, more research is needed to establish the optimal dosing and regimen for narrowband UVB phototherapy, particularly in combination with other treatment options.¹⁵

Overall, the literature on narrowband UVB phototherapy for treating vitiligo provides evidence that this treatment option is safe and effective in reducing skin depigmentation associated with this condition. However, further research is needed to determine the optimal treatment regimens, long-term effects of this treatment option, and factors that may affect treatment response, which could lead to improved outcomes for individuals with vitiligo.^{9,10,15}

CONCLUSION

Overall, the literature on narrowband UVB phototherapy for treating vitiligo suggests that this treatment option effectively reduces the depigmentation of skin associated with this condition. Numerous studies have demonstrated its effectiveness in inducing repigmentation and providing satisfactory results for patients. However, the literature also notes that the effectiveness of this treatment can vary depending on factors such as disease duration, skin type, location of the affected areas, and patient-specific factors. Therefore, while narrowband UVB phototherapy can be an effective treatment option, it may not suit all individuals with vitiligo. Furthermore, the literature highlights the potential benefits of integrating narrowband UVB phototherapy with other treatment options, such as topical agents or systemic treatments. For instance, some studies suggest that combining narrowband UVB phototherapy with topical tacrolimus or corticosteroids may significantly improve skin repigmentation. These findings suggest that a multidisciplinary approach to treating vitiligo, including UVB phototherapy, may be beneficial. Regarding the value this research gives to society, it is clear that the findings have significant clinical implications for individuals with vitiligo. Vitiligo can be a debilitating condition that can cause significant psychological distress for affected individuals. Therefore, a safe and effective treatment option such as narrowband UVB phototherapy can significantly impact the quality of life of individuals with this condition. Regarding areas for further research, the literature highlights the need for more studies focusing on narrowband UVB phototherapy's long-term effects. While several studies have reported short-term benefits, more research is needed to determine the longer-term effects of this treatment and its safety profile, particularly concerning the risk of skin cancer. Furthermore, more research is needed to establish the optimal dosing and regimen for narrowband UVB phototherapy, particularly in combination with other treatment options. Overall, the literature on narrowband UVB phototherapy for treating vitiligo provides evidence

that this treatment option is safe and effective in reducing skin depigmentation associated with this condition. However, further research is needed to determine the optimal treatment regimens, long-term effects of this treatment option, and factors that may affect treatment response, which could lead to improved outcomes for individuals with vitiligo.

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