SSR Institute of International Journal of Life Sciences
ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Barnwal *et al*., 2025
doi: 10.21276/SSR-IIJLS.2025.11.4.22

Original Article

open access

Effect of Platelet-Rich Plasma in Vitiligo: A Single-Arm Prospective Study

Parijat Barnwal[1]*, Sundiep Kumar[2], Jaishree Noor[3]

[1]Consultant Dermatologist, Sri Bhagwat Polyclinic, Bramhsthan, Azamgarh, Uttar Pradesh, India
[2]Professor, Department of Dermatology and Venereology, Al-Falah School of Medical Science and Research Centre, Faridabad, Haryana, India
[3]Associate Professor, Department of Dermatology and Venereology, Al-Falah School of Medical Science and Research Centre, Faridabad, Haryana, India

***Address for Correspondence:** Dr. Parijat Barnwal, Consultant Dermatologist, Sri Bhagwat Polyclinic, Bramhsthan, Azamgarh, Uttar Pradesh, India
E-mail: drpariazam@rediffmail.com

Received: 09 Feb 2025/ Revised: 17 Apr 2025/ Accepted: 15 Jun 2025

ABSTRACT

Background: Vitiligo is a chronic autoimmune pigmentary disorder characterized by selective loss of melanocytes. Conventional treatments often provide inconsistent results and are associated with prolonged therapy durations. Platelet-rich plasma (PRP), an autologous concentrate rich in growth factors, has recently emerged as a regenerative therapeutic option aimed at stimulating melanocyte proliferation and modulating local immune responses.

Methods: This prospective interventional study was conducted on 40 patients aged 18–50 years with stable non-segmental vitiligo. PRP was prepared via a two-step centrifugation method and administered intradermally at monthly intervals for three sessions. Clinical response was assessed using the Vitiligo Area Scoring Index (VASI) and photographic documentation at baseline and at monthly follow-up visits over three months. Repigmentation was graded as excellent (>75%), good (50–75%), moderate (25–50%), or poor (<25%). Safety outcomes were also documented.

Results: Participants had a mean age of 31.5 years, with a balanced gender distribution. At the end of three months, 45% of patients achieved good to excellent repigmentation, while 35% had a moderate response, and 20% had a poor response. VASI scores showed a progressive and statistically significant reduction from baseline to the third month ($p<0.001$). No major adverse effects or disease progression were reported during the study.

Conclusion: PRP therapy was associated with clinically meaningful repigmentation and a significant reduction in VASI scores in patients with stable vitiligo. Its favorable safety profile and regenerative potential support its role as a viable therapeutic option, either alone or in combination with other established modalities.

Key-words: Autoimmune pigmentary disorder, Vitiligo, platelet-rich plasma, repigmentation, VASI score

INTRODUCTION

Vitiligo is a chronic autoimmune pigmentary disorder characterized by the destruction of epidermal melanocytes, affecting up to 0.1–2.1% of the global population and markedly impairing quality of life [1].

How to cite this article
Barnwal P, Kumar S, Noor J. Effect of Platelet-Rich Plasma in Vitiligo: A Single-Arm Prospective Study. SSR Inst Int J Life Sci., 2025; 11(4): 7950-7954.

Access this article online
https://iijls.com/

Traditional therapies—including topical corticosteroids, calcineurin inhibitors, and phototherapies—often yield variable repigmentation and may be associated with relapse or adverse effects [1,2].

Recently, regenerative approaches such as platelet-rich plasma (PRP) have garnered attention as novel adjunctive treatments for stable vitiligo [3]. PRP is an autologous concentration of platelets obtained through centrifugation, containing a cocktail of growth factors (e.g., PDGF, bFGF, TGF-β, EGF) and anti-inflammatory cytokines [4]. These bioactive molecules promote tissue repair by enhancing melanocyte survival, proliferation, and migration, as well as improving keratinocyte–

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doi: 10.21276/SSR-IIJLS.2025.11.4.22

melanocyte interactions and modulating local immune responses [4,5].

Clinical investigations into PRP's efficacy for vitiligo are promising. A review summarizing six studies (total n = 253 patients) found that PRP-treated lesions exhibited significantly better improvement than control groups, with minimal side effects reported [3]. In a small prospective cohort of 10 therapy-resistant patients, monotherapy with PRP resulted in>50% repigmentation in 40% and ≥75% repigmentation in 20%, with stable results maintained for up to 24 months [6].

Further, randomized trials employing PRP in combination with procedural interventions have demonstrated enhanced repigmentation. Parambath et al. showed that non-cultured epidermal cell suspension (NCES) delivered in PRP resulted in significantly greater repigmentation (75.6%) compared with PBS-suspended NCES (65%) at six months [7]. A meta-analysis of 11 trials involving PRP combined with either an excimer laser or a fractional CO_2 laser (but not other adjuncts, such as NB-UVB or NCES alone) confirmed superior repigmentation outcomes with combination therapy, reporting an odds ratio of 4.47 for excimer laser plus PRP versus monotherapy [8].

Mechanistic insights indicate that PRP enhances repigmentation through several pathways: (a) upregulating growth factors such as bFGF and stem cell factor to stimulate melanocyte proliferation; (b) delivering adhesion proteins (fibrin, fibronectin) to strengthen melanocyte anchoring; and (c) providing anti-inflammatory cytokines (IL-1ra, IL-10, TGF-β) to modulate local autoimmune activity [5,9]. This multifaceted action highlights PRP's potential not only as an adjuvant but also as a stand-alone regenerative option.

Despite encouraging evidence, gaps remain in the literature, particularly regarding the optimal formulation of PRP, the efficacy of monotherapy, long-term outcomes, and the development of standardised protocols. Controlled clinical studies with larger cohorts and consistent methodologies are essential to determine the definitive role of PRP in vitiligo management.

Therefore, the current study aims to evaluate the clinical efficacy and safety of intradermal PRP injections in patients with stable non-segmental vitiligo. The primary objective is to assess repigmentation, as measured by VASI and clinical grading, over three months. We hypothesize that PRP monotherapy will result in significant repigmentation with minimal adverse effects.

MATERIALS AND METHODS

Study Design and Setting- This prospective interventional study was conducted at a tertiary care hospital over 12 months. Written informed consent was obtained from all participants before enrollment.

Study Population- A total of 40 patients aged between 18 and 50 years, diagnosed clinically with stable non-segmental vitiligo (defined as no new lesions or progression of existing lesions over the past 6 months), were enrolled. Patients with a history of keloidal tendency, bleeding disorders, recent immunosuppressive therapy, active skin infections, or pregnancy were excluded.

Intervention- Autologous PRP was prepared using a two-step centrifugation technique. Approximately 20 mL of venous blood was collected from each patient under aseptic conditions. The first centrifugation was performed at 1,500 rpm for 10 minutes to separate red cells, followed by a second spin at 3,500 rpm for 10 minutes to concentrate platelets. The final PRP product, containing 3–5 times baseline platelet concentration, was activated with calcium gluconate immediately before administration.

PRP was injected intradermally into the vitiliginous patches using a 30-gauge insulin syringe at 1 cm intervals. Injections were administered at monthly intervals for a total of 3 sessions. All patients continued their existing topical therapy (e.g., corticosteroids or calcineurin inhibitors), if any, which was kept uniform throughout the study.

Outcome Measures- Clinical response was assessed using the Vitiligo Area Scoring Index (VASI) at baseline and monthly follow-ups for 3 months. Standardized photographs were taken at each visit for objective evaluation. Repigmentation was graded as excellent (>75%), good (50–75%), moderate (25–50%), or poor (<25%).

Safety Assessment- Local and systemic adverse events were documented at each visit, including pain, erythema, infection, ecchymosis, or allergic reactions.

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Any worsening of vitiligo or development of new lesions was also recorded.

Statistical Analysis- Data were analyzed using SPSS software version 26.0 (IBM Corp., Armonk, NY). Continuous variables were presented as mean±standard deviation (SD), while categorical variables were expressed as frequencies and percentages. A paired t-test was used to compare pre- and post-treatment VASI scores. A $p<0.05$ was considered statistically significant.

RESULTS

A total of 40 patients with clinically stable non-segmental vitiligo were enrolled in the study, with a mean age of 31.5 years and nearly equal gender distribution (Table 1). The average duration of disease at baseline was just over two years, indicating a chronic condition in the study population.

Table 1: Baseline Characteristics of Study Participants

Variable	Value	Percentage / SD
Number of participants	40	100%
Mean age (years)	31.5	±8.2
Gender (Male/Female)	22/18	55% / 45%
Duration of disease (months)	24.3	±6.7

Clinical response to PRP therapy was assessed using repigmentation grading, which revealed a variable degree of improvement (Table 2). The majority of participants experienced moderate to good repigmentation following treatment. A smaller proportion of patients showed excellent repigmentation, while a minority reported poor response.

Table 2: Clinical Response Following PRP Treatment

Repigmentation Grade	Number of Patients	Percentage (%)
Excellent (>75%)	6	15
Good (50–75%)	12	30
Moderate (25–50%)	14	35
Poor (<25%)	8	20

Serial assessment of disease activity using the Vitiligo Area Scoring Index (VASI) demonstrated a statistically significant improvement throughout treatment (Table 3). The mean VASI score showed a progressive decline at each follow-up interval, with significant differences emerging as early as the first month and further reductions noted at two and three months. The most substantial improvement was observed by the end of the third month, indicating a consistent and cumulative therapeutic effect of PRP injections.

Table 3: Mean VASI Scores Before and After PRP Treatment

Time Point	Mean VASI Score	p-value
Baseline	5.6±1.4	-
After 1 month	4.8±1.3	<0.05
After 2 months	3.9±1.1	<0.01
After 3 months	3.2±1.0	<0.001

DISCUSSION

PRP injections for stable non-segmental vitiligo yielded encouraging repigmentation in the majority of cases. In this study, combined assessments using repigmentation grades and serial VASI scores reflected consistent therapeutic benefit, aligning with prior findings of PRP employed alone or as an adjunct to other modalities [10,11]. Our results reinforce the potential of PRP to stimulate melanocyte regeneration and reactivation in depigmented patches.

Meta-analyses evaluating PRP in conjunction with fractional lasers report significantly higher repigmentation rates, achieving a mean difference of 1.58 in repigmentation grade, and improved patient satisfaction compared to control interventions, without an increase in adverse events [10]. Our monotherapy results, with 45% of participants achieving≥50% repigmentation (classified as good to excellent), are comparable to those of combination studies, suggesting that even isolated PRP may serve as an effective option in stable vitiligo.

The underlying mechanisms appear multifactorial. PRP provides high concentrations of growth factors (e.g., PDGF, bFGF, and TGF-β), extracellular matrix proteins, and anti-inflammatory cytokines known to promote melanocyte proliferation, migration, and survival [4,12]. Furthermore, PRP stimulates angiogenesis and tissue remodeling, which could enhance epithelial–dermal interactions critical for repigmentation [4]. Such mechanisms suggest that PRP addresses both

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regenerative and immunomodulatory pathways, potentially counteracting oxidative stress and melanocyte attrition in vitiligo [5].

Despite observable clinical improvement, variability in individual responses—35% with moderate and 20% with poor repigmentation—suggests that patient- or lesion-specific factors, such as baseline melanocyte depletion, lesion duration, or local inflammatory milieu, may influence outcomes [13]. Future investigations should aim to identify predictive biomarkers (e.g., melanocyte counts, cytokine profiles, oxidative stress markers) that correlate with therapeutic response.

Safety outcomes in this cohort were favorable, with no significant adverse events or new lesion formations, consistent with existing literature reporting PRP's high tolerability in vitiligo treatment [10]. Nevertheless, long-term follow-up is warranted to assess the durability of repigmentation and to exclude delayed recurrence.

LIMITATIONS

Limitations of this study include the absence of a control or comparator arm, a relatively small sample size, and a lack of objective mechanistic assays (e.g., histological or molecular analyses of melanocyte activity). Additionally, varying PRP preparation techniques and dosing regimens across studies may limit generalizability. Standardised protocols and the inclusion of control arms (e.g., placebo, topical agents, phototherapy) in future randomised trials would enhance the quality of the evidence.

CONCLUSIONS

Intradermal PRP therapy demonstrates promising efficacy and safety for stable non-segmental vitiligo, producing significant re-pigmentation in nearly half of the treated lesions. These findings support the integration of PRP into vitiligo management algorithms, potentially as first-line monotherapy or adjunct to phototherapeutic approaches. Continued research, including larger controlled trials and mechanistic evaluation, is essential to validate PRP's clinical role, optimise treatment parameters, and ensure sustained patient benefits.

CONTRIBUTION OF AUTHORS

Research concept- Parijat Barnwal
Research design- Parijat Barnwal, Sundiep Kumar
Supervision- Sundiep Kumar, Jaishree Noor
Materials- Parijat Barnwal
Data collection- Parijat Barnwal
Data analysis and interpretation- Parijat Barnwal, Jaishree Noor
Literature search- Parijat Barnwal
Writing article- Parijat Barnwal
Critical review- Sundiep Kumar, Jaishree Noor
Article editing- Parijat Barnwal, Sundiep Kumar
Final approval- Parijat Barnwal, Sundiep Kumar, Jaishree Noor

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