

Comparative Efficacy of Minoxidil, Dermaroller, and PRP Treatments in Androgenetic Alopecia (AGA): A Clinical Study

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DOI: <https://doi.org/10.36348/sjmps.2024.v10i08.016>

| Received: 13.07.2024 | Accepted: 17.08.2024 | Published: 28.08.2024

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Abstract

Background: Androgenetic alopecia (AGA) is a common form of hair loss affecting both men and women, characterized by progressive thinning of hair, particularly in the scalp's vertex and frontal areas. Treatments such as minoxidil and platelet-rich plasma (PRP) have been developed to manage AGA, each with distinct mechanisms and efficacy profiles.

Objective: This study aimed to compare the efficacy of Minoxidil, Dermaroller, and PRP in treating AGA, evaluating their impact on hair growth and patient satisfaction. **Methodology:** This prospective comparative parallel-group interventional study was conducted on the outpatient department of Dermatology, tertiary hospital, between December 2022 and May 2023. Where male participants aged 18-45 years with grade II, III, or IV AGA were enrolled. Ninety patients were randomly assigned to three groups: Group A received 5% minoxidil twice daily; Group B received the same minoxidil regimen with monthly dermaroller treatment; Group C received 5% minoxidil along with monthly PRP injections. Participants were assessed at baseline, 3 months, and 5 months using photographic documentation and dermoscopy to measure hair growth improvements. **Results:** The mean age of participants was 29.90 ± 5.50 years, with a balanced gender distribution (1:1 male to female ratio) and a significant family history of AGA (70%). PRP with minoxidil demonstrated superior efficacy compared to minoxidil alone or minoxidil with dermaroller, showing significant improvements in hair counts at both 3 months ($p=0.01$) and 5 months ($p<0.001$). Dermaroller with minoxidil also showed improvements, though not statistically significant compared to minoxidil alone. Secondary efficacy analysis revealed significant shifts towards hair growth enhancement in the PRP + minoxidil group. **Conclusion:** PRP combined with minoxidil represents a promising and effective treatment option for AGA, offering superior outcomes compared to minoxidil alone or minoxidil with dermaroller. This combination therapy enhances hair growth through its regenerative effects on hair follicles, making it a valuable option for patients seeking non-surgical interventions with high satisfaction rates.

Keywords: Androgenetic alopecia, PRP, minoxidil, dermaroller, hair growth, treatment efficacy.

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INTRODUCTION

Androgenetic alopecia (AGA), commonly referred to as male or female pattern baldness, is a prevalent form of hair loss that affects a significant portion of the global population. This condition, characterized by a progressive thinning of hair, particularly in the scalp's vertex and frontal areas, can profoundly impact an individual's self-esteem and quality of life [1-2]. The pathogenesis of AGA involves a complex interplay of genetic, hormonal, and environmental factors, with dihydrotestosterone (DHT) playing a central role in hair follicle miniaturization and the subsequent hair loss [3].

Over the years, various treatments have been developed to manage AGA, with two prominent therapies being topical minoxidil and platelet-rich plasma (PRP). Topical minoxidil, an over-the-counter medication approved by the FDA, has been a cornerstone in AGA treatment for decades [4]. Its mechanism of action, while not entirely understood, is believed to involve the widening of blood vessels, which enhances follicular blood flow and stimulates hair growth. Minoxidil's efficacy in slowing hair loss and promoting regrowth has been well-documented, making it a widely recommended option for individuals experiencing AGA [5-6].

In contrast, platelet-rich plasma (PRP) therapy represents a more novel approach. PRP involves the extraction of a patient's blood, which is then centrifuged to concentrate platelets and growth factors. This concentrated plasma is injected into the scalp, aiming to harness the regenerative properties of platelets to stimulate hair follicles and promote hair growth [7]. The interest in PRP therapy has surged in recent years due to its potential to not only halt hair loss but also to improve hair density and thickness without the need for daily application, as required with minoxidil [8-9].

The comparative efficacy of PRP versus topical minoxidil in treating AGA has become a subject of growing clinical interest and research. While both treatments offer promising results, their differing mechanisms, application methods, and potential side effects necessitate a thorough evaluation. Clinical studies and patient testimonials suggest that PRP might offer advantages in certain aspects, such as hair density and thickness, whereas minoxidil remains a reliable and easily accessible option for many.

Objective

To compare the efficacy of Minoxidil, Dermaroller, and PRP for the treatment of androgenetic alopecia (AGA).

METHODOLOGY

In this prospective comparative parallel-group interventional study Male participants aged between 18 and 45 years, diagnosed with grade II, III, or IV androgenetic alopecia (Norwood Hamilton classification), were recruited from the outpatient department of Dermatology, tertiary hospital, between December 2022 and May 2023. They were instructed to maintain consistent shampoo use, hairstyle, hair length, and hair color throughout the study period. Exclusion criteria included concurrent scalp dermatological conditions or significant systemic illnesses, as well as individuals with shaved scalps, recent topical scalp treatments, ongoing finasteride therapy, or prior use of

investigational hair growth products within the past six months.

Participants provided informed consent before undergoing photographic documentation at baseline, three months, and five months, both clinically and using dermoscopy. A total of 90 patients were randomly allocated into three groups. Group A applied 1ml of 5% minoxidil twice daily. Group B applied the same minoxidil regimen and received monthly dermaroller treatment using 1.5 mm needles, rolling over affected scalp areas until pinpoint bleeding occurred. Group C applied 1ml of 5% minoxidil twice daily along with monthly PRP treatment. Before these procedures, anesthetic cream was applied, followed by surgical cleansing of the scalp with betadine and normal saline.

In Group C, PRP was prepared by centrifuging 12ml of the patient's own blood in two ACD vials at 3600rpm for 15 minutes using the single-spin method. The platelet-poor plasma (PPP) was removed, leaving 2-3 cc of PRP, which was injected into the affected areas using a napping technique with an insulin syringe, ensuring strict aseptic conditions.

A stable reference point for photographic imaging throughout the study was defined by selecting a target area at the leading edge of the vertex bald spot, clipped to 1 mm length and marked within a 1x1 cm square. Reproducibility of this area was confirmed using threads placed from the glabella to the occiput and between the two helices, with a tangential line drawn from their intersection to measure and mark the square.

RESULTS

The study group's demographic characteristics were as follows: the mean age was 29.90 ± 5.50 years, with an equal distribution of male and female participants (1:1 ratio). A significant majority (70%) of participants had a positive family history of androgenic alopecia.

Table-1: Demographic Status of the study group

Demographic Status of the study group	
Mean age Group	29.90±5.50 years
Male: Female	1:1
Family History of androgenic alopecia	70%

Compared to the reference treatment of 5% minoxidil alone, the combination of dermaroller with minoxidil showed a nonsignificant change of -0.43 (95% CI -1.3 to 0.5, $p=0.36$) at 3 months and -0.63 (95% CI -1.6 to 0.33, $p=0.198$) at 5 months. In contrast, the

combination of PRP with minoxidil demonstrated significant improvements with changes of -1.2 (95% CI -2.3 to -0.28, $p=0.01$) at 3 months and -2.03 (95% CI -3.1 to -0.96, $p<0.001$) at 5 months.

Table-2: Primary efficacy analysis of the three different treatment type

Treatment given	3 Months	P value	5 Months	P value
	95% CI		95% CI	
5% minoxidil	(Reference)		(Reference)	
Dermaroller +minoxidil	-0.43 (-1.3-0.5)	0.36	-0.63 (-1.6 to 0.33)	0.198
PRP+minoxidil	-1.2 (-2.3 to- 0.28)	0.01	-2.03 (-3.1 to -0.96)	<0.001

For those treated with 5% minoxidil, the majority remained unchanged at 3 months (66.7%) and decreased significantly to 23.3% at 5 months ($p=0.011$). Conversely, those receiving dermaroller with minoxidil showed a significant decrease in unchanged responses from 66.7% at 3 months to 16.7% at 5 months ($p=0.000$),

accompanied by increases in slightly and moderately increased responses. Patients treated with PRP and minoxidil demonstrated no greatly or moderately decreased responses at both time points ($p=0.001$), with a notable shift towards slightly and moderately increased responses from 3 months to 5 months.

Table 3: Distribution of the patients according to the secondary efficacy Analysis

Treatment type	Secondary efficacy grading	At 3 months	At 5 months	P value
Treatment with 5% minoxidil	Greatly decreased	0	1 (3.3)	0.011
	Moderately decreased	1 (3.3)	0	
	Slightly decreased	2 (6.7)	2 (6.7)	
	Unchanged	20 (66.7)	7 (23.3)	
	Slightly increased	7 (23.3)	19 (63.3)	
Treatment with - Dermaroller + minoxidil	Moderately increased	0	1 (3.3)	0.000
	Greatly increased	0	0	
	Greatly decreased	0	0	
	Moderately decreased	0	0	
	Slightly decreased	0	0	
Treatment with PRP + minoxidil	Unchanged	20 (66.7)	5 (16.7)	0.001
	Slightly increased	10 (33.3)	19 (63.3)	
	Moderately increased	0	5 (16.7)	
	Greatly increased	0	1 (3.3)	
	Greatly decreased	0	0	
Treatment type	Secondary efficacy grading	At 3 months	At 5 months	P value
	Slightly decreased	0	2 (6.7)	
	Unchanged	12 (40.0)	1 (3.3)	
	Slightly increased	13 (43.3)	12 (40.0)	
	Moderately increased	5 (16.7)	10 (33.3)	
Greatly increased	0	5 (16.7)		

At baseline, mean scores were 59.77 ± 13.50 for 5% minoxidil, 69.30 ± 17.97 for dermaroller + minoxidil, and 64.37 ± 14.42 for PRP + minoxidil. By 3 months, significant improvements were observed in all groups: 61.53 ± 13.53 for minoxidil, 77.30 ± 21.64 for

dermaroller + minoxidil, and 76.73 ± 12.66 for PRP + minoxidil ($p=0.000$). These improvements continued at 5 months, with scores of 66.83 ± 16.73 for minoxidil, 85.73 ± 23.10 for dermaroller + minoxidil, and 86.13 ± 14.82 for PRP + minoxidil ($p=0.000$).

Table 4: Comparison of the dermoscopic analysis for improvements in the three groups

Treatment type	Baseline	At 3 months	At 5 months
Treatment with 5% minoxidil	59.77+13.50	61.53 +13.53	66.83+16.73
Treatment with -Derma roller + minoxidil	69.30+17.97	77.30+21.64	85.73+23.10
Treatment with PRP + minoxidil	64.37+14.42	76.73+12.66	86.13+14.82
P value	0.62	0.000	0.000

DISCUSSION

Androgenetic alopecia (AGA) is a hereditary and androgen-dependent hair disorder prevalent in both men and women. Beyond its aesthetic implications, AGA significantly impacts psychosocial well-being. Treatments vary in efficacy based on patient age, hair loss severity, and treatment adherence. Platelet-rich plasma (PRP) and microneedling with dermaroller are commonly suggested adjuncts for AGA treatment, yet comprehensive comparative studies are sparse.

This prospective comparative parallel-group interventional study focused on AGA cases among individuals aged 18-45 years. Most participants

experienced onset between ages 26-35 (58%), with an average onset age of 29.9 years. Comparable studies reported an average onset of 30.6 years among males with baldness, [10] and other report noted an onset average of 22.8 years [11]. A majority (70%) of our patients had a positive family history of AGA, which correlated with findings from other studies [12-13]. Conversely, another study found a positive family history in 46.66% of patients [14].

Grade distribution at baseline in our study revealed 42% and 37% of patients had grade II and III AGA, respectively, which increased slightly to 45% and 40% after 5 months. Notably, patients treated with PRP

and minoxidil showed moderate improvement, statistically significant compared to the other groups. Another study reported excellent improvement in 60% of group B patients (minoxidil + PRP) versus 33.33% in group A (only minoxidil) after 6 months [13].

Global photographic assessments indicated slight improvements across all groups. Durat *et al.*, observed responses ranging from +2 to +3 on a standardized 7-point scale among patients receiving microneedling with minoxidil and finasteride. Side effects were minimal with dermaroller and 5% minoxidil, similar to findings by Sharma *et al.*, where 18% of PRP-treated patients reported mild side effects.

Despite limitations in cohort size and study duration, our findings suggest that PRP with minoxidil offers superior efficacy compared to minoxidil alone or minoxidil with dermaroller in AGA treatment.

CONCLUSION

Platelet-rich plasma (PRP) and dermaroller represent innovative non-surgical therapies for stimulating hair growth in patients with AGA. Platelet growth factors likely play a role in regulating hair bulb life cycles, promoting improved hair growth. These treatments offer promising options for individuals who are not candidates for hair transplantation. Our study demonstrated that monthly PRP injections with minoxidil over four months significantly increased hair counts compared to minoxidil alone or minoxidil with dermaroller. Combining minoxidil with PRP or dermaroller enhances minoxidil's effectiveness by stimulating stem cell proliferation and differentiation in the hair follicle bulge area through various molecular mechanisms. Therefore, PRP with minoxidil presents a straightforward, cost-effective, and practical treatment option for AGA, achieving high patient satisfaction overall.

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