

Efficacy of Topical 5-Fluorouracil Combined with Microneedling in the Treatment of Stable Vitiligo

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ABSTRACT

Objective: To examine the effectiveness of topical 5-Fluorouracil combined with microneedling in treating stable vitiligo.

Study Design: A clinical prospective trial.

Place and Duration of the Study: Department of Dermatology, Azadi Teaching Hospital, Duhok, Iraq, from October 2024 to January 2025.

Methodology: Twenty-two patients with stable vitiligo were treated with topical 5-Fluorouracil 5% cream combined with microneedling (Dermapen) and evaluated by the McNemar test. The procedure was performed every two weeks for three months. The normality of the continuous variables was examined using a Q-Q plot. JMP[®] version 18.0 (SAS Institute Inc., Cary, NC, 1989–2023) was used for statistical analysis.

Results: Patients with stable vitiligo had the disease affecting the upper limbs (35.0%), the head and neck (30.0%), lower limbs (25.0%), and trunk (10.0%). According to the study, patients showed a significant improvement in their clinical status from visits two to five compared with the first visit, with a 30–55% improvement. At the final session, the distribution of responses was as follows: excellent (30%), good (10%), moderate (10%), and poor (5%), with no response observed in 45% of patients. A similar pattern was evident in patient satisfaction levels.

Conclusion: The use of topical 5-Fluorouracil in combination with microneedling is an effective treatment for stable vitiligo.

Key Words: 5-Fluorouracil cream, Microneedling, Pigmentation, Vitiligo.

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INTRODUCTION

Vitiligo is an autoimmune condition characterised by well-defined depigmented patches and macules due to the destruction of melanocytes in the skin, mucous membranes, and hair follicles.¹ As a general rule, vitiligo occurs worldwide with a global prevalence of 1%. Although the condition can present at any time, studies have shown that it usually develops during early adulthood.²

Although many treatment modalities exist to regain pigmentation, there is still no universally accepted treatment for this challenging disease.³ 5-Fluorouracil (5-FU) functions as an antimitotic agent, making it evident that topical 5-FU serves as an effective treatment for various dermatological conditions such as warts, seborrheic keratosis, keloids, and superficial basal cell carcinoma.⁴

Microneedling using a Dermapen device is a safe, straightforward, and cost-effective procedure that improves absorption by penetrating the upper layer of the epidermis. The minor abrasions produced by the microneedles induce slight bleeding and activate the release of various growth factors, including platelet-derived growth factor (PDGF), transforming growth factor-alpha and beta, and fibroblast growth factor (FGF).⁵ This study aimed to evaluate the efficacy of combining 5-FU with microneedling for the treatment of stable vitiligo.

METHODOLOGY

This clinical trial was carried out prospectively at the Department of Dermatology, Azadi Teaching Hospital, Duhok, Iraq, from October 2024 to January 2025, after receiving the ethical approval from the Higher Council of Medical Specialists (Reference No. 1685; date: 17/7/2024).

The study involved a sample of twenty-two patients of both genders, aged 12 years or older, who were diagnosed with stable vitiligo. The patients received 5-FU as the treatment in this study. Patients aged 12 years and older with stable vitiligo—defined as no new lesions, no expansion of existing lesions, and no Koebner phenomenon for at least six months—were eligible for inclusion.

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Participants were required to have discontinued systemic vitiligo treatments for at least three months and topical treatments for at least one month prior to enrolment. Exclusion criteria included active vitiligo (e.g., new or enlarging lesions or Koebner phenomenon), local or systemic infections, pregnancy or lactation, immunosuppressive conditions or ongoing immunosuppressive therapy (such as HIV infection, chemotherapy, or long-term corticosteroid use), and a history of keloid or hypertrophic scarring.

The selected area was numbed using topical lidocaine cream. Microneedling of the vitiligo region was conducted utilising a Dermapen at the lowest speed. Needle penetration depths ranged from 0.25 to 0.5 mm for facial areas and 1-2 mm for body areas. The needling was performed in both horizontal and vertical directions until pinpoint bleeding was observed. After microneedling, 5-FU cream was applied to the vitiligo patches. The cream was applied once daily for one week under occlusion. Following this, a topical antibiotic (fusidic acid 2% cream) was applied for two weeks. Topical 5-FU (5% cream) was applied immediately after microneedling. The quantity was not calculated per cm², but a thin, uniform layer sufficient to cover the lesional area was used consistently for all patients.

Clinical improvement was evaluated every two weeks during the study and again three months after the final session using serial clinical photographs. Two blinded dermatologists conducted an objective clinical assessment at baseline and three months post-treatment to evaluate the degree of depigmentation.

The repigmentation response was graded as G0: no response, G1: <25% repigmentation (poor), G2: 25-50% repigmentation (moderate), G3: 51-75% repigmentation (good), and G4: >75% repigmentation (excellent). The possible adverse events of each session were recorded in the pre-designed questionnaire. The pain level of the patients at each session was determined using a numerical pain scale ranging from 1 to 10.

The descriptive statistics were presented in mean (SD) or frequency (percentage). The normality of the continuous variables was examined using a Q-Q plot. The McNemar test was used to compare the clinical response and patient satisfaction in individuals with stable vitiligo treated with topical 5-FU combined with microneedling between the first and subsequent visits. JMP® version 18.0 (SAS Institute Inc., Cary, NC, 1989-2023) was used for statistical analysis.

RESULTS

The mean age of the patients with stable vitiligo was 25.3 (14-50 years). The patients were males (25%) and females (75%). The disease duration was from 12 to 180 months.

Most participants had a disease duration greater than 36 months (65%), followed by 12-24 months (25%) and 25-36 months (10%). The disease manifested gradually (30%) and suddenly (70%), with all cases being localised. The mean duration of stability was 38.15 months, mostly located within 6-12 months. No patient had itching, and only two patients had medical history: one with hypothyroidism and one with atopic dermatitis. The study found that most patients with stable vitiligo had no familial history of vitiligo (90%). Only two patients had a positive family history. Only one patient received regular treatment for other diseases, and no patient had a history of medication allergy. The study found that 12 patients had received previous treatment within one month, including topical glucocorticosteroids (n = 11) and herbal or traditional therapy (n = 1). The sites of lesions were mostly located in the upper limbs (35%), followed by the head and neck (30%), lower limbs (25%), and trunk (10%). All patients had homogenous chalky white lesions under Woods' Lamp and well-defined borders, with no cases of halo nevi. Two patients had leukotrichia. Most had a single lesion (90%), followed by three lesions (5.0%), and one patient had eight lesions (5.0%; Table I).

Table I: Disease-related information of patients with stable vitiligo.

Characteristics (n = 20)	Statistics	
	Number	Percentages
Duration of disease (12-180 months)	80.4	50.18
Disease duration		
12-24 months	5	25.0
25-36 months	2	10.0
>36 months	13	65.0
Onset		
Gradually	6	30.0
Suddenly	14	70.0
Site	20	100.0
Localised		
Duration of stability (6-120 months)	38.15	40.15
Std Err Mean: 8.98		
Stability duration		
6-12 months	10	50.0
13-24 months	3	15.0
>24 months	7	35.0
Itching	20	100.0
No		
Medical History		
No	18	90.0
Atopic dermatitis	1	5.0
Hypothyroidism	1	5.0
Family history of vitiligo	2	10.0
Past surgical history	0	0.0
Regular treatment of other diseases	1	5.0
History of allergy to medications	0	0.0
Previous treatment of vitiligo lesions within one month		
No	8	40.0
Herbal or traditional therapy	1	5.0
Topical glucocorticosteroids	11	55.0
Site of lesion		
Lower limbs	5	25.0
Upper limbs	7	35.0
Head and neck	6	30.0
Trunk	2	10.0
Homogeneous chalky white lesion by Woods'	20	100.0
Lamb		
Border of lesion (Well defined)	20	100.0
Halo nevi	0	0.0
Leukotrichia	2	10.0
Number of lesions		
1	18	90.0
3	1	5.0
8	1	5.0

Table II: Patients' response and satisfaction with topical 5-FU combined with microneedling on different visits.

No. of visits	Response no (%)			Response levels no (%)					p (compared to visit 1)
	No response	Positive response	p (compared to visit 1)	No response	Poor response	Moderate response	Good response	Excellent response	
Visit 1	19 (95.0)	1 (5.0)		19 (95.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.0)	
Visit 2	14 (70.0)	6 (30.0)	0.0253	14 (70.0)	3 (15.0)	2 (10.0)	0 (0.0)	1 (5.0)	0.4159
Visit 3	12 (60.0)	8 (40.0)	0.0082	12 (60.0)	1 (5.0)	2 (10.0)	4 (20.0)	1 (5.0)	0.4289
Visit 4	9 (45.0)	11 (55.0)	0.0016	9 (45.0)	2 (10.0)	2 (10.0)	4 (20.0)	3 (15.0)	0.1886
Visit 5	9 (45.0)	11 (55.0)	0.0016	9 (45.0)	1 (5.0)	2 (10.0)	2 (10.0)	6 (30.0)	0.1886

The McNemar test was performed for statistical analysis.

The study showed that patients with stable vitiligo experienced significant clinical improvement at visits 2-5 compared with the first visit. The rates of positive response were 30% (visit 2; $p = 0.0253$), 40% (visit 3; $p = 0.0083$), and 55% (visits 4 and 5; $p = 0.0016$). However, no significant improvement was observed in response levels (poor, moderate, good, and excellent) compared with the first visit (Table II). The mean pain score did not increase significantly compared to the first visit.

The most common adverse event was erythema, observed across all visits, followed by ulceration in two patients, both occurring after the first visit. The study found no significant difference in adverse events between the first and subsequent visits in patients with stable vitiligo treated with topical 5-FU combined with microneedling. Patient satisfaction improved significantly compared with the first visit.

DISCUSSION

This study showed that the application of 5-FU in patients with stable vitiligo is an effective therapeutic approach, improving clinical status, with no serious adverse events observed. Most studies in the literature reported similar findings, although the rates of response are different across different studies. For example, Sharma *et al.* reported excellent repigmentation in 30% of cases, following ten sessions conducted at two-week intervals and a six-month follow-up.⁶ However, Pazyar *et al.* reported that only 6.7% of patients exhibited excellent repigmentation after a six-month follow-up,⁵ Khafagy *et al.* reported a 3.7% improvement in their study.⁷

5-FU stimulates melanocyte growth within hair follicles, promoting their migration to the epidermis, where they synthesise melanin.⁸ The process of needling induces a notable inflammatory reaction characterised by localised swelling, leading to the widening of intercellular spaces within the basal layer. This expansion allows active melanocytes to migrate from the pigmented epidermis through the enlarged intercellular areas. The migration and proliferation of melanocytes are supported by inflammatory mediators such as leukotrienes C4 and D4, along with matrix metalloproteinases generated by keratinocytes.⁹

The study by Shashikiran *et al.*, which investigated the effect of topical 5-FU combined with needling, reported that 49% of the patches achieved more than 75% repigmentation, while

26% exhibited 50-75% repigmentation.¹⁰ A study conducted by Mina *et al.* also observed higher overall repigmentation in patches treated with 5-FU. Notably, 48% of the patches treated with 5-FU exhibited excellent improvement, compared with those treated with microneedling combined with tacrolimus.¹¹ The better outcomes in these studies may be attributed to larger sample sizes and longer treatment durations. Galal *et al.* reported an even higher improvement rate, with 56.7% of patches achieving very good to excellent responses to the treatment.¹² Galal's study used topical 5-FU at a concentration of 0.5%, not 5%, for the treatment of vitiligo.

A research study conducted by Levy *et al.* demonstrates this phenomenon, revealing that a greater proportion of FU was retained in the skin following topical application of the 0.5% cream compared with the 5% formulation.¹³ The carbon dioxide (CO₂) laser has been used as an alternative to microneedling in combination with topical 5-FU, as reported by Mohamed *et al.*, achieving good to excellent results in 55% of cases.¹⁴ The superior outcomes in this study were attributed to the CO₂ laser's ability to induce greater inflammation, which enhanced melanocyte migration and facilitated deeper penetration of 5-FU into the skin.¹⁵

Due to technological difficulties, integration of patients from different medical settings was not possible. In addition, the results might not be representative of patients in various contexts. The combination of 5-FU and microneedling represents a potentially effective treatment strategy for stable vitiligo. However, due to variability in patient responses, further research, involving larger sample sizes and extended follow-up durations, is needed.

CONCLUSION

This study showed that 5-FU delivered through the microneedling technique is an effective way to improve the clinical condition of patients with stable vitiligo.

ETHICAL APPROVAL:

The ethical approval was obtained from the Kurdistan Board for Medical Specialists in Erbil, Kurdistan Region, Duhok, Iraq (No. 1685; dated: 17 July 2024).

PATIENTS' CONSENT:

Written informed consent was obtained from all patients before the initiation of the study.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

NMBA: Conception of the study, diagnosis, intervention, follow-up, measurements, review, and analysis.

DSQ, BKS: Conception and design of the study, review, and analysis.

All authors approved the final version of the manuscript to be published.

REFERENCES

1. Zahra FT, Adil M, Amin SS, Mohtashim M, Bansal R, Khan HQ. Efficacy of topical 5% 5-fluorouracil with needling *versus* 5% 5-fluorouracil alone in stable vitiligo: A randomized controlled study. *J Cutan Aesthet Surg* 2020; **13(3)**:197-203. doi: 10.4103/JCAS.JCAS_12_20.
2. Desai VA, Momin AM, and Vaishnani JB. Effect of topical 5% 5-fluorouracil with microneedling in vitiligo patients as an additional modality to standard treatment at tertiary care hospital. *Indian Dermatol Online J* 2024; **15(3)**:443-8. doi: 10.4103/idoj.idoj_774_23.
3. Ebrahim HM and Albalate W. Efficacy of microneedling combined with tacrolimus *versus* either one alone for vitiligo treatment. *J Cosmet Dermatol* 2020; **19(4)**:855-62. doi: 10.1111/jocd.13304.
4. Moore AY. Clinical applications for topical 5-fluorouracil in the treatment of dermatological disorders. *J Dermatol Treat* 2009; **20(6)**:328-35. doi: 10.3109/09546630902789326.
5. Pazyar N, Hatami M, Yaghoobi R, Parvar SY, Radmanesh M, Hadibarhaghtalab M. The efficacy of adding topical 5-fluorouracil to micro-needling in the treatment of vitiligo: A randomized controlled trial. *J Cosmet Dermatol* 2023; **22(5)**:1513-20. doi: 10.1111/jocd.15616.
6. Sharma S, Matharoo P, and Bassi R. Evaluation of combination of microneedling with tacrolimus in the treatment of stable vitiligo. *J Portug Soc Dermatol Venereol* 2021; **79(3)**:227-31. doi: 10.29021/spdv.79.3.1336.
7. Khafagy N, Hassen S, Ezat F, and Elhawaty A. Comparing the efficacy of micro-needling alone *versus* micro-needling with topical 5-fluorouracil in treating stable non-segmental vitiligo. *Egypt J Hosp Med* 2023; **90(1)**:1960-7. doi: 10.21608/ejh-m.2023.284771.
8. Kim S, Woo YR, Cho SH, Lee JD, and Kim HS. Clinical efficacy of 5-fluorouracil and bleomycin in dermatology. *J Clin Med* 2024; **13(2)**:335. doi: 10.3390/jcm13020335.
9. Anbar TS, El-Ghareeb IM, Assaf MI, Abdel-Rahman AT, El-Khayyat MA, Albalat WA. The effect of ER: YAG plus 5-fluorouracil on the outcome of punch grafting in nonsegmental vitiligo: A left-right comparative study. *Egypt J Dermatol Venereol* 2016; **36(1)**:4-10. doi: 10.4103/1110-6530.194154.
10. Shashikiran A, Gandhi S, Muruges S, and Kusagur M. Efficacy of topical 5% fluorouracil needling in vitiligo. *Indian J Dermatol Venereol Leprol* 2018; **84(2)**:203-5. doi: 10.4103/ijdv.IJD-VL_386_16.
11. Mina M, Elgarhy L, Al-saeid H, and Ibrahim Z. Comparison between the efficacy of microneedling combined with 5-fluorouracil vs microneedling with tacrolimus in the treatment of vitiligo. *J Cosmet Dermatol* 2018; **17(5)**:744-51. doi: 10.1111/jocd.12440.
12. Galal SA, Ali MM, and Elzeiny FRE. Evaluation of efficacy and safety topical 5-fluorouracil 0.5% in treatment of resistant vitiligo [alone or after microneedling]; a pilot study. *Int J Med Arts* 2021; **3(4)**:1803-10. doi: 10.21608/ijma.2021.89242.1347.
13. Levy S, Furst K, and Chern W. A novel 0.5% fluorouracil cream is minimally absorbed into the systemic circulation yet is as effective as 5% fluorouracil cream. *Cutis* 2002; **70(2 Suppl)**:14-21.
14. Mohamed HA, Mohammed GF, Gomaa AH, Eyada MM. Carbon dioxide laser plus topical 5-fluorouracil: A new combination therapeutic modality for acral vitiligo. *J Cosmet Laser Ther* 2015; **17(4)**:216-23. doi: 10.3109/14764172.2014.1003241.
15. Wenande E, Olesen UH, Nielsen MM, Janfelt C, Hansen SH, Anderson RR, *et al*. Fractional laser-assisted topical delivery leads to enhanced, accelerated and deeper cutaneous 5-fluorouracil uptake. *Expert Opin Drug Deliv* 2017; **14(3)**:307-17. doi: 10.1080/17425247.2017.1260119.

