ORIGINAL RESEARCH

Surrounding Needling and Narrowband Ultraviolet B Phototherapy Treatment: Synergistic Effects for Repigmentation in Chronic, Stable Nonsegmental Vitiligo

Gong-Yau Chu, MD; Shih-Ming Weng, MD, PhD; Chieh-Chen Huang, MD;
Wen Chun Liang, Chung-Hua Hsu, MD, PhD

ABSTRACT

Context • Narrowband ultraviolet B (NBUVB) phototherapy is the standard treatment for chronic stable vitiligo, but its efficacy, when used alone, is often unsatisfactory.

Objective • The study evaluated the efficacy of surrounding needling with acupuncture needles in combination with NBUVB phototherapy for lesions on different body parts of patients with chronic stable vitiligo.

Design • The research team designed a 12-week, randomized, open-label, prospective, intra-individual, comparative clinical trial.

Setting • The study took place in the Department of Dermatology at Shin-Kong Wu Ho-Su Memorial Hospital in Taiwan.

Participants • Participants were patients at the hospital, aged 20-80 years, with chronic stable nonsegmental vitiligo. The lesions on both sides of their bodies had the same baseline conditions. Nine patients with 14 pairs of lesions (n = 28) were included in the study, and eight participants with 13 pairs of lesions (n = 26) successfully completed the study.

Intervention • Vitiligo lesions in the intervention group were treated with surrounding needling combined with NBUVB phototherapy, whereas the control group received NBUVB phototherapy only.

Outcome Measures • The primary outcome was evaluated at Week 12 using the modified Vitiligo Area Scoring Index (VASI), which focuses on local depigmentation only without multiplication by body surface area, and the testing used the Wilcoxon signed-rank test. A higher VASI score indicates more severe vitiligo. Pain was rated postintervention, after completion of all treatments.

Results • At baseline, the modified VASI score in both groups was 93.07 ± 4.62. Postintervention, this score in the intervention group improved to 78.46 ± 15.24, with a significant difference between baseline and postintervention (P = .007), and in the control group, the score improved to 91.92 ± 6.67, with no significant difference having occurred (P = .317). A statistically significant difference was found between the intervention group and the control group in the change in scores postintervention (P = .007).

Conclusion • Surrounding needling in combination with NBUVB phototherapy may be a promising treatment for chronic stable nonsegmental vitiligo. Future studies with larger sample sizes and long-term follow-up are warranted. (*Altern Ther Health Med.* 2023;29(1):97-103).

Gong-Yau Chu, MD, Attending physician, Institute of Traditional Medicine, School of Medicine, National Yang Ming Chiao Tung University; Attending physician, Institute of Traditional Medicine, School of Medicine, National Yang-Ming University; Attending physician, Department of Dermatology, Shin-Kong Wu Ho-Su Memorial Hospital; and Superintendent, Department of Dermatology, Kang-Ning General Hospital, Taipei, Taiwan. **Shih-Ming Weng,** MD, PhD, Associate professor, Department of Speech Language Pathology and Audiology, National Taipei University of Nursing and Health Sciences, and Attending physician, Department of Pediatrics, Wan Fang Hospital, Taipei Medical University, Taipei, Taiwan. **Chieh-Chen Huang,** MD, Assistant professor, and **Wen Chun Liang**, Nurse, Department of Dermatology, Shin-Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan. **Chung-Hua Hsu,** MD, PhD, Professor, Institute of Traditional Medicine, School of Medicine, National Yang Ming Chiao Tung University; and Superintendent, Department of Chinese Medicine, Linsen Chinese Medicine and Kunming Branch, Taipei City Hospital, Taipei, Taiwan.

Corresponding author: Chung-Hua Hsu, MD, PhD
E-mail: owlherbs@yahoo.com.tw

Vitiligo is a chronic, asymptomatic, acquired, cutaneous depigmentary disorder that leads to a deficiency of melanocytes in the mucosa and skin. The global prevalence of vitiligo is approximately 1% to 2%,[1] and the earliest record of vitiligo occurred in 2200 BC.[2]

Owing to patients' obvious differences in appearance, vitiligo is often mistinterpreted, particularly in some countries where the skin's hypopigmentation or depigmentation is related to contagious diseases such as leprosy. The social stereotype has persisted in some cultures, resulting in a heavy psychological burden and mental stress in patients with vitiligo.[3] Vitiligo has a huge impact on patients' self-respect, social development, and quality of life.[1]

Two types of vitiligo exist: nonsegmental, about ±85% to 90% of patients, and segmental, about ±10% of patients. [3] Nonsegmental vitiligo involves the development of depigmentation or hypopigmentation bilaterally, whereas segmental vitiligo is typically limited to one side of the body.[3] Vitiligo can be further classified as progressing or stable based on the disease's activity and as localized or generalized based on its area of involvement.[4]

Multiple theories have been proposed to clarify the pathogenesis of vitiligo, and eventually, the loss of functional melanocytes in the epidermis. These hypotheses include genetic susceptibility, destruction of melanocytes through innate and adaptive immunity, damage to melanocytes by oxidative stress, cytotoxicity of neurotransmitters directly against melanocytes, and lack of adhesion of epidermal melanocytes. A combination of all these plausible theories better explains the pathogenesis of vitiligo—the combination theory.[3,4]

Owing to its complicated pathogenesis, the treatment of vitiligo is challenging. Common therapies include topical corticosteroids, topical immunomodulators, topical antioxidants, and phototherapy. For extensive and recalcitrant cases, systemic corticosteroids, immunosuppressants and antioxidants, and pigment cell transplantation may be considered.[3] Most treatments have anti-inflammatory and immunosuppressive effects that help stop the attacks of the immune system in vitiligo lesions, but they have no excitatory effects on melanocytes to induce their differentiation, migration, and proliferation.[1,3] Thus, although multiple interventions are effective for vitiligo, no precisely curable therapy has yet been developed.

Phototherapy is currently used as the primary treatment for vitiligo in clinical practice. It was first used to treat vitiligo more than 3500 years ago in ancient Egypt and India. The healers smeared plant extracts on the involved skin in combination with exposing it to sunlight for the treatment of leukoderma.[5]

Psoralen plus UVA (PUVA) or photochemotherapy has been the most common phototherapy for patients with vitiligo since the middle of the last century. Nevertheless, NBUVB phototherapy has gradually surpassed PUVA in recent years because of its superior efficacy and fewer adverse effects, as shown by many clinical studies.[5]

Bae et al's [1]2017 systematic review and meta-analysis of 35 randomized and nonrandomized trials included 1428 patients and evaluated the repigmentation rates of NBUVB.[1] The study found that 37.4% of participants achieved repigmentation ≥50% within 6 months of the phototherapy, and 56.8% achieved repigmentation ≥50% within 12 months. Only 35.7% of participants achieved repigmentation ≥75% within 12 months, indicating that a longer treatment duration may be necessary to improve the treatment's efficacy. Unfortunately, 37.9% of participants hadn't achieved repigmentation ≥25% within 3 months, and 25.8% and 25.0% of participants hadn't achieved repigmentation ≥25% within 6 and 12 months, respectively. Some patients may not respond to NBUVB phototherapy. Thus, Bae et al found that the efficacy of NBUVB phototherapy is often unsatisfactory in some patients with vitiligo.[1]

Also according to Bae et al,[1] the most responsive body sites, over a minimum duration of 6 months, have been the face and neck, with a marked repigmentation rate of 44.2%, followed by the trunk at 26.1%, extremities at 17.3%, and hands and feet at 0%. The treatment response of hands and feet was extremely low.[1] Regions where hair follicles occur at a low density—the hands and feet—rarely respond to treatment.[6,7]

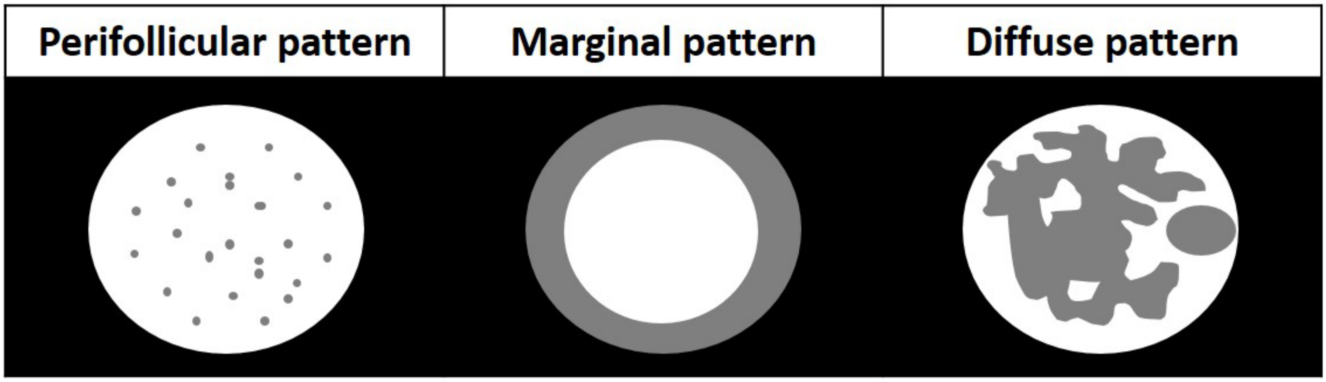
In recent years, discussions have occurred about multiple combined therapies for enhancing the efficacy of phototherapy. [6,7] Patients with vitiligo often receive various combination treatments in clinical practice. One such option is the combination of phototherapy with needling therapy.[7]

Surgical needling has been found to be beneficial for the treatment of vitiligo, including needling treatment with 20- or 30-gauge needles.[8-10] The plausible mechanisms of repigmentation after surgical needling include an injury-induced inflammatory reaction that elicits the migration of keratinocytes and melanocytes during the healing process, leading to the mechanical immigration of melanocytes from the peripheral pigmented skin or outer root sheath of pigmented hair to the depigmented area.[9] The needle's tip may either mechanically push the functional melanocytes from the peripheral pigmented margins or cause the trauma-induced migration of keratinocytes and melanocytes through the healing process.[8-10] Significant improvement has also been found for vitiligo treated with fire needling[11] and electrocautery needling.[12]

The technique discussed above is similar to surrounding needling with acupuncture needles in traditional Chinese medicine. Surrounding needling involves shallow needling with acupuncture needles around an affected area and has been used as an alternative treatment for multiple diseases.[13-15]

Needling treatment of human skin can induce the expression of various growth factors—transforming growth factor beta 1-3 (TGF-β 1-3), fibroblast growth factor (FGF), epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), and tumor necrosis factor alpha (TNFα).[16,17] The signals released by cutaneous keratinocytes and leukocytes have been proven to induce melanocytes to generate more melanin and to turn more dendritic.[18]

Figure 1. Clinically Observed Repigmentation Patterns: Perifollicular, Marginal, and Diffuse Pattern



A recent clinical study indicated that a wound environment can trigger the migration of melanocytes to the wound site and that melanocyte-like dendritic cells can be found at the epidermis-dermis junction in the later stage of wound healing.[19] The peripheral region of a wound is where increasing melanocyte migration occurs and mechanisms for wound healing may not only promote melanocyte stem-cell differentiation to fulfill immediate demands for tissue repair but also promote the maintenance of melanocyte stem cells.[20] Studies have also provided evidence that melanocyte stem cells of the hair follicle can migrate to the epidermis during the wound healing process; hence, hair follicles may supply epidermal melanocytes in the process of repigmentation in vitiligo.[21-23]

The four clinically observed repigmentation patterns include: (1) perifollicular, the most common; (2) marginal, (3) diffuse, and (4) combined, with more than one pattern.[6] The perifollicular pattern is caused by the activation of melanocyte precursors from the hair follicle and presents as small pigmented macules around the hair follicles. The marginal pattern is induced by the activation of epidermal melanocytes in the lesional borders, which results in a repigmentation edge at the margins of the lesions. The diffuse repigmentation pattern arises from the activation of interfollicular melanocyte precursors and presents as generalized darkening across the vitiligo lesions (Figure 1).[6]

Surrounding needling treatment for vitiligo is an ancient technique of Chinese medicine; nevertheless, clinical studies on surrounding needling combined with NBUVB phototherapy treatment are limited. In the current study, the research team evaluated the efficacy of surrounding needling with acupuncture needles in combination with NBUVB phototherapy for lesions in different body parts of patients with chronic stable vitiligo.

To the best of current research team's knowledge, this is the first intraindividual comparative study to investigate the repigmentation effects of surrounding needling with acupuncture needles combined with NBUVB phototherapy in patients with vitiligo.

METHODS

Participants

The study was conducted over 12 weeks, from October 2018 to December 2019, and was a randomized, open-label, prospective, intra-individual, comparative clinical trial that was performed in the Department of Dermatology at Shin Kong Wu Ho Su Memorial Hospital in Taipei, Taiwan. Participants were patients at the hospital. The research team post the study on a board.

Potential participants were included in the study if they were: (1) between 20 and 80 years of age and (2) had chronic stable vitiligo involving surface areas of the face, limbs, trunk, hands, or feet, and had lesions on both sides with the same baseline conditions. Stability of the disease was defined as no obvious change in vitiliginous patches over the six months prior to the study.

Potential participants were excluded from the study if they: (1) were pregnant; (2) had a coagulopathy, active infectious disease; (3) had an autoimmune disorder; (4) had a tendency to develop keloids; (5) were claustrophobic; (6) were intolerant of phototherapy; (7) had a history of photosensitizing drug use; (8) were receiving concomitant radiotherapy, chemotherapy, or immunosuppressive therapy; (9) had a fear of needles; or (10) had a history of lesions showing changes on the skin.

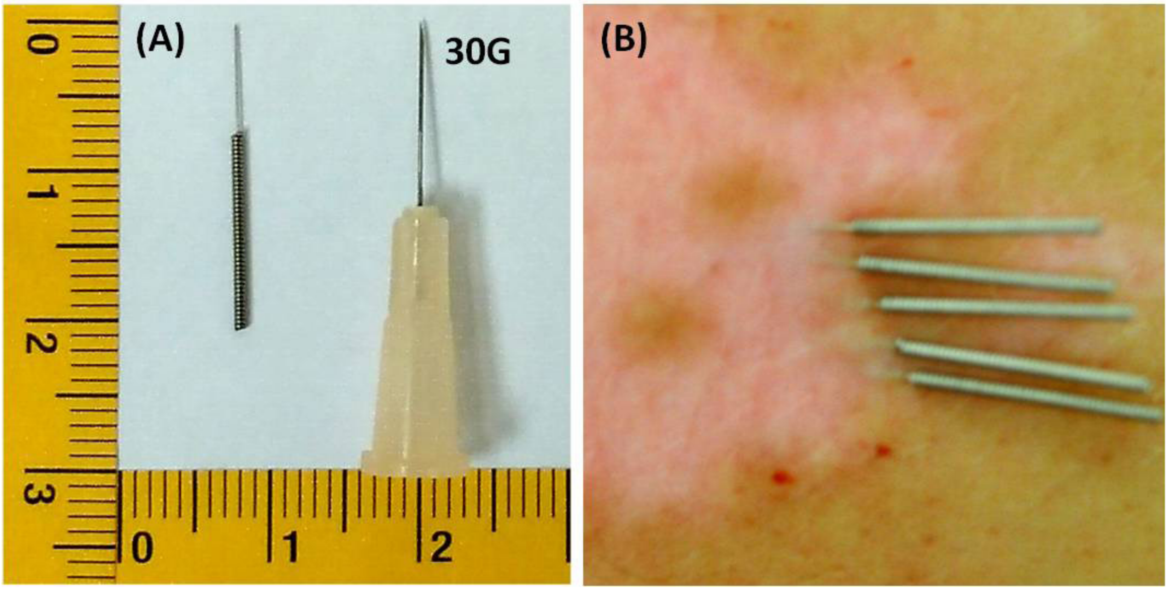
All participants provided oral and written informed consent before participation in the study. The study's protocol conformed to local ethical guidelines, and the study was approved by the institutional review board of the hospital (20180205R). The ClinicalTrials.gov Protocol Registration System assigned the trial a clinical protocol number (NCT03718962).

Procedures

Participants. A detailed patient history was obtained, and a dermatological examination was performed before the study. We collected data included past medical history , especially thyroid disorder, duration of disease, and drug use history.

A washout period of at least 3 months was required for participants who had undergone recent vitiligo treatment,

Figure 2. Needling. Photo 2A shows that the acupuncture needle is thinner than a 30-G needle; photo 2B shows the surrounding needling method being performed with gentle pricks of the peripheral pigmented skin toward the vitiligo lesions along the border, without retaining the needle in the skin. The interval between the two acupuncture points was 1-3 mm.



and participants were prohibited from undergoing other vitiligo treatments throughout the trial's duration.

Groups. If a participant had vitiliginous patches at bilateral and similar locations, one side was treated with surrounding needling combined with NBUVB phototherapy, with that side being included in the intervention group, and the other side was treated with NBUVB phototherapy only, with that side being included in the control group.

Randomization. Patients drew lots randomly (The research team prepared two sticks ,one marks left(intervention) and one marks right(intervention). Patients drew one of them with close eyes) to decide which side would be needled and be included in the intervention group.

Phototherapy. Whole-body NBUVB phototherapy with a wavelength of 311 nm was performed. The energy level of the NBUVB phototherapy used was the same on both sides. A standard initial dose of 180 mJ/cm^2 was administered to all participants, with the irradiation dose being increased by 5% to 10% on each subsequent visit. The treatment was administered two to three times per week on nonconsecutive days. All procedure were monitored by professional dermatologist to confirm the sufficient treatments and avoid side effects.

The goal of the each phototherapy was to achieve persistent asymptomatic erythema. In the case of symptomatic erythema with or without edema or blistering, further treatment was withheld until the symptoms subsided.

Surrounding needling. Surrounding needling therapy was performed using small acupuncture needles (ϕ0.16mm × 7mm) in accordance with local regulations (Figure 2A). Because acupuncture needles are solid and 30-gauge needles are tubular for injection, the research team chose the small acupuncture needles to perform surrounding needling instead of 30-gauge needles (ϕ0.305 mm × 13 mm), fire needling, or electrocautery needling as previous studies had used.[7-9,14,15] Acupuncture needles are thinner and more focused and result in less unnecessary tissue injury.

Outcome measures. The primary outcome was evaluated postintervention at week 12 using the modified Vitiligo Area Scoring Index (VASI) score, which focuses only on local depigmentation without multiplication by the body surface area.[24] Because the study evaluated paired lesions, the modified VASI score was used. Participants completed the modified VASI at baseline at week 0, at weeks 2 and 6, and postintervention at week 12.

A secondary outcome for pain was evaluated for each lesion using a visual analog scale (VAS). Pain was rated postintervention, after completion of all treatments.

Participants were checked every other week for side effects of the treatments, if any. After 12weeks study, the reaerch team will keep follow up for 12 weeks to make sure no complication and sequela

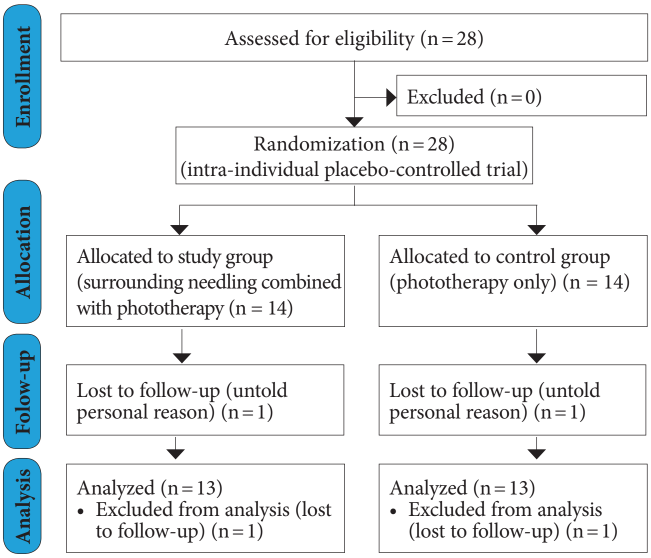
Intervention

The needles were held in an approximately horizontal direction. A gentle prick was made into the skin's epidermal and dermal junction (E-D junction), and the insertion of most of the length of the needle was attempted.

The surrounding needling was performed with quick pricks into the peripheral pigmented skin toward the vitiligo lesions along the border, instead of retaining the needle in the skin, and each acupuncture point was pricked at intervals of 1-3 mm (Figure 2B). For participants who were particularly averse to pain, anesthetics were applied 30 minutes before treatment. The surrounding needling treatment was performed biweekly.

Figure 3. Participants. Figure 3A shows the consort flow diagram; Figure 3B shows participants' baseline demographic and clinical characteristics (n = 9, with 28 lesions)

A.



B. Baseline patient demographic and clinical characteristics (N = 9, *n* = 28)

Gender	**N = 9**
Male	4 (44%)
Female	5 (56%)
Age, mean ± SD (range), y	55 ± 16.4 (24-70)
Race/ethnicity, N (%)	**N = 9**
Asian	9 (100%)
Treated areas	***n* = 28**
Facial vitiligo, n (%)	6 (21%)
Acral vitiligo, n (%)	4 (14%)
Nonacral extremity vitiligo n (%)	6 (21%)
Turncal vitiligo, n (%)	12 (43%)[a]
Duration of disease, mean ± SD (range), y	44.78 ± 4.12 (2-15)
History of thyroid disorder n (%)	0 (0%)
Baseline VASI (bothe groups)	93.07 ± 4.62

[a]Lost to follow-up (n = 2)

Outcome Measures

VASI.[24] The extent of depigmentation is expressed using the following scores: 0, 10, 25, 50, 75, 90, and 100, which indicate: (1) 100: no pigment has been demonstrated; (2) 90: pigmented speckles are present; (3) 75: the size of the depigmented region surpasses that of the pigmented region; (4) 50: the size of the depigmented and pigmented regions are equal; (5) 25: the size of the pigmented area surpasses that of the depigmented region; (6) 10: only a few depigmented specks are present; and (7) 0: no depigmented area is present. A higher modified VASI score indicates more severe vitiligo, whereas a lower VASI score indicates less severe vitiligo.

VAS. The pain scale's scores ranges between 0 = no pain and 10 = severe pain. All data were evaluated by an independent dermatologist who was blinded to treatment allocation.

Statistical Analysis

All data were evaluated using SPSS version 26 (IBM, Armonk, NY, USA). Differences in the scores between the two paired patches and between baseline and weeks 2, 6, and 12 were tested using the Wilcoxon signed-rank test. A *P* value of <.05 was considered statistically significant.

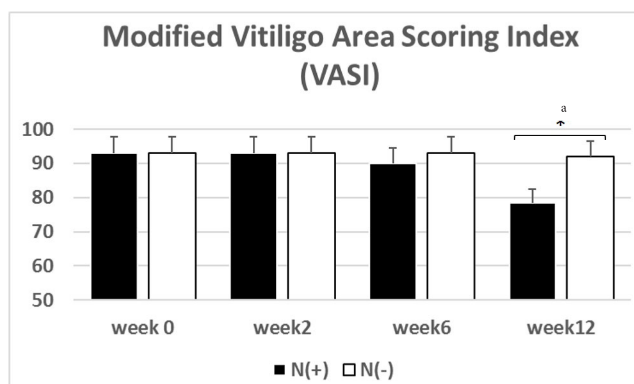
RESULTS

Patient demographics

Nine patients with 14 pairs of lesions (n = 28) were included in the study, and eight, with 13 pairs of lesions (n = 26), successfully completed the study. One participant dropped out of the study after 2 weeks due to personal reasons (Figure 3A). Of the nine participants, 44% were men and 56% were women, with a mean age of 55 ± 16.40 years.

The 26 vitiligo lesions included six facial patches, four acral patches, six extremity patches, and ten truncal patches,

Figure 4. Modified Vitiligo Area Scoring Index (VASI) from Baseline to Postintervention. N(+) identifies the intervention group; N(-) identifies the control group.



	Modified vitiligo area scoring index				
	Week 0	**Week 2**	**Week 6**	**Week 12**	
N(+)	93.07 ± 4.62	93.07 ± 4.62	90 ± 7.60	78.46 ± 15.24	*P* = .007[a,b]
N(-)	93.07 ± 4.62	93.07 ± 4.62	93.07 ± 4.62	91.92 ± 6.67	*P* = .317[c]
			P = .102[d]	*P* = .007[a,e]	

[a]*P* < .05

[b]Shaows a significant difference between baseline and postintervention for the N(+) group

[c]Shows no significant difference between baseline and postintervention for the N(-) group

[d]Shows a significant difference between the N(+) group and the N(-) group at week 6

[e]Shows a significant difference between the N(+) group and the N(-) group postintervention

Figure 5. Pain Evaluated by Visual Analog Scale (VAS)

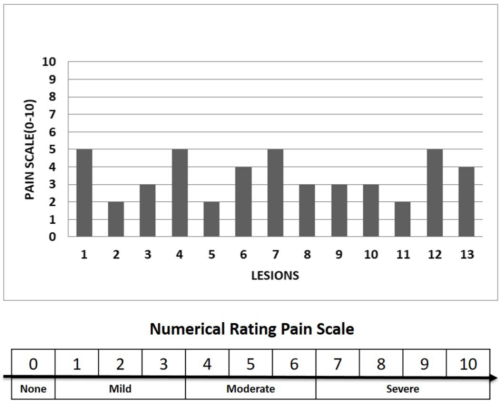


Figure 6. Acral Vitiligo Demonstrated a Marginal Repigmentation Pattern Postintervention for the Intervention Group. N(+) identifies the intervention group; N(–) identifies the control group.

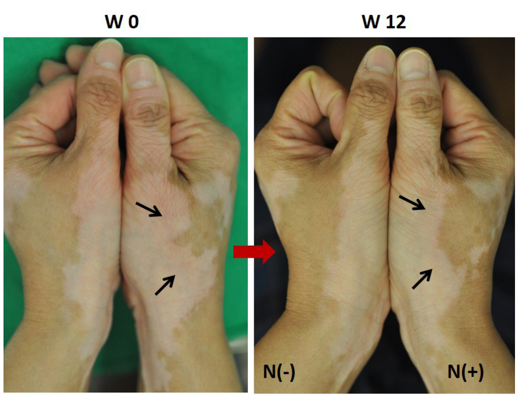
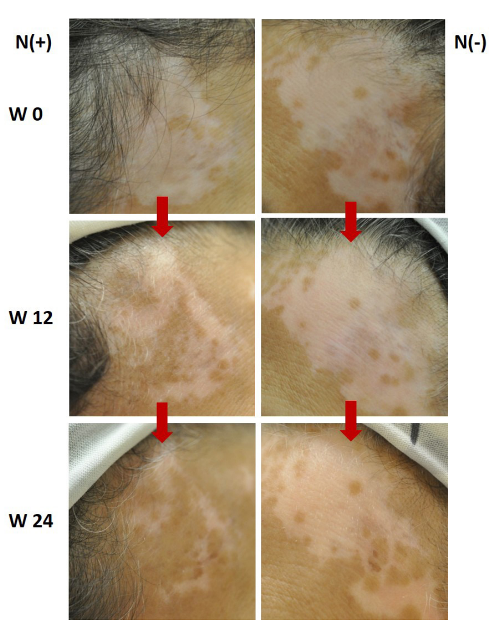


Figure 7. Follicular and Diffuse Repigmentation Pattern in the Surrounding Needling Areas. The pattern was more obvious postintervention, and the skin at week 24 shows the lasting efficacy. N(+) identifies the intervention group; N(-) identifies the control group.



and they were all treated. Participants' mean duration since the onset of vitiligo was 4.78 ± 4.12 years, with a range from 2 to 15 years. All participants had nonsegmental vitiligo (Figure 3B).

Modified VASI Score

Figure 4 presents the modified VASI scores for both groups from baseline through postintervention. At baseline, the modified VASI score of both groups was 93.07 ± 4.62. At week 2, this score of 93.07 ± 4.62 had been maintained in both groups.

Between baseline and week 6, the score had improved to 90.00 ± 7.60 in the intervention group, but the change wasn't significant ($P = .063$). The score for the control group was maintained at 93.07 ± 4.62.

Between baseline and postintervention, the intervention group's score had improved significantly to 78.46 ± 15.24 ($P = .007$), but the control group showed no significant difference at 91.92 ± 6.67 ($P = .317$).

A statistically significant difference was found between the intervention group and the control group in the change in scores postintervention ($P = .007$).

Adverse Events

Mild erythema without discomfort was observed for all participants after NBUVB phototherapy of the treated lesions. Microbleeding points and slight bruising were noted in the needling regions after surrounding needling, but no sequelae were found.

Pain

Most participants could tolerate the pain during the surrounding needling treatment; only two participants asked about local anesthesia. However, the participants stated that the pain was still considered to be tolerable if no local anesthesia were administered. No participant withdrew from the study owing to an inability to tolerate the pain.

At the end of the study, the pain was evaluated using a numerical rating pain scale for all lesions, and the score didn't exceed 5 for any of the lesions; the average score was 3.54 ± 1.2 (Figure 5).

Acral Vitiligo

Acral vitiligo relates to the distal aspects of the extremities, such as the hands, fingers, feet, and toes. The study found a marginal repigmentation pattern postintervention for the intervention group (Figure 6)

Follicular and Diffuse Repigmentation

Further analysis discovered not only marginal repigmentation but also a more follicular and diffuse repigmentation pattern in surrounding needling regions (Figure 7). The finding suggests that even stimulation in the peripheral margins of a vitiligo patch can trigger comprehensive repigmentation in whole lesions, and such stimulation demonstrated lasting effects even after surrounding needling treatment was stopped, at 12 weeks postintervention. This phenomenon indicates that surrounding needling therapy may have a complicated excitation mechanism to prompt repigmentation.

DISCUSSION

The current study used small acupuncture needles (ϕ0.16 mm × 7 mm) to perform surrounding needling, and like some prior studies,[8-10] confirmed the greater efficacy of surrounding needling with NBUVB phototherapy compared to that of NBUVB phototherapy alone.

While Bae et al found that the treatment response of hands and feet is extremely low[1] and Birlea et al found that regions where hair follicles occur at a low density—the hands and feet—rarely respond to treatment,[6] the current research team had theorized that repigmentation might occur if the combined treatment was able to induce a marginal repigmentation pattern by surrounding needling, even if the location was associated with a reduced ability to induce follicular pattern repigmentation. With respect to acral vitiligo, the current study found a marginal repigmentation pattern postintervention for the intervention group.

The current study also found not only marginal repigmentation but also a more follicular and diffuse repigmentation pattern in surrounding needling regions. The finding suggested that stimulation in the peripheral margins of a vitiligo patch could trigger comprehensive repigmentation in whole lesions, and such stimulation demonstrated lasting effects even after surrounding needling treatment was stopped. This phenomenon indicated that surrounding needling therapy may have a more complicated excitation mechanism to prompt repigmentation.

With the use of acupuncture needles rather than 30-gauge needles, fire needling, or electrocautery needling, the current research team observed only mild erythema after NBUVB phototherapy at the treated sites and no differences between the intervention group and the control group. The adverse events after surrounding needling were microbleeding points and slight bruising only, and no sequelae were found. The team didn't observe oozing of small drops of blood, as had been reported previously with 20-gauge needle pricks.[9]

Although pain had not been evaluated statistically in previous studies, theoretically, thinner needles without heat cause smaller wounds and less pain. All participants in the current study could tolerate the needling process, and the impression of pain due to the surrounding needling treatment was mild to moderate; the average pain score was 3.54 ± 1.2. Other complications, such as the Koebner phenomenon after treatment, wound infection, and scar formation, weren't observed in the current study.

The limitations of the current study include the small sample size, the open-label study design, and investigation of stable nonsegmental vitiligo only. However, even with a small number of participants, the research team noticed a meaningful improvement in the intervention group. Surrounding needling in combination with NBUVB phototherapy may be a promising new treatment for stable nonsegmental vitiligo, especially acral vitiligo. The team doesn't suggest this option for treating active vitiligo because of the lack of clinical efficacy and safety data for that type of disease. Future long-term, large-scale, double-blind, randomized controlled trials are warranted to better understand the efficacy of this combination treatment method and any associated adverse events.

CONCLUSION

This clinical trial demonstrated that surrounding needling in combination with NBUVB phototherapy was more effective than NBUVB phototherapy alone in treating stable nonsegmental vitiligo, and the combined therapy was safe and tolerable. The combined therapy may be a promising new treatment for stable nonsegmental vitiligo. Future studies with larger sample sizes and long-term follow-up are warranted.

AUTHORS' DISCLOSURE STATEMENT

This study was supported in part by a research grant (2018SKHADR016) from Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan. The authors had no conflicts of interest related to the study.

REFERENCES

1. Bae JM, Jung HM, Hong BY, Lee JH, Choi WJ, Lee JH, Kim GM. Phototherapy for vitiligo: A systematic review and meta-analysis. *JAMA Dermatol.* 2017; 153(7):666-74.
2. Prasad PVV, Bhatnagar VK. Medico-historical study of Kilasa (vitiligo/leucoderma) a common skin disorder. *Bull Indian Inst Hist Med Hyderabad.* 2003; 33:113-27.
3. Speeckaert R, van Geel N. Vitiligo: An update on pathophysiology and treatment options. *Am J Clin Dermatol.* 2017; 18:733-44.
4. Bishnoi A, Parsad D. Clinical and molecular aspects of vitiligo treatments. *Int J Mol Sci.* 2018; 19:1509.
5. Esmat S, Hegazy RA, Shalaby S, Chu-Sung Hu S, Lan CCE. Phototherapy and combination therapies for vitiligo. *Dermatol. Clin.* 2017; 35:171-92.
6. Birlea SA, Goldstein NB, Norris DA. Repigmentation through melanocyte regeneration in vitiligo. *Dermatol Clin.* 2017; 35(2):205-18.
7. Savant SS. Surgical therapy of vitiligo: Current status. *Indian J Dermatol Venereol Leprol.* 2005; 71:307-10.
8. Ahmad TJ, Rashid T, Rani Z. Needling: An adjunct to narrowband ultraviolet B therapy in localised fixed vitiligo. *JPAD.* 2008; 18:149-53.
9. Sheikh I. Needle sheikhing treatment of vitiligo. *Malays J Dermatol.* 2010; 24:165.
10. Zawar VP, Karad GM. Needling in unresponsive stable vitiligo. *J Am Acad Dermatol.* 2016; 75(5):e199-e200.
11. Wang T, Ren Y, Di D, Zhu Q, Luo G. Segmental vitiligo treated by fire needle therapy: A case series. *Eur J Dermatol.* 2018; 28(1):118-119.
12. Yang L, Wong P M, Yang L, Katayama I, Wu H, Zhang Huimin. Electrocautery needling and the 308-nm excimer lamp: A synergistic combination for the treatment of stable nonsegmental vitiligo. *Dermatol Ther (Heidelb).* 2020; 10:695-705.
13. Gang X, Chao-Sheng Z, Wei-Zhen T, Jie X, Gang X, Xiu-Li L, Qing W, Chao C, Wen L, Hai-Dong C, Li-Dong W. Neuroprotective effect of surround needling combined with acupoint injection on acute herpetic neuralgia. *Zhongguo Zhen Jiu.* 2019; 39:371-6.
14. Xukai-sheng X, Wei-pei L, Jian-ying C, Lu-chang, Zhi-hua H. Efficacy observation on rear thigh muscles strain of athletes treated with surrounding needling of electroacupuncture and hot compress of Chinese medicine. *Zhongguo Zhen Jiu.* 2012; 32:511-4.
15. Xin-qun X, Yao-xing C, Feng L, Yu M, Lu D. Observation on therapeutic effect of surrounded needling therapy on acute gouty arthritis. *Zhongguo Zhen Jiu.* 2009; 29:375-7.
16. Schmitt L, Marquardt Y, Amann P, Heise R, Huth L, Wagner-Schiffler S, Huth S, Baron JM. Comprehensive molecular characterization of microneedling therapy in a human three-dimensional skin model. *PLoS One.* 2018; 13(9):e0204318.
17. Zeitter S, Sikora Z, Jahn S, Stahl F, Straub S, Lazaridis A, Reimers K, Vogt PM, Aust MC. Microneedling: Matching the results of medical needling and repetitive treatments to maximize potential for skin regeneration. *Burns.* 2014; 40(5):966-73.
18. Lévesque M, Feng Y, Jones RA, Martin P. Inflammation drives wound hyperpigmentation in zebrafish by recruiting pigment cells to sites of tissue damage. *Dis Model Mech.* 2013 Mar; 6(2):508-15.
19. Sugata K, Kitahara T, Takema Y. Changes of human skin in subepidermal wound healing process. *Skin Res Technol.* 2008; 14:436-9.
20. Chou WC, Takeo M, Rabbani P, Hu H, Lee W, Chung YR, Carucci J, Overbeek P, Ito M. Direct migration of follicular melanocyte stem cells to the epidermis after wounding or UVB irradiation is dependent on Mc1r signaling. *Nat Med.* 2013 Jul; 19(7):924-92.
21. Taylor G, Lehrer MS, Jensen PJ, Sun TT, Lavker RM. Involvement of follicular stem cells in forming not only the follicle but also the epidermis. *Cell.* 2000; 102:451-461.
22. Ito M, et al. Stem cells in the hair follicle bulge contribute to wound repair but not to homeostasis of the epidermis. *Nat Med.* 2005; 11:1351-1354.
23. Cui J, Shen LY, Wang GC. Role of hair follicles in the repigmentation of vitiligo. *J Invest Dermatol.* 1991; 97:410-416.
24. Hamzavi I, Jain H, McLean D, Shapiro J, Zeng H, Lui H. Parametric modeling of narrowband UV-B phototherapy for vitiligo using a novel quantitative tool: The Vitiligo Area Scoring Index. *Arch Dermatol.* 2004; 140:677-83.