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A RANDOMIZED COMPARATIVE STUDY OF INTRALESIONAL INJECTION VERSUS MICRONEEDLING- ASSISTED DELIVERY OF PLATELET RICH PLASMA AND TRIAMCINOLONE ACETONIDE IN ALOPECIA AREATA OF THE SCALP

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ABSTRACT

Background

Alopecia Areata is a chronic autoimmune disorder characterized by non-scarring hair loss with significant psychological impact. Intralesional corticosteroids remain the standard therapy for localized disease, while regenerative modalities such as Platelet-Rich Plasma and microneedling have recently gained attention.

Aim

To compare the efficacy and safety of intralesional injection versus microneedling-assisted delivery of platelet-rich plasma and Triamcinolone Acetonide in scalp alopecia areata.

Materials and Methods

This randomized comparative interventional study included 30 patients with scalp alopecia areata who were equally allocated into two groups. Group A received intralesional injections of PRP with triamcinolone acetonide, while Group B underwent microneedling-assisted delivery of PRP with triamcinolone acetonide. Four treatment sessions were administered at 3-week intervals. Clinical response was assessed using Severity of Alopecia Tool (SALT) score, hair regrowth assessment, patient satisfaction score, and adverse effects. Statistical analysis was performed using SPSS version 26.

Results

Both groups showed significant improvement in SALT scores after treatment. The mean SALT score in Group A reduced from 18.6 ± 6.4 to 6.8 ± 3.7, while in Group B it reduced from 19.1 ± 5.9 to 8.9 ± 4.2 at 12 weeks. Excellent hair regrowth (>75%) was observed in 60% of patients in Group A and 46.7% in Group B. Procedural pain was significantly lower in the microneedling group (VAS 3.9 ± 1.3) compared to the intralesional group (VAS 6.7 ± 1.1). Skin atrophy was noted only in the intralesional group.

Conclusion

Both treatment modalities were effective in scalp alopecia areata. Intralesional therapy showed slightly superior efficacy, whereas microneedling-assisted delivery demonstrated better tolerability and lower pain scores. Microneedling-assisted delivery may serve as a useful minimally invasive alternative for patients' intolerant to repeated injections.

KEYWORDS: Alopecia areata; platelet-rich plasma; triamcinolone acetonide; microneedling; intralesional therapy; SALT score.

INTRODUCTION

Alopecia Areata is a chronic autoimmune disorder characterized by non-scarring hair loss involving the scalp and other hair-bearing areas. It affects nearly 2% of the population during their lifetime and can significantly impair quality of life.1,2 The disease results from immune-mediated attack on anagen hair follicles, leading to localized or extensive hair loss.3

Several treatment modalities have been used for alopecia areata, including corticosteroids, topical immunotherapy, minoxidil, platelet-rich plasma (PRP), and Janus kinase inhibitors.4 Among these, intralesional Triamcinolone Acetonide remains the standard treatment for localized disease due to its anti-inflammatory and immunosuppressive effects.5 However, repeated injections may be painful and can cause adverse effects such as skin atrophy and telangiectasia.6

Platelet-Rich Plasma has recently gained attention in alopecia areata because of its regenerative and immunomodulatory properties. PRP contains various growth factors that promote follicular proliferation, angiogenesis, and prolongation of the anagen phase.7,8 Microneedling further enhances drug penetration and stimulates hair growth through controlled microinjury and growth factor release.9

Both intralesional injections and microneedling-assisted delivery are increasingly used in alopecia areata, but comparative studies evaluating their efficacy are limited. Hence, the present study was undertaken to compare the efficacy and safety of intralesional injection versus microneedling-assisted delivery of platelet-rich plasma and triamcinolone acetonide in scalp alopecia areata.

MATERIALS AND METHODS

Study Design and Setting

This randomized comparative interventional study was conducted in the Department of Dermatology at Saveetha Medical College and Hospital over a period of 12 months after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrolment.

Study Population

Thirty patients clinically diagnosed with Alopecia Areata involving the scalp were included in the study. Patients aged 18–50 years with patchy alopecia areata involving less than 50% of the scalp and disease duration less than 5 years were enrolled.

Patients with alopecia totalis/universalis, active scalp infection, keloidal tendency, bleeding disorders, platelet dysfunction, pregnancy, lactation, immunosuppressive therapy, or treatment for alopecia areata within the previous 3 months were excluded.

Sample Size and Randomization

A total of 30 patients were included and randomly allocated into two groups of 15 each using computer-generated randomization.

Group A: Intralesional injection of platelet-rich plasma (PRP) with Triamcinolone Acetonide
Group B: Microneedling-assisted delivery of PRP with triamcinolone acetonide

Preparation of Platelet-Rich Plasma

Approximately 20 mL of autologous venous blood was collected under aseptic precautions in acid citrate dextrose tubes. PRP was prepared using a double-spin method. The final platelet concentration obtained was approximately 4–5 times the baseline platelet count.

Procedure

Group A – Intralesional Injection

PRP mixed with triamcinolone acetonide (5 mg/mL) was injected intradermally into the alopecia patches using an insulin syringe at 1 cm intervals.

Group B – Microneedling-Assisted Delivery

Microneedling was performed using a dermaroller with 1.5 mm needles over the alopecia patches until mild pinpoint bleeding was achieved. PRP mixed with triamcinolone acetonide (5 mg/mL) was then applied topically and gently massaged over the treated area to facilitate transdermal delivery.

Both groups received 4 treatment sessions at intervals of 3 weeks.

Clinical Assessment

Patients were evaluated at baseline and at every follow-up visit using:

- Severity of Alopecia Tool (SALT) score
- Standardized clinical photographs
- Hair regrowth assessment
- Patient satisfaction score
- Adverse effects

Outcome Measures

The primary outcome measure was reduction in SALT score from baseline to 12 weeks. Secondary outcome measures included percentage of hair regrowth, patient satisfaction, and adverse effects.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26. Quantitative variables were expressed as mean ± standard deviation. Independent t-test and paired t-test were used for comparison between groups and within groups respectively. Chi-square test was used for categorical variables. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 30 patients with Alopecia Areata of the scalp were included in the study and completed all follow-up sessions. Patients were randomized equally into Group A (intralesional injection) and Group B (microneedling-assisted delivery), with 15 patients in each group.

Baseline Characteristics

The mean age of patients in Group A was 29.8 ± 8.1 years and in Group B was 31.2 ± 7.5 years. Male predominance was observed in both groups. There was no statistically significant difference between the groups with respect to age, gender distribution, disease duration, or baseline SALT score ($p > 0.05$).

Table 1: Baseline characteristics of study participants

Mean age (years)	29.8 ± 8.1	31.2 ± 7.5	0.64
Male: Female	9: 6	8: 7	0.71
Mean disease duration (months)	7.4 ± 3.2	8.1 ± 3.6	0.58
Mean baseline SALT score	18.6 ± 6.4	19.1 ± 5.9	0.82
Single patch (%)	10 (66.7%)	9 (60%)	0.70
Multiple patches (%)	5 (33.3%)	6 (40%)	

Clinical Response

Both groups demonstrated significant improvement in SALT scores after treatment compared to baseline ($p < 0.001$).

In Group A, the mean SALT score reduced from 18.6 ± 6.4 at baseline to 6.8 ± 3.7 at 12 weeks. In Group B, the mean SALT score reduced from 19.1 ± 5.9 to 8.9 ± 4.2 at 12 weeks. Although Group A showed greater reduction in SALT score, the difference between the groups was not statistically significant ($p = 0.14$).

Table 2: Comparison of SALT score improvement

Baseline SALT score	18.6 ± 6.4	19.1 ± 5.9	0.82
SALT score at 6 weeks	11.2 ± 4.9	13.1 ± 5.1	0.29
SALT score at 12 weeks	6.8 ± 3.7	8.9 ± 4.2	0.14
Mean reduction in SALT score	11.8 ± 4.1	10.2 ± 4.5	0.29

Hair Regrowth Assessment

Excellent hair regrowth (>75%) was observed in 9 patients (60%) in Group A and 7 patients (46.7%) in Group B. Moderate regrowth (50–75%) was seen in 4 patients (26.7%) in Group A and 5 patients (33.3%) in Group B. Mild response (<50%) was noted in 2 patients (13.3%) in Group A and 3 patients (20%) in Group B.

Table 3: Hair regrowth response

Excellent response (>75%)	9 (60%)	7 (46.7%)
Moderate response (50–75%)	4 (26.7%)	5 (33.3%)
Mild response (<50%)	2 (13.3%)	3 (20%)

Patient Satisfaction and Adverse Effects

The mean patient satisfaction score was slightly higher in Group A (8.1 ± 1.2) compared to Group B (7.8 ± 1.4), though the difference was not statistically significant ($p = 0.51$).

Pain during the procedure was significantly higher in the intralesional injection group with a mean Visual Analog Scale (VAS) score of 6.7 ± 1.1 compared to 3.9 ± 1.3 in the microneedling group ($p < 0.001$).

Skin atrophy was observed in 2 patients (13.3%) in Group A, whereas no cases were observed in Group B. Transient erythema and edema were more common in the microneedling group and subsided within 24–48 hours.

Table 4: Adverse effects and patient satisfaction

Mean patient satisfaction score	8.1 ± 1.2	7.8 ± 1.4	0.51
Mean pain score (VAS)	6.7 ± 1.1	3.9 ± 1.3	<0.001
Skin atrophy	2 (13.3%)	0	
Transient erythema/edema	3 (20%)	5 (33.3%)	
Relapse during follow-up	1 (6.7%)	2 (13.3%)	

DISCUSSION

Alopecia Areata is a chronic relapsing autoimmune disorder characterized by T-cell mediated attack on anagen hair follicles, resulting in patchy non-scarring hair loss. Management remains challenging because of the unpredictable course of the disease and variable therapeutic response. Intralesional corticosteroids continue to be considered the standard treatment for localized alopecia areata, while regenerative therapies such as Platelet-Rich Plasma and microneedling have gained increasing interest in recent years.10

In the present study, both intralesional injection and microneedling-assisted delivery of PRP with Triamcinolone Acetonide produced significant clinical improvement in SALT scores from baseline. However, the intralesional injection group demonstrated slightly greater reduction in SALT score and a higher proportion of patients achieving excellent hair regrowth compared to the microneedling group, although the difference was not statistically significant.

Intralesional corticosteroids exert their therapeutic effect by suppressing perifollicular lymphocytic infiltration and inhibiting cytokine-mediated autoimmune inflammation around hair follicles.10 Previous studies have consistently demonstrated the efficacy of intralesional triamcinolone acetonide in localized alopecia areata. Chang et al. reported favorable regrowth rates with intralesional corticosteroids, particularly in patients with limited scalp involvement.11 Similarly, Abell and Munro observed significant hair regrowth following intralesional triamcinolone administration in patchy alopecia areata.5 Our findings are in concordance with these studies, where intralesional therapy achieved greater improvement in SALT score and hair regrowth.

PRP has emerged as a promising therapeutic modality because of its high concentration of growth factors including platelet-derived growth factor, transforming growth factor-β, vascular endothelial growth factor, and epidermal growth factor, which stimulate follicular stem cells, angiogenesis, and prolongation of the anagen phase.7,12 In addition to regenerative effects, PRP may also exert immunomodulatory action by reducing perifollicular inflammation. Trink et al. demonstrated significant improvement in hair regrowth and reduction in dystrophic hairs following PRP treatment in alopecia areata.7 Similar observations were made by Singhal et al., who reported improvement in hair density and patient satisfaction after PRP therapy.13

Microneedling enhances transdermal drug delivery through creation of microchannels in the epidermis and dermis. The procedure itself may stimulate hair growth by activating dermal papilla stem cells and inducing release of platelet-derived growth factors.9 In the present study, microneedling-assisted delivery showed clinically significant improvement with lower procedural pain scores compared to intralesional injections. This suggests that microneedling may serve as a less painful alternative in patients intolerant to repeated injections. Dhurat et al. demonstrated that microneedling can stimulate hair growth through wound healing mechanisms and activation of hair follicle-related genes.9

Pain during the procedure was significantly greater in the intralesional injection group in our study. This finding is expected because multiple scalp injections are associated with considerable discomfort. In contrast, microneedling-assisted delivery was better tolerated and associated mainly with transient erythema and edema. Skin atrophy was observed only in the intralesional group, likely secondary to focal corticosteroid deposition. Similar adverse effects have been documented in previous studies evaluating intralesional corticosteroid therapy.6

Although the intralesional group showed marginally superior efficacy, the absence of statistically significant difference between the groups indicates that microneedling-assisted delivery may offer comparable clinical benefit with improved tolerability. This may be particularly useful in patients with needle apprehension, low pain tolerance, or multiple lesions requiring repeated treatment sessions.

The limitations of the present study include small sample size, shorter follow-up duration, and absence of histopathological evaluation. Larger multicentric studies with longer follow-up are required to determine long-term efficacy, relapse rates, and optimal treatment protocols combining PRP, corticosteroids, and microneedling in alopecia areata.

CONCLUSION

Both intralesional injection and microneedling-assisted delivery of Platelet-Rich Plasma with Triamcinolone Acetonide were found to be effective in the treatment of Alopecia Areata of the scalp, showing significant improvement in SALT scores and hair regrowth. Intralesional therapy demonstrated slightly superior clinical efficacy, whereas microneedling-assisted delivery was associated with significantly lower pain and better tolerability.

Microneedling-assisted delivery may therefore serve as a useful minimally invasive alternative in patients who are intolerant to repeated injections or have low pain threshold. Further large-scale studies with longer follow-up are necessary to establish standardized treatment protocols and evaluate long-term outcomes and relapse rates.

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