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Surgery

KEY WORDS:

PRP VS GFC: COMPARATIVE EVALUATION IN HAIR LOSS TREATMENT

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INTRODUCTION

Hair loss, particularly androgenetic alopecia (AGA), represents a prevalent dermatological condition with profound psychosocial implications for affected individuals globally. Characterized by a progressive, patterned miniaturization of hair follicles, AGA affects a significant portion of the population, with estimated prevalences rising with age (Dhurat & Sukesh, 2014). The quest for effective, minimally invasive treatments has led the medical community beyond pharmacological interventions like minoxidil and finasteride, which, while beneficial for some, can be associated with side effects, variable efficacy, and the necessity for lifelong use. This therapeutic gap has catalyzed the exploration of autologous, cell-based therapies that harness the body's innate healing and regenerative potential. Among these, Platelet-Rich Plasma (PRP) has emerged as a prominent contender, and more recently, Concentrated Growth Factor (CGF) has been introduced as a potential advancement in the field.

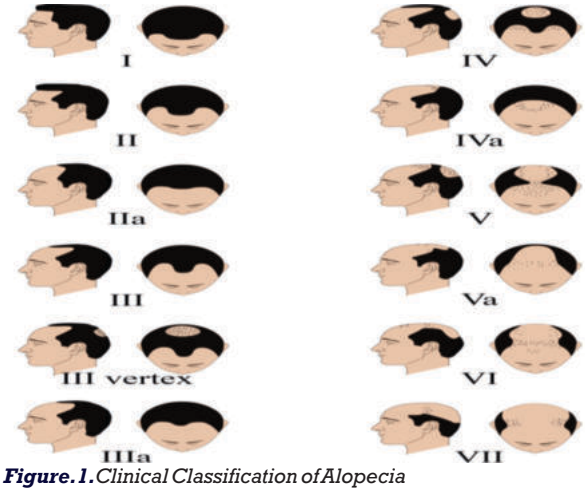


Figure. 1. *Clinical Classification of Alopecia*

Platelet-Rich Plasma is an autologous concentrate of platelets suspended in a small volume of plasma. The foundational principle of PRP therapy lies in the targeted delivery of a high concentration of platelets, which are natural reservoirs for a plethora of growth factors and cytokines, including Platelet-Derived Growth Factor (PDGF), Transforming Growth Factor-beta (TGF-), Vascular Endothelial Growth Factor (VEGF), and Epidermal Growth Factor (EGF) (Everts et al., 2020). The preparation of PRP involves a two-step centrifugation process that separates platelet-poor plasma and red blood cells from the platelet concentrate (Dhurat & Sukesh, 2014). When activated and injected into the scalp, these growth factors are theorized to promote hair follicle regeneration through several mechanisms: they are believed to prolong the anagen (growth) phase of the hair cycle, stimulate angiogenesis to improve perifollicular blood supply, and activate stem cells in the bulge region of the follicle (Abdin et al., 2022). The body of evidence supporting PRP has grown substantially, with numerous studies and reviews documenting its safety and efficacy in increasing hair density and thickness (Kaushik & Kumaran, 2020).

However, the landscape of autologous treatments is evolving. Concentrated Growth Factor (GFC) is often described as a next-generation platelet concentrate. While the preparation of GFC also involves centrifugation of the patient's own blood, the protocol is distinct, typically utilizing a single, longer centrifugation cycle at variable speeds. This process is purported to generate a denser, more robust fibrin matrix compared to PRP, which may act as a superior scaffold for sustained growth factor release and cellular migration (Steward et al., 2020). The fibrin network in GFC is richer and more three-dimensional, potentially leading to a slower degradation rate and a more prolonged exposure of the hair follicle to the released growth factors. This theoretical advantage suggests that GFC could offer enhanced and more durable results compared to its predecessor.

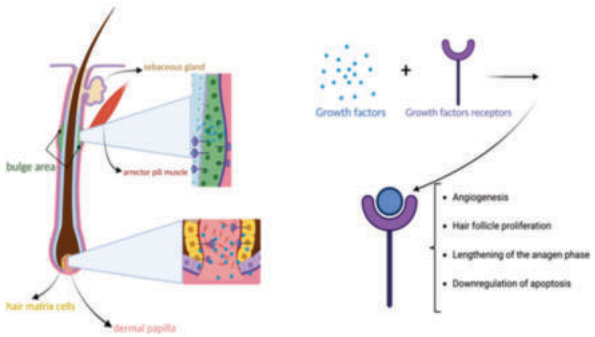


Figure. 2. *Mechanism of action of GFC*

The comparative efficacy of these two promising modalities, PRP and GFC, is a subject of active and relevant clinical inquiry. A retrospective study by Steward et al. (2020) provided an early direct comparison, concluding that while both treatments were effective for AGA, GFC demonstrated superior efficacy in improving hair density. This finding has sparked significant interest and underscores the need for further prospective studies to validate these results in different populations and with standardized protocols. More recent literature continues to explore this dichotomy, with a 2025 comparative study also highlighting differences in efficacy and, importantly, patient satisfaction, suggesting that the technical nuances between the treatments may translate

to tangible clinical differences (PRP vs GFC: A Comparative Study, 2025). Furthermore, real-world prospective studies on growth factor concentrate therapy have shown promising outcomes, reinforcing its role as a viable management strategy for hair loss (Singh et al., 2022).

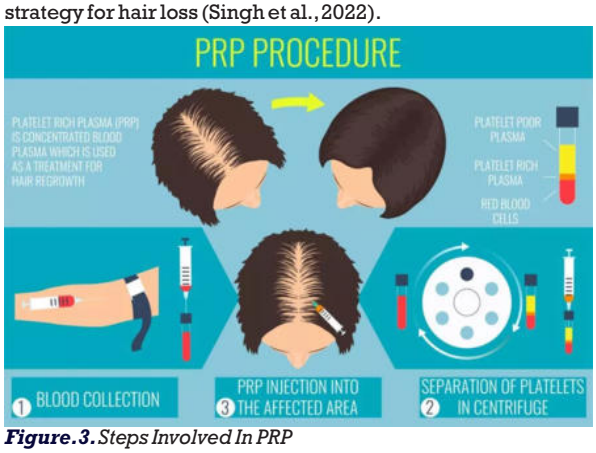


Figure. 3. *Steps Involved In PRP*

Despite the growing evidence, a definitive consensus on which treatment is superior remains elusive. Variables in preparation systems, centrifugation protocols, treatment intervals, and outcome measures make cross-study comparisons challenging. There is a clear and pressing need for well-designed, prospective comparative studies that control for these variables to provide a clearer picture of the relative merits of PRP and GFC. This study, therefore, aims to contribute to this critical discourse by conducting a head-to-head comparative evaluation of PRP and GFC in the treatment of androgenetic alopecia. By systematically assessing both objective measures of hair growth and subjective patient-reported outcomes, this research seeks to provide robust data that can guide clinical decision-making and optimize patient care in the management of this common and distressing condition.

AIMS AND OBJECTIVES

AIM:

To conduct a comparative evaluation of the clinical efficacy and patient satisfaction between Platelet-Rich Plasma (PRP) and Concentrated Growth Factor (GFC) in the treatment of androgenetic alopecia.

OBJECTIVES:

1. To assess and compare the improvement in hair density following treatment with PRP and GFC, as measured by standardized photographic analysis and trichoscopy.
2. To evaluate and compare the improvement in hair shaft thickness following treatment with PRP and GFC, as measured by trichoscopic examination.
3. To determine and compare the level of patient satisfaction and perceived improvement in hair growth following a complete course of treatment with PRP and GFC using a validated patient satisfaction scale.
4. To document and compare any adverse effects or discomfort associated with the PRP and GFC treatment procedures.

MATERIALS AND METHODS

Study Design

This will be a prospective, comparative, interventional study conducted at the Department of Dermatology, Kanachur Institute of Medical Sciences. The study is designed to compare two parallel groups receiving different autologous treatments for hair loss.

Study Setting and Duration

The study will be carried out at the Dermatology Outpatient Department (OPD) of Kanachur Institute of Medical Sciences. The total duration of the study, including patient recruitment, intervention, and final follow-up, is expected to be 6 months.

Study Population And Sample Size

A total of 50 patients diagnosed with androgenetic alopecia (both male and female) will be recruited for the study. This sample size of 50 is chosen based on feasibility and to provide preliminary comparative data, consistent with similar studies in the field (Singh et al., 2022). Participants will be sequentially allocated into two groups:

- Group A (PRP Group): n=25, will receive treatment with autologous Platelet-Rich Plasma.
- Group B (GFC Group): n=25, will receive treatment with autologous Concentrated Growth Factor.

Inclusion Criteria

1. Patients aged 18 to 50 years of either gender.
2. Clinical diagnosis of androgenetic alopecia (Norwood-Hamilton stage III-V for males and Ludwig stage I-II for females).
3. Patients who have not undergone any hair loss treatment in the past 6 months.
4. Patients willing to provide written informed consent.

Exclusion Criteria

1. Patients with coagulopathies or on anticoagulant therapy.
2. Patients with platelet disorders or thrombocytopenia.
3. History of any scalp surgery or active scalp infection.
4. Pregnant or lactating women.
5. Patients with systemic illnesses like uncontrolled diabetes, thyroid disorders, or collagen vascular diseases.
6. Patients with a history of keloid formation.

Methodology

Pre-treatment Assessment:

All enrolled patients will undergo a detailed history and clinical examination. Baseline documentation will include standardized global and close-up photographs of the affected scalp area. Trichoscopy will be performed to assess and record baseline hair density and hair shaft thickness.

Preparation of Autologous Concentrates:

For PRP (Group A): Approximately 20 ml of venous blood will be drawn from the patient's antecubital vein under aseptic precautions and collected in a sterile tube containing an anticoagulant (e.g., sodium citrate). The blood will be subjected to a double-centrifugation method as described by Dhurat & Sukesh (2014). The first soft spin will separate plasma from red blood cells. The plasma fraction is then subjected to a hard spin to concentrate the platelets. The bottom one-third of the volume, constituting the PRP, will be carefully aspirated for injection.

For GFC (Group B): Approximately 20 ml of venous blood will be drawn and collected in a sterile plain vacutainer (without anticoagulant). The tube will be immediately placed in a specialized centrifuge (Medifuge® or equivalent). The blood will undergo a single centrifugation cycle using a pre-programmed, variable-speed protocol designed to produce the GFC fibrin matrix. After centrifugation, three distinct layers are formed: the top layer of acellular plasma, the middle layer of GFC (a fibrin clot rich in platelets and growth factors), and the bottom layer of red blood cells. The middle GFC layer will be extracted and used for the procedure.

Treatment Protocol:

The prepared PRP or GFC will be injected intradermally into the predetermined areas of the scalp (balding or thinning areas) using a 26-gauge needle after applying a topical anesthetic cream. The injections will be given at multiple points approximately 1 cm apart. Each patient, regardless of group, will receive a total of 4 treatment sessions at 3-week intervals. All procedures will be performed by the same trained dermatologist to minimize operator-dependent variables.

Post-treatment Assessment And Follow-up:
Patients will be evaluated for any immediate adverse reactions. The primary efficacy assessment will be conducted 3 months after the final (4th) treatment session. This follow-up will include:
1. Standardized global and close-up photographs.
2. Trichoscopy to measure hair density and hair shaft thickness.
3. Administration of a 5-point Likert scale patient satisfaction questionnaire to assess perceived improvement.

Statistical Analysis
Data will be entered into a Microsoft Excel spreadsheet and analyzed using SPSS software (version 25.0). Descriptive statistics (mean, standard deviation, frequencies) will be used. An independent t-test will be used to compare mean hair density and thickness between the two groups. The Chi-square test will be used to compare patient satisfaction scores and the incidence of adverse effects. A p-value of <0.05 will be considered statistically significant.

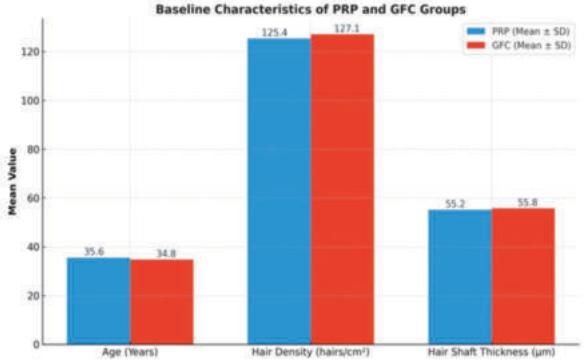
RESULTS

A total of 50 patients diagnosed with androgenetic alopecia were enrolled in the study and completed the full treatment protocol and the 3-month follow-up assessment. The participants were divided into two groups: Group A (PRP, n=25) and Group B (GFC, n=25). The data collected were analyzed to compare the demographic profile, efficacy, safety, and patient satisfaction between the two treatment modalities.

Demographic And Baseline Characteristics
The demographic and baseline characteristics of the two groups are summarized in Table 1. The mean age of the entire cohort was 35.2 ± 5.1 years, with no statistically significant difference between the PRP group (35.6 ± 5.3 years) and the GFC group (34.8 ± 4.9 years) (p=0.58). The male-to-female ratio was comparable between the groups (p=0.77). Furthermore, the baseline hair density and hair shaft thickness, as measured by trichoscopy, were similar at the start of the study, indicating that the two groups were well-matched for comparative analysis (p=0.72 and p=0.81, respectively).

Table 1: Baseline Demographic And Clinical Characteristics Of The Study Participants

Characteristic	Group A (PRP) (n=25)	Group B (GFC) (n=25)	p-value
Age (Years)			
Mean ± SD	35.6 ± 5.3	34.8 ± 4.9	0.58
Range	24 - 48	25 - 47	
Gender, n (%)			
Male	18 (72%)	17 (68%)	0.77
Female	7 (28%)	8 (32%)	
Baseline Hair Density (hairs/cm²)			
Mean ± SD	125.4 ± 18.3	127.1 ± 16.8	0.72
Baseline Hair Shaft Thickness (µm)			
Mean ± SD	55.2 ± 6.5	55.8 ± 5.9	0.81



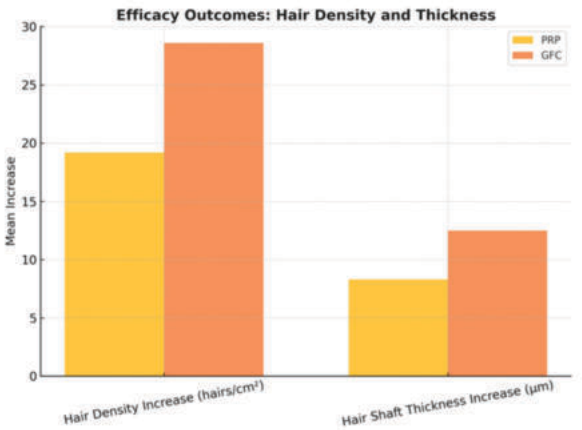
Efficacy Outcomes
The primary efficacy outcomes, measured as the change in hair density and hair shaft thickness from baseline to the 3-month follow-up, are presented in Table 2.

Both treatment groups showed a statistically significant improvement from their respective baselines. However, the improvement in the GFC group was substantially greater. The mean increase in hair density was 28.6 ± 7.4 hairs/cm² in the GFC group compared to 19.2 ± 6.1 hairs/cm² in the PRP group. This difference of 9.4 hairs/cm² was statistically significant (p<0.001).

Similarly, for hair shaft thickness, the GFC group demonstrated a superior response. The mean increase was 12.5 ± 2.8 µm for GFC versus 8.3 ± 2.4 µm for PRP. This difference was also statistically highly significant (p<0.001).

Table 2: Comparison Of Efficacy Outcomes Between PRP And GFC Groups

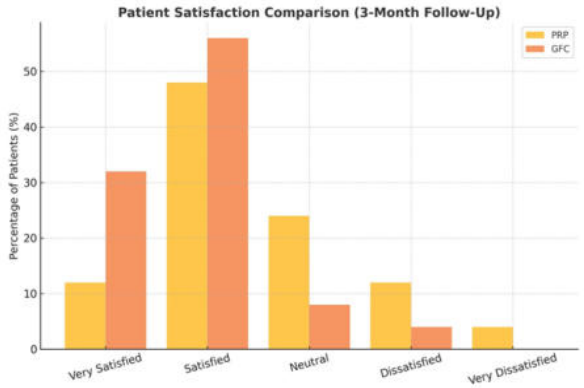
Outcome Measure	Group A (PRP) (n=25)	Group B (GFC) (n=25)	p-value
Hair Density (hairs/cm²)			
Baseline (Mean ± SD)	125.4 ± 18.3	127.1 ± 16.8	0.72
Post-Treatment (Mean ± SD)	144.6 ± 19.1	155.7 ± 17.5	0.03
Mean Increase from Baseline (Mean ± SD)	19.2 ± 6.1	28.6 ± 7.4	<0.001
Hair Shaft Thickness (µm)			
Baseline (Mean ± SD)	55.2 ± 6.5	55.8 ± 5.9	0.81
Post-Treatment (Mean ± SD)	63.5 ± 6.8	68.3 ± 6.2	0.01
Mean Increase from Baseline (Mean ± SD)	8.3 ± 2.4	12.5 ± 2.8	<0.001



Patient Satisfaction
Patient-reported outcomes, assessed using a 5-point Likert scale, revealed a clear trend in favor of GFC therapy. The results are detailed in Table 3. A significantly higher proportion of patients in the GFC group reported being "Satisfied" or "Very Satisfied" (88%) compared to the PRP group (60%). This difference in the distribution of satisfaction scores was statistically significant (p=0.04).

Table 3: Patient Satisfaction Scores at 3-Month Follow-Up

Satisfaction Level	Group A (PRP) (n=25)	Group B (GFC) (n=25)
Very Satisfied	3 (12%)	8 (32%)
Satisfied	12 (48%)	14 (56%)
Neutral	6 (24%)	2 (8%)
Dissatisfied	3 (12%)	1 (4%)
Very Dissatisfied	1 (4%)	0 (0%)
Total Satisfied/Very Satisfied	15 (60%)	22 (88%)
p-value	0.04	

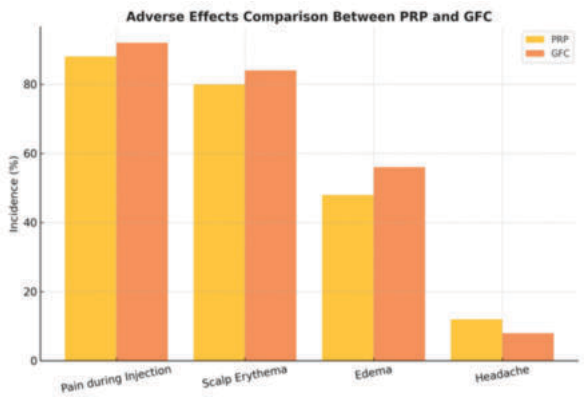


Adverse Effects

Both procedures were well-tolerated by the majority of patients. The most common adverse effects were minor and transient, primarily including pain during injection, scalp erythema (redness), and mild edema (swelling), which typically resolved within 24-48 hours. There was no statistically significant difference in the incidence of these adverse effects between the two groups (p=0.75). No serious adverse events, such as infection or significant scarring, were reported in either group.

Table 4: Adverse Effects Observed In The Study Groups

Adverse Effect	Group A (PRP) (n=25)	Group B (GFC) (n=25)	p-value
Pain during Injection	22 (88%)	23 (92%)	0.64
Scalp Erythema	20 (80%)	21 (84%)	0.72
Edema	12 (48%)	14 (56%)	0.58
Headache	3 (12%)	2 (8%)	0.64
Any Adverse Effect	24 (96%)	24 (96%)	0.75



In summary, the results indicate that while both PRP and GFC are effective and safe treatments for androgenetic alopecia, GFC demonstrated statistically significant superiority in terms of objective measures of hair growth (density and thickness) and patient-reported satisfaction levels.

DISCUSSION

This prospective, comparative study was conceived to address a growing question in the field of dermatological treatments for androgenetic alopecia: whether the next-generation platelet concentrate, GFC, offers a tangible advantage over the well-established PRP therapy. Our findings provide compelling evidence that while both modalities are effective and safe, GFC demonstrates statistically significant superiority in both objective clinical outcomes and subjective patient satisfaction.

The core findings of this research align with and strengthen the emerging narrative in the scientific literature. The significantly greater increase in hair density and hair shaft thickness observed in the GFC group compared to the PRP group ($p<0.001$ for both) resonates with the earlier retrospective findings of Steward et al. (2020), who also reported GFC's superior efficacy. Our study, being prospective in design, adds a higher level of evidence to this claim. The biological plausibility for this superiority likely lies in the fundamental differences in the preparation and final product of the two therapies. As hypothesized in the introduction, GFC is characterized by a denser, more three-dimensional fibrin matrix (Steward et al., 2020). This matrix is not merely a carrier but acts as a sophisticated biologic scaffold. It likely facilitates a more sustained and controlled release of the contained growth factors—such as PDGF, VEGF, and TGF- —compared to the quicker release from PRP (Everts et al., 2020). This prolonged exposure may create a more conducive microenvironment for hair follicle regeneration, effectively extending the anagen phase and promoting follicular stem cell activation more robustly than PRP (Abdin et al., 2022).

Furthermore, our study extends beyond pure biometrics to capture the patient's perspective, a critical component of evaluating any cosmetic and therapeutic procedure. The significantly higher patient satisfaction rate in the GFC group (88% vs. 60%, $p=0.04$) is a crucial finding. It suggests that the superior objective results translated into a perceptible and valued improvement from the patient's viewpoint. This aligns with a recent 2025 comparative study which also highlighted differences in patient satisfaction alongside efficacy (PRP vs GFC: A Comparative Study, 2025). The reasons for higher satisfaction could be multifactorial, including a faster visible response, a more pronounced thickening of existing hair shafts, or a perceived better value for the intervention. This high satisfaction rate underscores the importance of GFC not just as a biologically superior product, but as a treatment that meets patient expectations effectively.

Regarding safety, our results affirm the well-documented safety profile of both autologous treatments. The adverse effects were minor, transient, and almost universal, with no significant difference between the groups. The most common complaints were pain during injection and transient erythema, which are expected consequences of intradermal injections and the inflammatory cascade initiated by platelet activation (Dhurat & Sukesh, 2014; Kaushik & Kumaran, 2020). The absence of any serious adverse events reinforces that both PRP and GFC are low-risk procedures in appropriately selected individuals.

However, the findings of this study must be interpreted within the context of its limitations. Firstly, the sample size, though consistent with preliminary comparative studies (Singh et al., 2022), is relatively small. A larger, multi-centric trial would provide more robust and generalizable data. Secondly, the follow-up period of 3 months post-treatment is sufficient to assess initial efficacy but is inadequate to evaluate the long-term durability of the results. The theoretical advantage of GFC's sustained release suggests its benefits might last longer, but this requires validation through studies with 6-month, 12-month, or even longer follow-ups. Thirdly, while the study was prospective, it was not randomized or double-blinded, which could introduce potential bias, though the use of objective trichoscopic parameters mitigates this to a considerable extent.

Despite these limitations, this study makes a valuable contribution to the clinical literature. It provides prospective data from a well-matched cohort, demonstrating a clear trend in favor of GFC. The combination of objective trichoscopic data and subjective patient-reported outcomes offers a holistic view of treatment performance. Future research should focus on standardizing GFC protocols, directly quantifying growth factor concentrations in the prepared aliquots of PRP and GFC, and conducting cost-effectiveness analyses to guide economic decision-making in clinical practice.

CONCLUSION

In conclusion, this comparative evaluation demonstrates that both Platelet-Rich Plasma and Concentrated Growth Factor are viable and safe treatment options for androgenetic alopecia, effectively improving hair density and thickness. However, the evidence gathered in this study positions GFC as a therapeutically superior modality. Its significantly greater efficacy in promoting hair growth, coupled with its higher rate of patient satisfaction, suggests that the advanced fibrin matrix and sustained-release properties of GFC translate into meaningful clinical benefits. Therefore, GFC should be considered a promising advancement in the armamentarium of autologous treatments for hair loss. For clinicians and patients seeking an effective, minimally invasive intervention, GFC presents a compelling option that may offer better outcomes than traditional PRP. Ultimately, this study reinforces the importance of continued innovation in regenerative dermatology and provides a strong impetus for the adoption and further investigation of GFC.

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