

## Original Research Article

# EARLY RESPONSE AND POST-INDUCTION DURABILITY OF HAIR GROWTH FOLLOWING PLATELET-RICH PLASMA OR 5% TOPICAL MINOXIDIL IN MALE ANDROGENETIC ALOPECIA: A SECONDARY PHASE-BASED ANALYSIS

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## ABSTRACT

**Background:** The timing of visible improvement and persistence of benefit after completion of a finite platelet-rich plasma (PRP) course are clinically important in androgenetic alopecia. These features differ conceptually from the overall efficacy comparison reported in the companion manuscript. **Objective:** To describe early response timing and compare phase-specific changes in hair density during the first 6 months and from 6 to 12 months after PRP or continuous 5% topical minoxidil.

**Materials and Methods:** This secondary analysis used aggregate data from a prospective comparative study of 100 men aged 20-50 years with Hamilton-Norwood grade III-VII androgenetic alopecia. Fifty participants received activated autologous PRP once monthly for six sessions; 50 applied 1 mL of 5% topical minoxidil twice daily for 12 months. Mean hair-density changes were examined for the active/induction phase (baseline to 6 months) and the post-induction/extended-treatment phase (6-12 months). The reported timing of noticeable improvement was summarized descriptively. Because individual monthly measurements and within-person covariance were unavailable, the interval analysis was descriptive and no new significance tests were performed. **Results:** Mean hair density increased from 37.94 to 46.90 with PRP and from 44.34 to 49.82 with minoxidil during months 0-6, corresponding to mean gains of 8.96 and 5.48 units and average monthly gains of 1.49 and 0.91, respectively. From months 6-12, after completion of the six-session PRP course but during continued minoxidil use, mean density increased by a further 2.36 units with PRP and 2.70 units with minoxidil. Mean PRP hair density therefore did not decline after the induction course and rose by 5.0% relative to its 6-month value. The thesis narrative reported noticeable improvement at approximately 2-3 months with PRP and around month 4 with minoxidil.

**Conclusion:** PRP showed a larger early group-level rate of hair-density increase, followed by persistence and a smaller additional gain after completion of six monthly sessions. During months 6-12, the rates of increase were similar between groups. Baseline hair density was on lower side in PRP group (37.94±10.73) as compare to Minoxidil group (44.34±8.43), even though PRP group showed more increased in hair density. In PRP group, increase in hair density was early & which was continue even after completing six sessions.

**Keywords:** Androgenetic alopecia; Durability; Hair density; Minoxidil; Platelet-rich plasma; Response kinetics.

## INTRODUCTION

Androgenetic alopecia (AGA) is a chronic, progressive, non-scarring disorder characterised by patterned follicular miniaturisation in genetically susceptible individuals. Although objective hair growth is important, the timing of visible improvement is also clinically relevant because delayed benefit can reduce treatment persistence and patient confidence.<sup>[1]</sup>

Topical minoxidil is an established therapy for male AGA. Treatment is generally continued long term, and efficacy depends on sustained application. Randomised studies have shown that 5% topical minoxidil can produce earlier and greater hair regrowth than lower concentrations, while longer follow-up indicates that continued treatment may maintain hair growth above baseline even when the initial peak response attenuates.<sup>[2,3]</sup>

Autologous PRP is delivered as a finite series of scalp injections in many clinical protocols. Platelet-derived mediators may stimulate dermal papilla cell proliferation, beta-catenin signalling, fibroblast growth factor-7 expression and anagen entry.<sup>[4]</sup> Clinical protocols vary substantially in centrifugation, platelet concentration, activation, injection interval and maintenance treatment. Studies using monthly induction schedules have reported early improvements, but evidence regarding persistence after the induction course remains heterogeneous.<sup>[5-10]</sup>

The parent prospective study compared six monthly sessions of activated PRP with twice-daily 5% topical minoxidil over 12 months. The companion manuscript reports the overall between-group hair-density outcomes at baseline, 6 months and 12 months. The present secondary analysis was designed to address a different clinical question: whether the pattern of gain suggested earlier response with PRP and whether the mean benefit persisted after PRP injections ended at month.<sup>[6]</sup> Because the thesis did not report participant-level monthly data, this paper presents a transparent phase-based analysis of the available aggregate measurements rather than claiming a formal longitudinal or predictor model.

## MATERIALS AND METHODS

### Study design and source data

This was a secondary analysis of aggregate data from a prospective, parallel-group comparative study of PRP and topical minoxidil in male AGA. The original study enrolled 100 participants, with 50 in each treatment group. The allocation was done randomly after taking consent from the patients who were willing.

### Participants

Eligible participants were men aged 20-50 years with Hamilton-Norwood grade III-VII AGA who had received no hair-loss treatment during the preceding 6 months. Exclusion criteria were another cause of

alopecia, bleeding disorder, anticoagulant use, active scalp infection, keloidal tendency, psoriasis or lichen planus with concern for the Koebner phenomenon, and known intolerance to minoxidil. Written informed consent was obtained.

### Interventions

For PRP preparation, 5 mL of autologous blood was collected in acid-citrate-dextrose solution. A double-spin protocol was used: 660 g for 7 minutes followed by 2350 g for 5 minutes. PRP was activated using a 3:7 mixture of 0.5 M calcium chloride and PRP and injected intradermally over the alopecic scalp at 0.1 mL/cm<sup>2</sup>. Six sessions were administered at monthly intervals. Participants in the comparator group applied 1 mL of 5% topical minoxidil twice daily for 12 months.

### Outcome assessment

The thesis states that hair density was recorded monthly using a dermoscope/densitometer and that standardised photographs were obtained. However, numerical hair-density results were reported only at baseline, 6 months and 12 months. The thesis also used a five-category patient-reported improvement scale, 0, no improvement; 1, little improvement (1-25%); 2, moderate improvement (26-50%); 3, much improved (51-75%); and 4, very much improved (76-100%). The narrative report stated that improvement became noticeable at approximately 2-3 months in the PRP group and around the fourth month in the minoxidil group.

### Phase definitions and derived measures

The baseline-to-6-month interval was defined as the active/induction phase because all six monthly PRP sessions were delivered during this period and minoxidil was being applied continuously. The 6-12-month interval was defined as the post-induction phase for PRP and the extended-treatment phase for minoxidil. Group-level durability after PRP was operationally defined as maintenance of the 6-month mean hair-density gain at month 12, without a decline in the group mean. Absolute interval change, average monthly change, change from the 6-month value and the proportion of the total 12-month gain occurring after month 6 were calculated from reported group means.

### Statistical considerations

Continuous outcomes are presented as reported means and standard deviations where available. The interval-specific values in this report are arithmetic derivations from published group means. The early-response timing was available only as a narrative group-level observation and was therefore treated as descriptive.

### Ethics

The original study was reviewed and approved from the ethical perspective by the Office of the Ethics Committee, Base Hospital, Delhi Cantt. The approval number was not available in the converted thesis. Written informed consent was obtained from all participants.

## RESULTS

### Participants and reported follow-up

All 100 enrolled participants were represented in the reported baseline, 6-month and 12-month aggregate analyses, with 50 participants in each group. Baseline hair density was lower in the PRP group than in the minoxidil group ( $37.94 \pm 10.74$  versus  $44.34 \pm 8.44$ ).

### Early response

The thesis narrative stated that visible or patient-noticed improvement began at approximately 2-3 months in the PRP group and around the fourth month in the minoxidil group. This suggests a possible earlier onset with PRP. However, the thesis did not provide participant-level onset dates, monthly response counts or a prespecified definition of first response; consequently, the timing difference could not be tested statistically.

### Hair-density change during the active/induction phase

From baseline to 6 months, mean hair density increased from 37.94 to 46.90 in the PRP group and from 44.34 to 49.82 in the minoxidil group. The mean

absolute gains were 8.96 and 5.48 units, respectively. When expressed as an average over the 6-month interval, the group-level rate of increase was 1.49 units/month with PRP and 0.91 units/month with minoxidil. The corresponding percentage increases from baseline reported in the thesis were 25.51% and 13.10%.

### Post-induction persistence and extended response

Between months 6 and 12, mean hair density increased by a further 2.36 units in the PRP group, from 46.90 to 49.26, despite completion of the six-session course at month 6. This represented a 5.0% increase relative to the 6-month mean and accounted for 20.8% of the total 12-month gain. In the minoxidil group, which continued twice-daily treatment, mean hair density increased by 2.70 units, from 49.82 to 52.52; this represented a 5.4% increase relative to month 6 and 33.0% of the total 12-month gain. The average descriptive rates during months 6-12 were 0.39 and 0.45 units/month, respectively. Thus, the more marked early separation in rate of gain was not evident in the later interval, but the PRP group showed no group-level loss of its 6-month improvement.

**Table 1: Treatment phases and reported mean hair density**

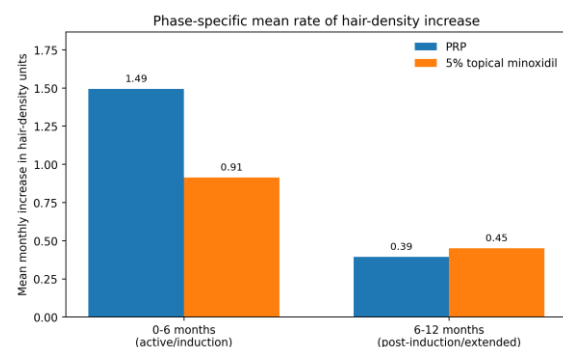
| Phase/time point | PRP exposure                              | Minoxidil exposure                | PRP mean hair density | Minoxidil mean hair density |
|------------------|-------------------------------------------|-----------------------------------|-----------------------|-----------------------------|
| Baseline         | Before first injection                    | Before treatment                  | $37.94 \pm 10.74$     | $44.34 \pm 8.44$            |
| Month 6          | Six monthly sessions completed            | Twice daily for 6 months          | $46.90 \pm 11.51$     | $49.82 \pm 8.04$            |
| Month 12         | No additional PRP reported after month 6* | Twice daily continued to month 12 | $49.26 \pm 9.99$      | $52.52 \pm 8.31$            |

\*Confirm from the original case records that no maintenance PRP or other alopecia therapy was administered between months 6 and 12.

**Table 2: Derived phase-specific hair-density changes**

| Derived metric                                 | PRP   | 5% topical minoxidil | Interpretation                                    |
|------------------------------------------------|-------|----------------------|---------------------------------------------------|
| Absolute change, baseline to month 6           | 8.96  | 5.48                 | Larger early group-level gain with PRP            |
| Average monthly change, months 0-6             | 1.49  | 0.91                 | Descriptive rate; not a fitted longitudinal slope |
| Absolute change, months 6-12                   | 2.36  | 2.70                 | Further increase in both groups                   |
| Average monthly change, months 6-12            | 0.39  | 0.45                 | Similar descriptive late-phase rates              |
| Month 6-12 change relative to month 6          | 5.0%  | 5.4%                 | No decline in the group mean after PRP induction  |
| Month 6-12 contribution to total 12-month gain | 20.8% | 33.0%                | Most gain occurred during the first 6 months      |

All interval values are arithmetic derivations from reported aggregate means. Inferential comparison of 6-12-month change was not possible without paired patient-level data.



**Figure 1: Phase-specific mean rate of hair-density increase.** Values were calculated by dividing the reported mean change within each 6-month interval by six. These descriptive rates are not regression slopes and were not subjected to significance testing because individual repeated measurements were unavailable.

## DISCUSSION

This secondary phase-based analysis suggests that the pattern of response differed over time. During the first 6 months, when the PRP group underwent monthly treatment, the average group-level increase

in hair density was greater than that observed with twice-daily minoxidil. After the sixth PRP session, the PRP mean did not return toward baseline; instead, it increased modestly over the next 6 months. This supports persistence of the group-level gain after the induction course, although it does not establish individual durability or define an optimal maintenance schedule.

The reported earlier onset of noticeable improvement with PRP is biologically plausible. Activated PRP can stimulate dermal papilla cell proliferation and pathways associated with anagen entry,<sup>[4]</sup> while clinical studies using closely spaced induction sessions have described early reductions in shedding or increased hair counts.<sup>[6-10]</sup> Hausauer and Jones found that a more intensive monthly PRP induction regimen produced faster and greater improvement than a less frequent regimen over 6 months.<sup>[10]</sup> However, the current thesis did not provide monthly numerical outcomes, so its reported 2-3-month onset should be regarded as a descriptive observation rather than a comparative time-to-event result.

The late-phase pattern deserves careful interpretation. PRP treatment ended at month 6, whereas minoxidil continued throughout the full 12 months. Therefore, the month 6-12 interval compares post-induction follow-up after a procedural course with ongoing pharmacological treatment, not two untreated durability periods. The similar descriptive rates in the later interval may reflect a slowing after the main induction response with PRP and continued gradual benefit with minoxidil. Long-term minoxidil studies have shown that regrowth may peak and subsequently attenuate while remaining above baseline with continued therapy.<sup>[3]</sup>

The persistence observed after PRP is consistent with one-year clinical reports in which benefit remained detectable after an induction course and a later booster.<sup>[7]</sup> Other controlled studies have shown improved hair-density measures after PRP,<sup>[9,12]</sup> whereas some randomised comparisons have found increases on both PRP- and control-treated scalp areas without a significant between-area difference.<sup>[13]</sup> These variable findings reinforce the importance of standardised PRP preparation, platelet quantification, target-area definition and blinded longitudinal assessment.

The present analysis intentionally differs from the companion efficacy manuscript. The companion report addresses absolute hair density and percentage change at prespecified 6- and 12-month endpoints. This report treats the two 6-month intervals as clinically different phases and focuses on onset and persistence. Nevertheless, both papers originate from the same cohort and share source measurements. Transparent disclosure, cross-referencing and submission of the companion manuscript to editors are therefore essential.

The originally proposed title included “predictors of hair growth.” That component cannot be supported by the available thesis. The study proforma recorded age, age at onset, duration, pattern and course of hair

loss, treatment history and family history, but the thesis does not present patient-level links between these variables and hair-density outcomes. The clinical photographs and selected examples labelled with Hamilton-Norwood grade are illustrative and cannot be used as an unbiased predictor sample. A valid predictor analysis would require the original individual-level dataset and a prespecified multivariable model, ideally adjusting for baseline density, treatment group, age, disease duration and AGA grade.

### **Limitations**

This analysis is limited by the use of aggregate data at only three time points. Although the thesis states that hair density was measured monthly, the monthly values were not reported. The timing of noticeable improvement was narrative, without participant-level onset data or a validated threshold. The 6-12-month changes could not be tested because within-person variability and covariance were unavailable. Baseline hair density differed significantly between groups, allocation and assessor blinding were not documented, and adherence to minoxidil was not quantified. Platelet enrichment, leukocyte content and final injected volume were not reported. The source document also contains conflicting study-site and study-period entries that must be resolved. Durability was assessed at the group-mean level only, and no valid predictor analysis was possible from the available material.

## **CONCLUSION**

In men with Hamilton-Norwood grade III-VII AGA, monthly activated PRP was associated with a larger descriptive rate of hair-density increase during the first 6 months than twice-daily 5% topical minoxidil. After completion of the six-session PRP course, the group mean hair density did not decline and showed a modest further increase through month 12, suggesting post-induction persistence. The late-phase descriptive rate was similar to that observed during continued minoxidil therapy. These findings should be considered hypothesis-generating until individual monthly measurements are analysed using baseline-adjusted longitudinal models. Predictor analysis requires the original patient-level dataset and should not be claimed from the thesis in its current form.

### **Key message**

PRP showed a faster early group-level increase and maintained its mean gain for 6 months after the induction course, but the available thesis supports only a descriptive phase-based analysis—not a formal time-to-response, durability or predictor model.

### **Author contributions**

AB: Conceptualisation, methodology, clinical investigation, participant recruitment, data collection and preparation of the original thesis. SK: Study

supervision, clinical oversight, methodology and critical revision. RKJ: Secondary statistical derivation, interpretation, manuscript drafting, literature synthesis, journal formatting and critical revision. All authors reviewed and approved the final manuscript and agree to be accountable for all aspects of the work.

#### **Declarations**

**Ethics approval and consent to participate:** The original study received ethical approval from the Office of the Ethics Committee, Base Hospital, Delhi Cantt, and written informed consent was obtained.

**Consent for publication:** No identifiable patient material is included in this secondary report.

**Funding:** Nil.

**Conflicts of interest:** None declared.

**Data availability:** The analysis was derived from aggregate results in the source thesis. The individual monthly and baseline-covariate dataset should be preserved and may be made available subject to institutional and ethics approval.

**Duplicate-publication disclosure:** This is a secondary phase-based analysis of the same cohort as a companion manuscript focused on overall objective hair-density outcomes. Both reports must be disclosed and cross-referenced during submission.

**AI disclosure:** Generative artificial intelligence not used in language editing, manuscript organisation and document formatting.

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