ORIGINAL REPORT

Long-term Durability of Narrowband Ultraviolet B-induced Repigmentation in Non-segmental Vitiligo: A Retrospective Study

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Narrowband ultraviolet B (NB-UVB) phototherapy is a well-established vitiligo treatment. However, limited data exist on the long-term effects of NB-UVB-induced repigmentation. This study evaluated the long-term durability of repigmentation achieved through NB-UVB phototherapy for up to 1 year in 176 patients with non-segmental vitiligo. Demographic and clinical variables, including age, gender, skin phototype, body site involvement, treatment duration, cumulative radiation dose, and clinically significant repigmentation response, were collected. Clinically significant repigmentation was defined as ≥50% repigmentation of vitiligo-affected areas, while a durable response was repigmentation lasting ≥6 months post-treatment. Of the 176 patients, 80 (45%) achieved clinically significant repigmentation, with the highest success rates observed in the face and neck region (53%). Among responders, 76 (95%) patients maintained their response for ≥6 months post-treatment discontinuation, and 47 (59%) sustained repigmentation for >72 months. Additionally, ≥50% repigmentation, longer treatment duration (>18 months), and higher cumulative radiation dose (>356 J/cm²) were associated with a durable repigmentation response. NB-UVB phototherapy provides lasting repigmentation in non-segmental vitiligo, with many patients maintaining results for >6 years. Clinically significant response post-NB-UVB phototherapy, prolonged treatment duration, and cumulative radiation dose are key factors associated with long-term repigmentation.

Key words: vitiligo; narrowband ultraviolet B phototherapy; durability of significant repigmentation.

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SIGNIFICANCE

Narrowband ultraviolet B phototherapy is a well-established vitiligo treatment. However, data on the long-term persistence of narrowband ultraviolet B-induced repigmentation remain limited. Our study analysed data from 176 patients and found that the persistence of significant repigmentation (which is defined as achieving ≥50% repigmentation at the end of the [narrowband ultraviolet B] phototherapy), longer treatment duration (>18 months), and higher cumulative dose are associated with greater durability.

Vitiligo is an acquired autoimmune disease that manifests as depigmented patches with psychological effects. Phototherapy has been the primary vitiligo treatment for decades, beginning with psoralen, followed by ultraviolet A (UVA) phototherapy (PUVA) in 1948 (1). Systemic or topical PUVA is considered an effective modality; however, its potential for non-melanoma skin cancer (NMSC), photosensitivity, and gastrointestinal side effects restrict its long-term use.

In 1997, Westerhof and Nieuweboer-Krobotova (2) first reported narrowband ultraviolet B (NB-UVB) phototherapy to be effective for treating vitiligo with improved facial repigmentation compared with a poor response in the palms and feet.

Over time, PUVA has gradually been replaced by NB-UVB and this is currently considered the standard treatment for non-segmental vitiligo. Restrictions associated with a photosensitizer and fewer adverse effects are major advantages considered in the use of NB-UVB over PUVA (3–5).

Currently, a new era in vitiligo treatment has emerged, mainly with the use of local and systemic Janus kinase (JAK) inhibitors, which have shown promising initial results in several studies. Significant repigmentation following the JAK1/JAK2 inhibitor ruxolitinib cream application was observed in both facial and body non-segmental vitiligo (8, 9). Although these studies present promising findings, several challenges should be addressed before the clinical implementation of JAK inhibitors, including cost considerations, limited accessibility, potential adverse effects related to long-term carcinogenicity, and outcome variability.

Cases of NMSC in vitiliginous lesions are rare (10). The consensus is that NB-UVB does not significantly increase the risk of NMSC compared with the general population. Therefore, NB-UVB treatment might be a safe long-term phototherapy option for patients with vitiligo. As previously mentioned, many studies support

the fact that NB-UVB phototherapy is effective for vitiligo; however, only limited studies with a small number of patients have addressed the durability of NB-UVB-induced repigmentation following treatment cessation.

Furthermore, because NB-UVB treatment can take several months or even years, it is important to determine whether the repigmentation achieved at the completion of treatment persists or fades following discontinuation. Framing expectations regarding treatment duration may be crucial for promoting adherence and empowering patients to make informed decisions regarding the value of long-term therapy.

Therefore, this retrospective study aimed to identify factors associated with the long-term stability of cosmetically acceptable repigmentation induced by NB-UVB phototherapy.

MATERIALS AND METHODS

The primary objective of this study was to evaluate the duration of repigmentation in patients with non-segmental vitiligo following NB-UVB phototherapy, with ≥6 months of repigmentation considered a durable result. The secondary objective was to identify variables associated with repigmentation durability. To this end, data from 176 patients with non-segmental vitiligo who completed at least 20 consecutive NB-UVB treatments at the Phototherapy Unit of Sheba Medical Center between 2003 and 2022 were analysed, with follow-up periods ranging from 12 to 228 months.

The study protocol was approved by the Institutional Review Board and Ethics Committee of Sheba Medical Center (approval number: SMC-9010-21) and was conducted in accordance with the Helsinki Declaration.

Patients receiving additional non-NB UVB phototherapy and/or immunosuppressive medications were excluded. All patients were treated in a UV 5001 BL unit (Waldmann Medical Division, Schwenningen, Germany) equipped with 24 TL01 radiators (F85/100 W-01) with a radiation source between 310 and 315 nm and a maximum at 311 nm. Treatment sessions were performed 3 times a week on non-consecutive days. Phototherapy was initiated at a dose of 200 mJ/cm² for all skin phototypes and subsequently increased by 50 mJ/cm² every other session for all patients. In case of mild skin burn, the last session's dose was maintained for 3 consecutive sessions; thereafter the standard incremental dosing schedule was resumed. Patients were advised to apply emollients to their skin daily (after treatment). The genital area was shielded, and the eyes were protected using UV-blocking goggles during treatment. Patients did not wear goggles if lesions were present in the eyelid area; however, they were advised to shut their eyes and direct their vision downwards during the sessions. Treatment was discontinued when the patient's desired repigmentation level was achieved and/or no further improvement was observed during the last 2 months of treatment. If the improvement continued by the end of 1 year, the treatment was discontinued for 2 months and subsequently restarted from the beginning. Continuous treatment was capped at 1 year to meet the medicolegal consent requirements.

Demographic and clinical data, including age at treatment initiation, gender, Fitzpatrick skin type, vitiligo location, total treatment duration (in months), cumulative radiation dose per body area, repigmentation percentage per body area, and repigmentation duration were extracted from electronic medical records.

Since a durable response was defined as lasting ≥6 months, treatment response duration was categorized into the following 3 periods: 0–5, 6–72, and >72 months. Clinical improvement was estimated based on the reduction in body surface area (BSA) involvement, with ≥50% repigmentation considered clinically significant.

Statistical analysis

Statistical analyses were performed using the χ^2 test of independence to evaluate associations between potential factors and response durability, including gender, age, skin phototype, response percentage, treatment dose (mJ/cm²), and treatment duration.

As most patients had Fitzpatrick skin type III, skin types were grouped into 3 categories to ensure a more balanced distribution across groups. All statistical tests were 2-sided with a 95% confidence level and were conducted using SPSS Statistics for Windows, version 10.00 (SPSS Inc, Chicago, IL, USA).

RESULTS

Overall, 176 patients with non-segmental vitiligo were treated with NB-UVB phototherapy (age 3–79 years). Additionally, 51% (90) and 49% (86) of the patients were females and males, respectively (**Table I**). Patients had a minimum follow-up period of 12 (range: 12–228) months after NB-UVB phototherapy discontinuation. The mean duration of phototherapy was 10.5 (range: 2–103) months, with the total radiation exposure ranging from 0.75 J/cm² to 4,053 J/cm². Among the 132 patients affected in the face and neck region, a significant response (≥ 50% repigmentation) was observed in 53% (70) (**Table II**).

Table I. Distribution of treatment durability based on gender

Treatment durability (months)	Gender		
	Male	Female	Total
0–5	32 (37%)	23 (26%)	55 (31%)
6–72	37 (43%)	38 (42%)	75 (43%)
> 72	17 (20%)	29 (32%)	46 (26%)
Total	86 (49%)	90 (51%)	176

Cell percentages are column-based. "Total" column/row reflects % of $n = 176$.

Table II. Vitiligo locations according to gender and Fitzpatrick skin type

	Gender		Fitzpatrick skin type		
Involved area	Male	Female	1+2	3	4+5
Facial	70 (53%)	62 (47%)	23 (17%)	65 (49%)	44 (33%)
Truncal	41 (46%)	49 (54%)	20 (22%)	41 (46%)	29 (32%)
Limb	56 (45%)	68 (55%)	23 (19%)	56 (45%)	45 (36%)
Hands and feet	34 (49%)	36 (51%)	13 (19%)	32 (46%)	25 (35%)

Gender and Fitzpatrick skin type were not associated with differences in lesion distribution. Most patients had skin type III.

The results were further classified into the following categories.

1. *Association between treatment durability and significant response percentage*

A χ^2 test of independence revealed a statistically significant association between the significant response percentage achieved and treatment durability, χ^2 (2, $n=176$) = 89.93, $p<0.001$. Patients with a higher success rate significant response (≥50% repigmentation) were significantly more likely to sustain long-term treatment responses for over 72 months than those with lower success rates (58.75% vs 8.33%). Conversely, those with a lower success rate (0–50%) were more likely to experience short-term responses within 0–5 months (73.96% vs 5%) (**Table III**).

2. Association between treatment durability and duration of treatment

A χ^2test of independence revealed a statistically significant association between the duration of treatment and treatment durability, χ^2 (2, $n=176$) = 10.53, $p<0.01$. Patients who underwent longer treatment durations (>18 months) were more likely to sustain a response within the 6–72 months range than those with shorter treatments (54.55% vs. 22.08%). In contrast, shorter treatment durations (<18 months) were associated with a higher proportion of short-term responses (0–5 months: 44.81% vs 27.27%) (**Table IV**).

3. Association between treatment durability and cumulative treatment dose

A χ^2 test of independence revealed a statistically significant association between cumulative treatment dose and treatment durability, χ^2 (2, $n=176$) = 13.30, $p<0.01$. Patients who received a higher cumulative dose (>356 J/cm²) were more likely to sustain a response within the 6–72 months range than those with a lower dose (39.19% vs 16.67%). Conversely, lower cumulative doses (<356 J/cm²) were associated with a higher proportion of short-term responses (0–5 months: 51.96% vs 29.73%) (**Table V**).

No statistically significant associations were observed between treatment durability and gender ($p>0.05$), Fitzpatrick skin type ($p>0.05$), or patient age ($p>0.05$).

Regarding side effects, 20 patients experienced mild skin burn that did not require treatment interruption. Consequently, the previous session's dose was maintained for the next 3 sessions, after which the standard incremental schedule was resumed.

DISCUSSION

In this study, we investigated the long-term durability of the significant response at the completion of NB-UVB phototherapy in patients with non-segmental vitiligo. We found that 80 (45%) of the 176 patients achieved a clinically significant response, primarily in the face and neck region. Of the patients with clinically significant responses, 76 (95%) maintained their response for ≥6 months following treatment discontinuation, with 47 (59%) sustaining repigmentation for >72 months. Furthermore, our result showed that a higher success rate (≥50% repigmentation), longer treatment duration (>18 months), and higher cumulative radiation dose (>356 J/cm²) were associated with a durable repigmentation response and that age, gender, and skin phototype were unassociated with response durability.

NB-UVB phototherapy is considered the gold-standard treatment for non-segmental vitiligo. However, the response to NB-UVB phototherapy could be affected by early initiation, duration, or intense approach to the treatment. Most authors recommend a minimum treatment period of 6 months for NB-UVB to demonstrate significant repigmentation (11). Others have found that

Table III. Association between treatment durability and significant response percentage

	Response percentage		
Treatment durability (months)	<50%	≥50%	Total
0–5	71 (73.96%)	4 (5%)	75 (43%)
6–72	17 (17.71%)	29 (36.25%)	46 (26%)
>72	8 (8.33%)	47 (58.75%)	55 (31%)
Total	96 (55%)	80 (45%)	176

Distribution of treatment durability (months) based on response percentage (<50% vs ≥50% repigmentation). Higher repigmentation percentages were associated with longer-lasting responses.
Cell percentages are column-based. "Total" column/row reflects % of $n=176$.

Table IV. Association between treatment durability and duration of treatment

	Duration of treatment		
Treatment durability (months)	< 18	> 18	Total
0–5	69 (44.81%)	6 (27.27%)	75 (43%)
6–72	34 (22.08%)	12 (54.55%)	46 (26%)
>72	51 (33.12%)	4 (18.18%)	55 (31%)
Total	154 (87%)	22 (13%)	176

Distribution of treatment durability (months) based on total treatment duration (<18 vs >18 months). Longer treatments were more commonly associated with intermediate-duration responses (6–72 months).
Cell percentages are column-based. "Total" column/row reflects % of $n=176$.

Table V. Association between treatment durability and cumulative treatment dose

	Cumulative dose (J/cm²)		
Treatment durability (months	< 356	> 356	Total
0–5	53 (51.96%)	22 (29.73%)	75 (43%)
6–72	17 (16.67%)	29 (39.19%)	46 (26%)
>72	32 (31.37%)	23 (31.08%)	55 (31%)
Total	102 (58%)	74 (42%)	176

Distribution of treatment durability (months) based on cumulative NB-UVB dose. Higher doses were associated with a greater proportion of intermediate-duration responses (6–72 months).
Cell percentages are column-based. "Total" column/row reflects % of $n = 176$.

the time required to achieve optimal results is 1 year in most cases (12). Our approach to NB-UVB phototherapy was to continue the treatment as long as the patient was still improving, to a maximum of 1 year, when we discontinued the treatment for 2 months and subsequently restarted as needed. However, the treatment was discontinued if no further improvement was observed for 2 months or if the level of repigmentation desired by the patient was achieved.

A systemic meta-analysis showed that the greatest response to NB-UVB phototherapy was on the face and neck region. At least 1 year of treatment was required to achieve a maximal treatment response, and the 3–6-month phototherapy period was insufficient to differentiate between non- and late-responders (6).

The treatment response to NB-UVB phototherapy is well known to differ among various body sites. In most studies, the most responsive body site to NB-UVB phototherapy was the face and neck region, followed by the trunk, extremities, hands, and feet, which corroborates the outcome of our study (3–5).

Some studies have reported that initiating treatment early in the course of the disease, the length of the treatment period, and smaller body involvement, among other factors, affect treatment outcomes. While other studies found no significant effect of body surface involvement on the response to treatment, others reported a significant effect (3, 8). All our patients had vitiligo with >10% of their BSA depigmented before treatment.

In our study, 95% of the patients with ≥50% repigmentation had a significant long-term response of ≥6 months.

Among these, the response lasted >6 years in a subset of 47 (59%) patients, and none had skin cancer during the follow-up.

Only limited studies have investigated the long-term and significant repigmentation effects of NB-UVB. Sitek et al. (13) reported that 11 of the 31 patients with generalized vitiligo treated with NB-UVB 3 times a week achieved >75% repigmentation after 1 year of treatment. Of these, 5 patients had a sustainable response for up to 2 years of follow-up, whereas 6 relapsed, among whom 4 patients experienced relapse within 6 months after the treatment ended.

Nicolaidou et al. (14) reported that 25 of the 70 patients with non-segmental vitiligo treated with NB-UVB achieved 75% repigmentation of facial involvement, and patients with skin types III–V and those who responded in the first month of treatment had more chances to achieve better repigmentation rates. Repigmentation lasted for 4 years in 3 patients after treatment cessation.

Additionally, Silpa-Archa et al. (15) reported that factors predictive of good outcomes included the type of vitiligo, lesion location, disease duration before NB-UVB phototherapy, and duration and total number of NB-UVB treatments. Repigmentation persisted in 49 (84.5%) of the 58 patients after 1 year of discontinuing effective NB-UVB phototherapy. However, the authors included segmental and non-segmental vitiligo in their study, which was not the case in our study.

Kishan Kumar et al. (16) reported that 148 of the 150 patients treated with NB-UVB phototherapy twice weekly for 1 year retained repigmentation for 6 months' follow-up.

We hypothesize that discrepancies between our findings and those of previous studies may be attributed to differences in patient cohort sizes and, potentially, heterogeneity among patients. Another possible explanation is related to the treatment protocols used. In some studies, a more aggressive treatment protocol was used, including treatment sessions performed 3 times weekly and dose increments of 20% per treatment. Additionally, some studies maintained a constant dose after achieving mild erythema or with the first signs of repigmentation. Instead, we attempted to increase the dose as long as the patient tolerated it. Therefore, the possibility of a better response cannot be ruled out, which may be related to a more aggressive treatment protocol. Sherman et al. (17) reported a bidirectional association between vitiligo and melasma yet found that NB-UVB phototherapy did not increase melasma risk in vitiligo patients. Likewise, none of our patients developed post-treatment melasma.

In the era of recent developments with the new JAK-inhibitor molecules, we may forget that phototherapy remains an effective treatment for vitiligo. However, the frequent visits and length of time to achieve the treatment are cumbersome and time-consuming. Therefore, patients should be informed and enlightened to ensure they are aware of the time needed to achieve this response. When patients know the long-term efficacy of the treatment, they can decide more wisely whether the time needed for the treatment will be worth it.

Strengths and limitations

This study's strengths include its large cohort of 176 patients with non-segmental vitiligo and an extended follow-up period of up to 228 months. The comprehensive data collection offers valuable insights into the durability of NB-UVB-induced repigmentation and addresses a critical knowledge gap in long-term vitiligo management. Furthermore, the study underscores the

safety of NB-UVB phototherapy, with no cases of skin cancer reported during the follow-up period. However, the retrospective single-centre design limits the generalizability of the findings. The use of BSA as a measurement tool, while practical, may lack the precision of more detailed metrics such as VASI. Additionally, the predominance of Fitzpatrick skin type III among participants reduces the applicability of the findings to populations with different skin types. Addressing these limitations in future studies could enhance the robustness and broader relevance of the results.

Conclusion

NB-UVB phototherapy is an effective treatment for non-segmental vitiligo, particularly in the face and neck region. Among patients who achieved a significant response at the end of treatment, over half maintained repigmentation for up to 6 years.

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IRB approval status: The study protocol was approved by the Institutional Review Board and Ethics Committee of Sheba Medical Center (approval number: SMC-9010-21) and was conducted in accordance with the Helsinki Declaration.

Data availability statement: The data that support the findings of this study are available from the corresponding author, Riad Kassem, upon reasonable request.

The authors have no conflicts of interest to declare.

REFERENCES

1. Monem El Mofty A. A preliminary clinical report on the treatment of leucodermia with Ammi majus Linn. J Egypt Med Assoc 1948; 31: 651–665.
2. Westerhof W, Nieuweboer-Krobotova L. Treatment of vitiligo with UV-B radiation vs topical psoralen plus UV-A. Arch Dermatol 1997; 133: 1525–1528. https://doi.org/10.1001/archderm.1997.03890480045006
3. Parsad D, Kanwar AJ, Kumar B. Psoralen-ultraviolet A vs. narrow-band ultraviolet B phototherapy for the treatment of vitiligo. J Eur Acad Dermatol Venereol 2006; 20: 175–177. https://doi.org/10.1111/j.1468-3083.2006.01413.x
4. Natta R, Somsak T, Wisuttida T, Laor L. Narrowband ultraviolet B radiation therapy for recalcitrant vitiligo in Asians. J Am Acad Dermatol 2003; 49: 473–476. https://doi.org/10.1067/S0190-9622(03)01484-1
5. Kanwar AJ, Dogra S, Parsad D, Kumar B. Narrow-band UVB for the treatment of vitiligo: an emerging effective and well-tolerated therapy. Int J Dermatol 2005; 44: 57–60. https://doi.org/10.1111/j.1365-4632.2004.02329.x
6. Bae JM, Jung HM, Hong BY, Lee JH, Choi WJ, Lee JH, et al. Phototherapy for vitiligo: a systematic review and meta-analysis. JAMA Dermatol 2017; 153: 666–674. https://doi.org/10.1001/jamadermatol.2017.0002.
7. Yones SS, Palmer RA, Garibaldinos TM, Hawk JL. Randomized double-blind trial of treatment of vitiligo: efficacy of psoralen-UV-A therapy vs narrowband-UV-B therapy. Arch Dermatol 2007; 143: 578–584. https://doi.org/10.1001/archderm.143.5.578
8. Hamzavi I, Rosmarin D, Harris JE, Pandya AG, Lebwohl M, Gottlieb AB, et al. Efficacy of ruxolitinib cream in vitiligo by patient characteristics and affected body areas: descriptive subgroup analyses from a phase 2, randomized, double-blind trial. J Am Acad Dermatol 2022; 86: 1398–1401. https://doi.org/10.1016/j.jaad.2021.05.047
9. Hwang JR, Driscoll MS. Review of ruxolitinib for treatment of non-segmental vitiligo. Ann Pharmacother 2023; 57: 948–955. https://doi.org/10.1177/10600280221143748
10. Nordlund JJ. Nonmelanoma skin cancer in vitiligo patients. J Am Acad Dermatol 2009; 61: 1080–1081. https://doi.org/10.1016/j.jaad.2009.06.072
11. Cabrera R, Hojman L, Recule F, Sepulveda R, Delgado I. Predictive model for response rate to narrowband ultraviolet B phototherapy in vitiligo: a retrospective cohort study of 579 patients. Acta Derm Venereol 2018; 98: 416–420. https://doi.org/10.2340/00015555-2889
12. Kanwar AJ, Dogra S. Narrow-band UVB for the treatment of generalized vitiligo in children. Clin Exp Dermatol 2005; 30: 332–336. https://doi.org/10.1111/j.1365-2230.2005.01837.x
13. Sitek JC, Loeb M, Ronnevig JR. Narrowband UVB therapy for vitiligo: does the repigmentation last? J Eur Acad Dermatol Venereol 2007; 21: 891–896. https://doi.org/10.1111/j.1468-3083.2007.01980.x
14. Nicolaidou E, Antoniou C, Stratigos AJ, Stefanaki C, Katsambas AD. Efficacy, predictors of response, and long-term follow-up in patients with vitiligo treated with narrowband UVB phototherapy. J Am Acad Dermatol 2007; 56: 274–278. https://doi.org/10.1016/j.jaad.2006.09.004
15. Silpa-Archa N, Weerasubpong P, Junsuwan N, Yothachai P, Supapueng O, Wongpraparut C. Treatment outcome and persistence of repigmentation from narrow-band ultraviolet B phototherapy in vitiligo. J Dermatolog Treat 2019; 30: 691–696. https://doi.org/10.1080/09546634.2018.1544409
16. Kishan Kumar YH, Rao GR, Gopal KV, Shanti G, Rao KV. Evaluation of narrow-band UVB phototherapy in 150 patients with vitiligo. Indian J Dermatol Venereol Leprol 2009; 75: 162–166. https://doi.org/10.4103/0378-6323.48662
17. Sherman S, Duskin-Bitan H, Agiv T, Bar D, Marom-Haham L, Levi A et al. Bidirectional association between vitiligo and melasma: a large-scale population-based study. Indian J Dermatol Venereol Leprol 2025, Jul 4. [Onlone ahead of print] https://doi.org/10.25259/IJDVL_1828_2024