Case Series

Plasma Exeresis Therapy in Combination with Narrowband Ultraviolet B Phototherapy; A Novel Approach to Achieving Repigmentation in Vitiligo

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ABSTRACT

Objective: To determine the role of plasma exeresis in causing repigmentation in patients with vitiligo.

Methodology: After obtaining ethical approval, a case series was conducted at Madinah Teaching Hospital, Faisalabad, over a period of three months from December 2021 to February 2022.Six patients with vitiligo were selected on the basis of pre-determined inclusion criteria. They were undergoing narrowband ultraviolet B (NBUVB) phototherapy along with topical calcineurin inhibitors application. They were subjected to 3 sessions of plasma exeresis under topical anaesthesia. They were followed up on a weekly basis, and results were noted with the help of serial photographs and physician assessments. Patient satisfaction with the treatment was also noted.

Results: One out of the six patients was lost to follow up. The VASI scores for the treated patches showed a significant decrease. The patient satisfaction according to Likert scale was recorded as 5 for all five remaining patients at the end point.

Conclusion: Plasma exeresis therapy has proven to be a safe and effective new modality for treating stable vitiligo in patients with Fitzpatrick skin types IV to VI

KEYWORDS*:* Phototherapy, Plasma Exeresis, Ultraviolet, Vitiligo

INTRODUCTION

Vitiligo is an autoimmune condition affecting 0.2 to 1.8 percent of the world population.[1] It affects both genders equally and is characterized by well-defined depigmented patches, usually distributed in a symmetrical manner.[2] The presence of high volume of circulating cytotoxic T lymphocytes with altered $CD4^+/CD8^+$ ratios and melanocyte-specific T-cell responses favors the autoimmune etiology of vitiligo.[3] It has also been established that vitiligo can lead to major depressive disorder and social isolation.[4] Moreover, in certain areas of the world, it is associated with significant social stigma.[2] It is therefore important to treat vitiligo effectively to help these patients. Plasma exeresis is a modern-era technology that works by ionizing atmospheric gases to generate plasma in the affected tissue. It has been used successfully in a variety of skin conditions including removal of benign skin abnormalities; fibromas, keratosis, dermal naevi and xanthelasmas, with minimal side effects. It showed encouraging results in patients with active acne and acne scars as well.[5] Another impressive application is in non-surgical blepharoplasty that has gained immense popularity recently.[6] Its involvement in hybrid lifting homologous method has also shown promising advancement in non-surgical full face-lift.[7]

The application of plasma exeresis has been mostly studied in individuals with Fitzpatrick skin types I, II, and III worldwide. Therefore, there is inadequate evidence regarding its effect in people of colour

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(Fitzpatrick skin types IV–VI). One of the side effects that has been reported in people of colour is hyperpigmentation after the scab removal following exeresis.[8] This hyperpigmentation was seen to be of variable duration as seen in a study in which post inflammatory hyperpigmentation was reported after plasma exeresis in peri-orbital area.[8] Despite application of various treatment modalities, vitiligo remains one of the most prevalent pigmentary disorders, often difficult to treat and prone to frequent relapses. Plasma exeresis has been reported to cause post-inflammatory hyperpigmentation in patients with Fitzpatrick skin types IV and V. Since vitiligo is a pigmentary disorder characterized by depigmentation, this study aimed to investigate the potential of plasma exeresis in causing repigmentation in patients with vitiligo. In our study, we made use of the post-inflammatory hyperpigmentation caused by plasma exeresis by using it on stable vitiligo patches. Improvement in pigmentation was evaluated using a physician assessment scale supported by serial photographs, along with an assessment of patient satisfaction.

METHODOLOGY

This case series included six patients with stable vitiligo for past three months. The group consisted of five females and one male, aged between 15 and 60 years, who had received a minimum of eight sessions of narrow-band ultraviolet B (NBUVB) phototherapy. After obtaining ethical approval (vide letter No. TUF/IRB/217/21), the study was conducted at Madinah Teaching Hospital, Faisalabad, over a three-month period from December 2021 to February 2022. One patient was lost to follow-up. The Vitiligo Area Scoring Index (VASI) was used to assess disease severity, calculated as follows:

VASI = ∑ [Hand Units] × [Residual Depigmentation]

The study excluded patients with co-morbid conditions such as hypertension and diabetes, any autoimmune or inflammatory skin conditions, skin infections, unstable vitiligo and vitiligo patches on the face.

After obtaining the written informed consent, clinical photographs were taken prior to the start of treatment. The Vitiligo Area Scoring Index (VASI) was calculated for each patient, and the Likert scale was used to assess patient satisfaction. These patients also continued the NBUVB phototherapy according to standard phototherapy protocols. Plasma exeresis was done on selected patches on the trunk and limbs after the application of topical anesthesia, in a criss-cross grid manner. Following the procedure, the patients were instructed to apply topical tacrolimus twice daily on the affected area and to use sunscreen during the daytime. They were assessed on a weekly basis and plasma exeresis was done at the interval of three weeks on the selected vitiligo patches. The treatment continued either until complete repigmentation (100%) was achieved or for a maximum of five sessions of plasma exeresis therapy.

RESULTS

A total of six patients were enrolled in the study; however, one patient (patient 3) was lost to follow-up. Among the remaining five patients, all demonstrated a marked improvement in pigmentation, reflected by a significant reduction in their VASI scores.

Three patients (patients 1, 2, and 6) achieved complete repigmentation (VASI = 0) after just the first session of plasma exeresis therapy. Two other patients (patients 4 and 5) showed substantial improvement, with their VASI scores decreasing from 45 to 6.6 and 49.5 to 16.5, respectively, after multiple sessions.

All five patients who completed the study reported maximum satisfaction (Likert score = 5), indicating a high level of contentment with the treatment outcomes. Overall, the results suggest that plasma exeresis therapy, in conjunction with NBUVB phototherapy and topical tacrolimus, is highly effective in inducing repigmentation in stable

vitiligo, with rapid results and excellent patient satisfaction. The results are summarized in the table (table 1)

Table 1: Results of patients according to VASI scoring and Likert scale.

Patient no.	Age/ Gender	VASI score before first session	VASI score at the end of the sessions	Patient satisfaction (Likert scale)
1	18/F	33	0 (after 1st session)	5
2	20/F	50	0 (after 1st session)	5
3	28/M	45	Patient lost to follow-up	-
4	23/F	45	6.6 (after 4 sessions)	5
5	15/F	49.5	16.5 (after 3 sessions)	5
6	13/F	44	0 (after 1st session)	5

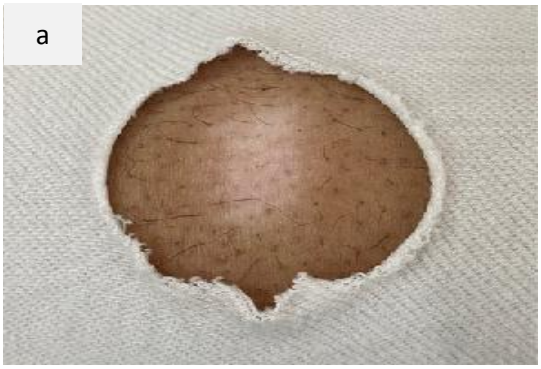
Figure 1: Patient 1, 18 years old, female patient with stable vitiligo patch on left wrist.

Patient with stable vitiligo patch on left wrist

First session of plasma exeresis done

Complete removal of scab and repigmentation seen after 3 weeks

Figure 2: Patient 2, 20 years old, female patient with stable vitiligo patch on right knee.



Patient with stable vitiligo patch on right knee

First session of plasma exeresis done

Complete removal of scab and repigmentation seen after 3 weeks

Figure 3: Patient 4, 23 years old, female patient with stable vitiligo patch on right leg.

Patient with stable vitiligo patch on right leg

First session of plasma exeresis done

Complete removal of scab and repigmentation along with speckled hyperpigmentation seen after 3 weeks

Figure 4: Patient 5, 15-year-old female with stable vitiligo patch on left lower leg.

Patient with stable vitiligo patch on left lower leg

Second session of plasma exeresis done after 3 weeks, as complete repigmentation was not achieved

Complete removal of scab and repigmentation along with speckled hyperpigmentation seen after 3 weeks of the second session

DISCUSSION

The objective of our trial was to find out a more effective, economical and quick way to help patients suffering from vitiligo. Considering the well-established impact of vitiligo on patients' quality of life, we initiated this clinical trial at Madinah Teaching Hospital, Faisalabad. The application of plasma exeresis in the treatment of vitiligo has never been investigated before, although some articles have reported one of its prominent side effects—hyperpigmentation. Our study effectively utilized this phenomenon to induce hyperpigmentation in the stable vitiligo patches and has succeeded in its goal in only five treatment sessions. There are various skin diseases involving the Koebner Phenomenon, which is the development of hypo-pigmented lesions at the site of trauma.[9] Vitiligo also exhibits this phenomenon, but in an all-or-none pattern, occurring only in generalized vitiligo patches.[10] However, these hypopigmented lesions are hypomelanotic,

whereas vitiligo lesions are amelontic.[9] On the contrary, the resolution of an affected skin lesion after trauma is known as remote reverse Koebner phenomenon or satellite repigmentation.10 There has also been a case report suggesting a remote reverse Koebner Phenomenon, in which spontaneous repigmentation took place in stable vitiligo patches distant from the patches treated by autologous punch grafting technique.[11]Moreover, use of punch grafting has been reported to be a successful surgical treatment modality, proving reverse Koebner phenomenon in stable vitiligo patches.[12] In our trial, the lesser known side effect of plasma exeresis was used to induce repigmentation in vitiligo patches.Plasma-based technologies have garnered interest in dermatology for their ability to induce controlled epidermal injury and modulate local inflammatory and redox pathways. While descriptive reports exist for plasma exeresis in aesthetic dermatology, controlled data on plasma exeresis specifically for vitiligo are scarce. Related modalities, notably cold atmospheric plasma (CAP), have demonstrated promising repigmentation in preclinical models and small clinical trials, likely via immunomodulatory and wound-healing mechanisms.[13] Plasma exeresis differs fundamentally from CAP in that it relies on a localized thermal arc to induce controlled epidermal sublimation, whereas CAP operates through non-thermal reactive species without tissue ablation. Despite differing mechanisms, both share downstream effects on wound healing and melanocyte activation, which may explain the observed repigmentation. Separately, regenerative adjuncts such as platelet-rich plasma and fractional lasers show improved repigmentation when combined with phototherapy, supporting the principle that a local tissue stimulus can synergize with light therapy.[14-17] A local study by Ahmad et al. evaluated the effectiveness of autologous skin punch grafting in patients with localized, stable vitiligo. The study demonstrated that punch grafting is a simple, cost-effective, and reliable surgical technique that leads to good repigmentation in well-selected patients.[18] Unlike autologous skin punch grafting, plasma exeresis is a noninvasive technique that shows good cosmetic results. Our case series adds to this emerging evidence by showing objective reduction in VASI scores and high patient satisfaction when plasma exeresis is combined with NBUVB phototherapy and topical calcineurin inhibitors. Nevertheless, the current literature is limited by small sample sizes, heterogenous protocols, and short follow-up; larger randomized controlled trials with standardized plasma parameters are needed to confirm efficacy and durability. The findings of this study highlight a novel approach to inducing repigmentation in vitiligo. The results and the improvement in VASI scoring indicate that plasma exeresis therapy has proven to be a safe and effective new modality for treating stable vitiligo in patients with Fitzpatrick skin types IV to VI.

CONCLUSION

Plasma exeresis appears to be a safe and potentially effective adjuvant therapy for inducing repigmentation in stable vitiligo. In this small case series, all patients who completed treatment demonstrated visible clinical improvement and reported high satisfaction levels. These preliminary findings suggest a possible synergistic effect when combined with narrowband ultraviolet B phototherapy and topical calcineurin inhibitors. Further large-scale, controlled studies are warranted to validate these results and establish standardized treatment protocols.

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