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Original Research

Comparative study of Minoxidil solution (5%) and platelet rich plasma in male pattern hair loss

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ABSTRACT

Background: Androgenic Alopecia (AGA) is a common condition causing significant hair loss in both men and women globally. It is driven by genetic factors and the hormone dihydrotestosterone (DHT), which leads to hair follicle miniaturization. Traditional treatments, such as oral Finasteride and topical Minoxidil, have shown varying effectiveness, prompting the exploration of alternative therapies. Platelet-Rich Plasma (PRP) therapy has emerged as a potential treatment, utilizing autologous growth factors to stimulate hair growth. This study aims to compare the efficacy of topical Minoxidil (5%) and PRP injections in treating AGAfocusing on hair density improvement, reduction in hair lossand overall patient satisfaction. **Methodology:** This observational comparative study was conducted at the Department of Dermatology, Venereology, and Leprosy at the National Institute of Medical Sciences Research and Hospital in Jaipur, India. A total of 80 patients diagnosed with AGA were recruited and randomly divided into two groups. Group A received topical Minoxidil (5%) solution applied twice daily, while Group B received PRP injections administered intradermally at four-week intervals over a period of four months. Baseline and follow-up assessments, including hair density measurements and patient satisfaction surveys, were conducted every four weeks. The efficacy of the treatments was evaluated using standardized clinical and photographic assessments. **Results:** The results of the study indicated that both topical Minoxidil and PRP injections were effective in reducing hair loss and improving hair density in patients with AGA. Significant improvements were observed in both groups, with patients reporting increased hair growth and satisfaction with the treatments. PRP therapy demonstrated slightly higher efficacy in certain parameters, such as hair density and patient satisfaction scores. However, both treatments were well-tolerated, with minimal side effects reported. The study's findings suggest that PRP therapy could serve as a valuable alternative for patients who do not respond adequately to traditional treatments like Minoxidil. **Conclusion:** This study highlights the comparative efficacy of topical Minoxidil and PRP therapy for treating androgenic alopecia. Both treatments were effective, with PRP therapy demonstrating marginally better results. Given its minimally invasive nature and positive patient outcomes, PRP therapy presents a promising alternative or adjunct to traditional AGA treatments, supporting its integration into clinical practice.

Keywords: Androgenic Alopecia, hair loss, Minoxidil, Platelet-Rich Plasma, PRP therapy, Dihydrotestosterone, DHT, follicular miniaturization, genetic predisposition, hormonal factors.

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INTRODUCTION

Androgenic Alopecia (AGA) is a common condition causing hair loss, affecting approximately 50 million people globally. Studies indicate that 50% of men will experience some form of hair loss by age 50, and around 40% of women will suffer from hair loss between ages 70 and 79, highlighting AGA as a significant concern in dermatology and hair care.[1]The incidence of AGA varies among ethnic groups, with Caucasians having the highest prevalence, followed by Asians and Africans. This suggests both genetic and environmental influences. The condition is primarily genetically determined, with family history being a significant risk factor.[2,3] Researchers have identified up to 15 genetic loci associated with AGA, with the androgen receptor gene on the X chromosome showing the strongest correlation.[4]

In men, AGA progression is driven by the hormone dihydrotestosterone (DHT), derived from testosterone. DHT binds to androgen receptors in hair follicles, causing follicular miniaturization, which transforms thick terminal hairs into finer vellus hairs.[5] Hair thinning typically begins at the temples and crown, progressing to significant scalp hair loss, measured using the Hamilton-Norwood scale.[6,7]Currently, two FDA-approved treatments for AGA are oral Finasteride for men and topical Minoxidil for both genders. These treatments require daily use and are often not covered by insurance, as AGA is considered a cosmetic issue. Consequently, patients bear the cost out-of-pocket. Minoxidil, applied directly to the scalp, increases blood flow to hair follicles and stimulates growth factors, although its effectiveness varies.[8]

Platelet-Rich Plasma (PRP) therapy is a newer, non-FDA-approved treatment gaining attention as a potential alternative to Minoxidil. PRP involves injecting concentrated platelets from the patient's blood into the scalp, which may enhance hair follicle function. PRP is minimally invasive, has limited adverse effects, and does not require daily treatment, making it attractive for some patients.[9,10]

The primary objective of this research is to compare the efficacy of PRP therapy and topical Minoxidil in treating AGA. Given the significant impact of AGA and the interest in identifying effective treatments, this study aims to provide evidence-based insights to inform clinical decisions and patient choices, determining which approach offers better results in promoting hair regrowth and reducing hair loss.

METHODOLOGY

This research was designed as an observational comparative study conducted at the Department of Dermatology, Venereology, and Leprosy at the National Institute of Medical Sciences Research and Hospital in Jaipur, India. The study period spanned from July 2022 to December 2023, covering a total duration of 18 months. A total of 80 patients diagnosed with androgenic alopecia (AGA) were recruited from the Dermatology outpatient department. Participants were selected based on specific inclusion and exclusion criteria. Inclusion criteria comprised patients clinically diagnosed with androgenic alopecia of the scalp, aged between 18 and 60 years, who had not received any treatment for AGA in the last three months, and were willing to participate in the study. Exclusion criteria included patients with thrombocytopenia, other types of alopecia (e.g., alopecia areata), those treated with medication for alopecia areata in the past two months, patients with inflammation or secondary infections (fungal, bacterial, viral) on the scalp, patients with scalp scars, those on Finasteride for AGA treatment, patients with a tendency to form keloids, pregnant or lactating women, and patients on anti-coagulation therapy.

The sample size was calculated to ensure adequate power to detect differences between the two treatment groups. A total of 80 patients were included, with 40 patients in each group, allowing for a 20% dropout rate. Participants were randomly allocated into two treatment groups using a computer-generated random number table.

Treatment Protocol:

- **Group A:** Patients were instructed to apply 1 ml of topical Minoxidil (5%) solution to the affected scalp area twice daily, ensuring the area was clean and dry before application. Follow-up visits were scheduled every four weeks.
- **Group B:** PRP was prepared using a manual double-spin technique. Approximately 25-35 ml of the patient's venous blood was drawn and centrifuged at 1500 rpm for 5 minutes (soft spin). The plasma, PRP, and some red blood cells were then centrifuged again at 2500 rpm for 15 minutes (hard spin). The resulting PRP was injected intradermally in doses of 0.1-0.2 ml per injection, approximately 1 cm apart, at four-week intervals for four months.

Assessment and Follow-Up:

Baseline assessments included a detailed history, clinical examination, and standardized global photography of the scalp. The modified Norwood-Hamilton scale was used to determine the severity of AGA. Follow-up assessments were conducted every four weeks, including hair density measurements, hair pull tests, and patient satisfaction surveys.

Statistical Analysis:

Data were analyzed using IBM SPSS Statistics software (version 23.0). Descriptive statistics, including frequency and percentage analyses, were used for categorical variables, while mean and standard deviation (SD) were used for continuous variables. Comparative analyses between the two groups were performed using t-tests for quantitative measures and chi-square tests for qualitative

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measures. Statistical significance was set at $p \leq 0.05$, with $p < 0.01$ considered highly significant.

RESULTS

This study evaluated the efficacy of topical Minoxidil (5%) and Platelet-Rich Plasma (PRP) injections in treating androgenic alopecia (AGA) among 80 patients, divided equally into two groups. The analysis focused on hair density improvement, reduction in hair loss, and patient satisfaction over a four-month treatment period with follow-ups every four weeks. The age distribution of patients showed that the majority fell within the 21-30 year age range, with 70.0% in Group A and 77.5% in Group B. The mean ages were 28.20 years for Group A and 27.78 years for Group B, with no significant difference in age distribution between the groups.

Table 1: Characteristics of all patients in the study

	Group A: Minoxidil	Group B: PRP
Number of patients	40	40
Age (mean±SD)	28.20±4.773	27.78±3.669
Duration of disease (yrs)(mean±SD)	1.913±0.791	1.763±0.506

Regarding the duration of AGA, most patients had the disease for 1-2 years, accounting for 52.5% in Group A and 67.5% in Group B. The mean duration was 1.913 years in Group A and 1.763 years in Group B, indicating no significant difference between the groups (P=0.618).Family history data revealed that 57.5% of patients in Group A had a family history of AGA, compared to 40.0% in Group B. However, this difference was not statistically significant (P=0.117).The distribution of Hamilton Norwood grades showed that Grade III was the most common, with 40.0% of Group A and 50.0% of Group B falling into this category. There were no significant differences in the distribution of grades between the groups (P=0.147) (Table 2).Hair pull test results were predominantly negative, with 77.5% of Group A and 80.0% of Group B showing negative results, indicating no significant difference (P=0.785) (Table 3).

Table 2: Hamilton Narwood Grade of AGA patients

Hamilton Narwood Grade	Group A: Minoxidil		Group B: PRP		Total		P value
	No.	%	No.	%	No.	%	
II	2	5.0%	5	12.5%	7	8.8%	$\chi2$=5.367 P=0.147 (NS)
III	16	40.0%	20	50.0%	36	45.0%	
IV	14	35.0%	13	32.5%	27	33.8%	
V	8	20.0%	2	5.0%	10	12.5%	
Total	**40**	**100.0%**	**40**	**100.0%**	**80**	**100.0%**	

Table 3: Hair Pull Test of AGA patients

Hair Pull test	Group A: Minoxidil		Group B: PRP		Total		P value
	No.	%	No.	%	No.	%	
Negative	31	77.5%	32	80.0%	63	78.8%	$\chi2$=0.075 P=0.785 (NS)
Positive	9	22.5%	8	20.0%	17	21.3%	
Total	**40**	**100.0%**	**40**	**100.0%**	**80**	**100.0%**	

Pretreatment staging showed that Stage 3 was the most common stage in both groups, with 42.5% of Group A and 45.0% of Group B in this stage. The staging was similar between the groups at baseline (P=0.449) (Table 2).After three months of treatment, Stage 3 remained the most common, but Group B showed a higher percentage of patients in Stage 2 (20.0%) compared to Group A (10.0%). There was a trend towards a significant difference in staging outcomes after three months (P=0.052) (Table 3).After six months, Group B had a higher percentage of patients in Stage 1 (15.0%) compared to Group A (2.5%) (Table 4).The chi-square test suggested a trend towards a significant difference in staging outcomes favoring PRP (P=0.082) (Table 4).

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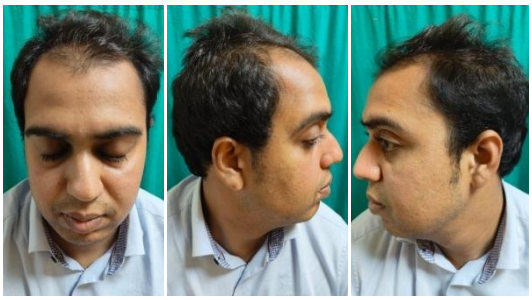
Table 4: Staging of AGA patients of different time intervals

Time interval	Stage Level	Group A: Minoxidil	Group B: PRP	Total	P-value
Pretreatment Stage	2	2	5	7	$\chi 2=2.648$ P=0.449 (NS)
	3	17	18	35	
	4	13	13	26	
	5	8	4	12	
Stage after 3 months	1	0	1	1	$\chi 2=9.402$ P=0.052 (NS)
	2	4	8	12	
	3	17	18	35	
	4	12	13	25	
	5	7	0	7	
Stage after 6 months	1	1	6	7	$\chi 2=8.283$ P=0.082 (NS)
	2	13	16	29	
	3	16	13	29	
	4	6	5	11	
	5	4	0	4	

Table 5: Comparison of treatment response of different time intervals

Time interval	Treatment response	Group A: Minoxidil	Group B: PRP	Total	P-value
After 3 months	No change	31	25	56	$\chi 2=3.773$ P=0.152 (NS)
	Progressed	1	0	1	
	Improved	8	15	23	
After 6 months	No change	29	16	45	$\chi 2=8.584$ P=0.003 (S)
	Improved	11	24	35	

Treatment response after three months showed that 62.5% of Group B had no change compared to 77.5% of Group A. Improvement was observed in 37.5% of Group B patients compared to 20.0% of Group A, indicating a better initial response to PRP, though not statistically significant (P=0.152).After six months, the difference in treatment response became more pronounced, with 60.0% of Group B showing improvement compared to 27.5% of Group A. The chi-square test indicated a significant difference in treatment response favoring PRP (P=0.003) (Table 5).Adverse effects varied between the groups. Group B reported a high incidence of pain (57.5%), while Group A experienced more itching (30.0%) and headaches (10.0%). Group A also had cases of eye irritation (5.0%) and scaling (7.5%). The chi-square test indicated a highly significant difference in adverse effects between the groups, with PRP associated with more pain and Minoxidil with more itching and other minor effects (P=0.0001).



Pre treatment

Post treatment

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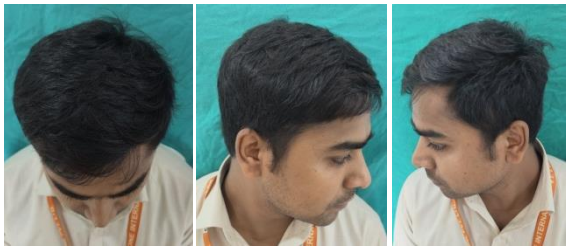
Pre treatment



Post treatment

DISCUSSION

In this study, 80 patients with androgenetic alopecia (AGA) were randomly divided into two groups: Group A (Minoxidil) and Group B (PRP), with 40 patients each. Group A used a 5% Minoxidil solution topically twice daily and underwent once-a-month mesotherapy for six months, while Group B received PRP treatment for six months. The majority of patients (70-77.5%) were aged 21-30 years, with mean ages of 28.20 and 27.78 years for the Minoxidil and PRP groups, respectively. This age distribution aligns closely with the findings of Gkini et al.[11], who reported a mean age of 27.8 years in their study on PRP treatment for AGA. Similarly, Tawfik and Osman[12] found mean ages of 30.85 and 31.05 years in their comparison of Minoxidil and PRP treatments. Gentile et al.[13] and Butt et al.[14] focused on older populations, with mean ages of 35 years and 30.7 years, respectively.

Most patients (52.5-67.5%) had experienced AGA for 1-2 years, with mean durations of 1.913 and 1.763 years for the Minoxidil and PRP groups. Gkini et al.[11] reported a longer mean duration of 4.75 years, and Gentile et al.[13] included patients with AGA history ranging from 2 to 25 years. Sorbellini et al.[15] reported a mean disease duration of 3.5 years in their PRP study. Verma et al.[16] included patients with a disease duration of 6 months to 2 years, aligning more closely with this study.

A family history of AGA was reported by 57.5% of patients in the Minoxidil group and 40.0% in the PRP group, averaging 48.8% overall. This prevalence falls within the range reported by other studies. Butt et al.[14] reported a higher prevalence (76%), while Gentile et al.[13] noted only 18%. Sorbellini et al.[15] reported that 55% of their PRP study participants had a family history, and Kang et al.[17] found 74.7% in their low-level light therapy study. Rossi et al.[18] reported an even higher prevalence of 82% in their finasteride study participants.

Grade III AGA was the most prevalent (40-50%), followed by Grade IV (32.5-35%) and Grade V (5-20%), with Grade II being less common. Gentile et al.[13] reported a majority of Grade IIa patients (42.7%) in their PRP study, followed by Grade IV (27.3%) and Grade III (18.2%). Alves and Grimalt[19] found a distribution more closely aligned with this study, with the majority (63.6%) in Grade III-IV. Sorbellini et al.[15] included patients from Grade I to V but didn't provide specific percentages. Rossi et al.[18] and Saed et al.[20] focused on specific grades.

The hair pull test results were predominantly negative in both groups, with 77.5% of Group A and 80.0% of Group B showing negative results. Gkini et al.[11] reported that the hair pull test was positive in all patients at baseline, becoming negative in 54% by the end of their study. Verma et al.[16] found the hair pull test positive in all patients at baseline, becoming negative in 36% of the PRP group and 40% of the Minoxidil group by the end of their study.

In pretreatment staging, Stage 3 was the most common (42.5-45%), followed by Stage 4 (32.5%) and Stage 5 (10-20%). Gentile et al.[13] reported a majority of Grade IIa patients (42.7%), followed by Grade IV (27.3%) and Grade III (18.2%). Alves and Grimalt[19] found the majority in Grade III-IV (63.6%). Verma et al.[16] reported a higher proportion of Grade II patients (36-40%), with Grade III and IV each accounting for about 28-32%. Rossi et al.[18] focused only on Grade II-III patients, while Saed et al.[20] included only Grade I-II.

After three months, Stage 3 remained the most common, with an increase in Stage 2 patients, especially in the PRP group. Gkini et al.[11] reported significant improvements in hair density and quality after three PRP sessions over three months. Khatu et al.[21] observed a reduction in hair loss and an increase in hair volume in six patients after four sessions of PRP over three months. Sorbellini et al.[15] noted that visible improvements with PRP typically occur after 2-3 months of treatment. For Minoxidil, Olsen et al.[22] reported significant increases in hair count after 48 weeks of treatment but didn't provide three-month data.

At six months, further improvement was seen, particularly in the PRP group, with more patients moving to Stage 1 and 2. Gentile et al.[13] reported significant improvements in mean hair count and total hair density after three months of PRP treatment, with results maintained at six months. Alves and Grimalt[19] found significant improvements in hair count and hair mass index after six months of PRP treatment. For Minoxidil, Olsen et al.[22] reported significant increases in target area hair count at six months with 5% Minoxidil foam. Rossi et al.[18] noted that the most evident improvements with finasteride occurred after one year.

After three months, 37.5% of PRP patients showed improvement compared to 20.0% of Minoxidil patients, though this difference was not statistically significant. Gentile et al.[13] reported significant improvements in mean hair count and total hair

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density after three months of PRP treatment. Khatu et al.[21] reported that six out of 11 patients had +2 to +3 improvement on a seven-point standardized hair growth assessment scale after four sessions of PRP over three months. Verma et al.[16] found that after three months, the mean hair count increased by 22.09 in the PRP group and 18.56 in the Minoxidil group. Olsen et al.[23] didn't report three-month data for Minoxidil, but Rossi et al.[24] found significant improvements in hair counts as early as eight weeks with 5% Minoxidil.

After six months, 60.0% of the PRP group showed improvement compared to 27.5% of the Minoxidil group, a statistically significant difference. Gentile et al.[13] reported that at six months, the PRP group-maintainedimprovements seen at three months, while the placebo group showed progressive hair loss. Alves and Grimalt[19] found significant improvements in hair count and hair mass index after six months of PRP treatment. Kapoor et al.[25] found that at six months, PRP showed the highest improvement in hair count (29.6%) compared to Minoxidil (12.3%) and finasteride (9.9%). Verma et al.[16] reported a mean hair count increase of 46.85 in the PRP group and 38.26 in the Minoxidil group at six months.

Adverse effects varied between treatments. Minoxidil caused itching (30.0%), headaches (10.0%), scaling (7.5%), and eye irritation (5.0%). Suchonwanit et al.[26] reported similar side effects, with higher itching incidence in this study possibly due to formulation differences. Friedman et al.[27] noted headaches with higher Minoxidil concentrations. PRP treatment was associated with a high incidence of pain (57.5%) and some cases of infection (2.5%). Gentile et al.[13] reported only mild pain in PRP-treated patients. The infection rate underscores the need for sterile conditions during PRP administration. PRP showed no instances of itching, headaches, or scaling, which are more commonly associated with Minoxidil. This difference in side effect profiles, confirmed by a chi-square test (χ^2=45.257, P=0.0001), suggests that while PRP may cause more immediate discomfort, it may have fewer ongoing minor side effects compared to Minoxidil. These findings contribute to the growing body of evidence comparing these two hair loss treatments and may aid in treatment selection based on individual patient factors and preferences.

CONCLUSION

This study aimed to compare the efficacy and safety of Minoxidil and Platelet-Rich Plasma (PRP) in treating Androgenetic Alopecia (AGA). The results demonstrated that while both treatments are effective, PRP showed a more pronounced improvement over time.Over six months of treatment, PRP demonstrated superior efficacy compared to Minoxidil. A higher percentage of patients in the PRP group showed significant improvement in their AGA staging, with the difference in treatment response becoming statistically significant, indicating PRP as the more effective treatment option. Despite the improved outcomes, PRP was associated with a higher incidence of pain, whereas Minoxidil was linked to more instances of itching and headaches. Nevertheless, both treatments were deemed to have acceptable safety profiles, with no severe complications reported. Further research with larger sample sizes and longer follow-up periods is recommended to validate these findings and explore the long-term benefits and safety of PRP in the treatment of AGA.

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