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*Case Report*

# Effective Multimodal Therapy for Chemically Aggravated Androgenetic Alopecia: A Case Report using PRP and Mesotherapy

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**Abstract:** Androgenetic alopecia (AGA) is a common condition characterized by progressive hair loss, closely associated with androgen hormone activity and genetic predisposition. Although platelet-rich plasma (PRP) therapy has gained attention for its regenerative potential and ability to stimulate follicular activity, the synergistic effect of combining PRP with mesotherapy remains unexplored. This case report presents a successful protocol involving a male patient with advanced AGA whose condition was further aggravated by chemical damage from a bleaching procedure. The therapeutic protocol included intradermal injections of PRP in combination with customized blends of active ingredients by mesotherapy, administered in multiple sessions. Quantitative photographic analysis revealed a visual increase in hair density, along with notable improvements in hair thickness and scalp health. The patient expressed great satisfaction with both the aesthetic results and scalp comfort. These results demonstrate the potential of an integrative PRP-mesotherapy approach as safe and effective treatment for patients with complex androgenetic alopecia.

**Keywords:** Platelet-Rich Plasma (PRP); Microneedling; Hair Regrowth; Androgenetic Alopecia; Topical Bioactive Agents.

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## 1. Introduction

Androgenetic alopecia (AGA) is a condition influenced by genetic predisposition and hormonal activity that results in progressive loss of scalp hair. It is the most common form of alopecia, affecting 50% of both men and women by the age of 50 [1]. Clinically, AGA is characterized as a reduction in hair density and shaft diameter, typically presenting as frontal hairline recession in men and diffuse thinning in women. The pathophysiology is primarily driven by the enzyme 5-alpha-reductase, which converts testosterone into dihydrotestosterone (DHT). Elevated DHT levels contribute to progressive follicular miniaturization and shortening of the anagen (growth) phase, ultimately resulting in thinner, shorter and less pigmented hair [2, 3]. Conventional therapeutic options include topical minoxidil, oral 5-alpha-reductase inhibitors (finasteride or dutasteride) and low-level laser therapy.

In recent years, advances in regenerative medicine have positioned Platelet Rich Plasma (PRP) as a promising therapeutic strategy for AGA. PRP contains a high concentration of growth factors such as VEGF, PDGF, and IGF-1 which play critical roles in angiogenesis, cellular signaling and follicular regeneration [4]. Studies show that PRP application promotes activation of follicular stem cells, extends the anagen phase of the hair cycle, and improves scalp vascularization, thereby contributing to hair restoration [5].

In addition to PRP, various topical bioactive agents such as minoxidil, biotin, arginine and panthenol have shown promise in stimulating hair regrowth by modulating key biological pathways involved in follicular regeneration [6]. Among available treatments, mesotherapy has gained attention as a targeted delivery method that allows for precise intradermal administration of these agents directly into the scalp. This technique not only improves transdermal absorption but also induces local mechanical stimulation of hair follicles, thereby enhancing regenerative signaling [7].

This case report describes an integrative therapeutic approach for androgenetic alopecia in a patient with additional chemical hair trauma. The treatment protocol combined PRP, microneedling and intradermal mesotherapy with a personalized combination of bioactive ingredients. Clinical observation and digital imaging analysis revealed notable improvements in hair density, thickness and vitality. To our knowledge, this is one of the first documented cases demonstrating the synergistic effect of this specific multimodal regimen in the context of androgenetic alopecia aggravated by chemical damage, offering a promising protocol for complex hair regeneration cases.

## 2. Case Report

A 43-year-old male patient with a four-year history of progressive hair loss reporting diffuse thinning primarily affecting the frontal hairline and vertex regions. Clinical examination presented androgenetic alopecia (AGA), classified as stage IV on the Norwood Hamilton scale, characterized by deep frontal recession and prominent vertex thinning. Initial treatment included topical 5% minoxidil, applied twice daily on alternate days, which resulted in a modest but noticeable improvement in hair density and hair loss. Subsequently, the patient underwent a two-session bleaching procedure with 30% hydrogen peroxide and bleach powder. This process resulted in substantial structural damage to the hair shaft, worsening of the alopecia and the development of inflammatory microlesions on the scalp.

To repair the follicular damage and accelerate scalp growth, an integrative and multimodal regenerative protocol was designed. This personalized treatment strategy combined platelet rich plasma (PRP), mesotherapy with bioactive compounds and microneedling, designed to synergistically stimulate follicular regeneration, angiogenesis and transdermal bioavailability. The protocol lasted four months. PRP therapy was administered in four sessions, 30 days apart. Each session consisted of collecting 20 mL of peripheral blood in citrate-containing tubes and centrifuging at 4,000 rpm for five minutes to isolate the platelet-rich plasma. PRP was injected intradermally into the scalp using mesotherapy, at 0.2 mL per point spaced 2 cm apart, using a 3 mL syringe and a 30G insulin needle.

Additionally, five microneedling and five mesotherapy sessions were conducted on alternate weeks to optimize local stimulation and compound diffusion. The mesotherapy formulation included a 5 mL bioactive mixture composed of biotin (5 mg/mL), arginine hydrochloride (150 mg/mL), minoxidil (5 mg/mL) and D-panthenol (40 mg/mL). These compounds were selected based on their documented effects: biotin and panthenol support keratin structure and hair shaft resilience; arginine enhances nitric oxide-mediated microcirculation; minoxidil promotes vasodilation and follicular stimulation. Additional intradermal agents included VEGF (Vascular Endothelial Growth Factor), AFGF (Acidic Fibroblast Growth Factor), IGF (Insulin-Based Growth Factor) and copper peptides (4 mg/mL), chosen for their pro-angiogenic and regenerative effects in scalp tissue. Microneedling was performed with a Dermapen device set to 2.0 mm depth, selected to reach the level of the follicular bulge and perifollicular vasculature, as supported by existing dermatologic studies. Immediately after microneedling, the same mesotherapy solution was applied topically to leverage the microchannels for enhanced absorption and therapeutic efficacy.

Results revealed noticeable clinical improvement and were evaluated using a multimodal assessment strategy, including standardized clinical photography, digital trichoscopy, visual hair shedding analysis and comparative digital image evaluation at two timepoints: baseline and 30 days following the final session. Evidence of significant increases in hair thickness and follicular density was observed, particularly in thinning areas such as the forehead and vertex. Hair loss decreased significantly, as evidenced by patient reported results and visual assessment (Figure 1).

**Figure 1.** Digital photographic analysis demonstrates a progressive pattern of hair coverage in affected areas. Comparative segmentation between pre- and post-treatment images highlights increased hair density following the combined therapeutic protocol.

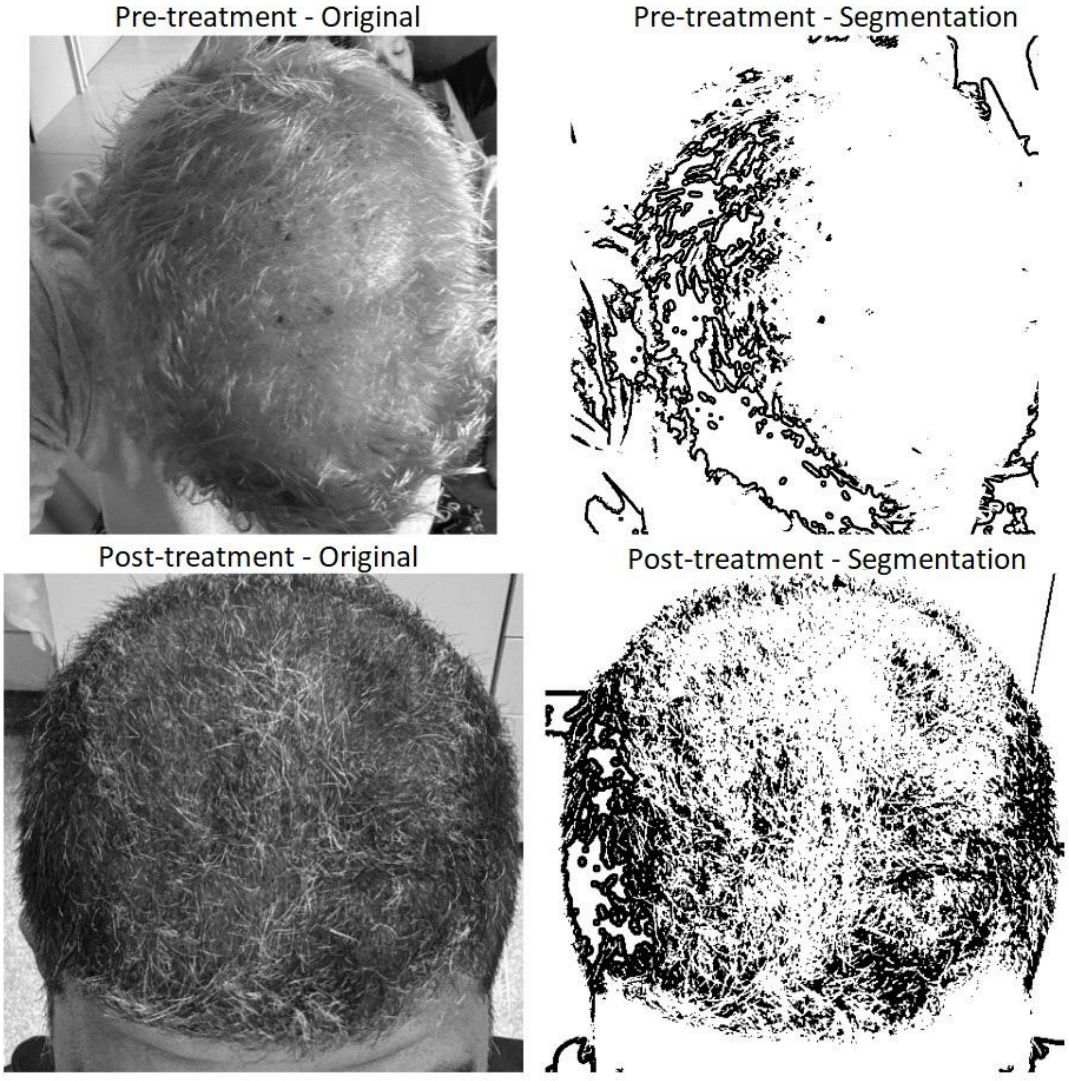
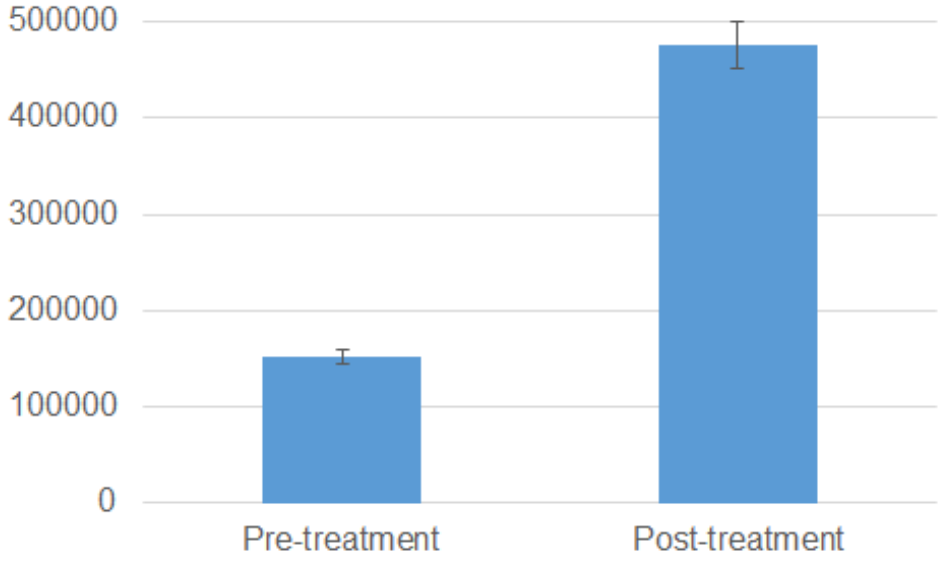



Figure 2 illustrates the quantitative evolution in hair shaft coverage, with a 212% increase in pixel detected coverage following treatment, highlighting the efficacy of the multimodal regenerative protocol. Comparison of digital photomicrographs demonstrated progressive follicular coverage, with enhanced improvement in scalp formation over time (Figure 3).

**Figure 2.** Quantitative analysis of hair density based on digital pixel segmentation, from 152,275 pixels (pre-treatment) to 475,436 pixels (post-treatment) ±5%, representing a 212% growth in hair shaft coverage.




## 3. Discussion

The multimodal treatment protocol employed in this case alternating weekly sessions of platelet rich plasma (PRP), intradermal mesotherapy and microneedling was designed to synergize biological regeneration, follicular stimulation and transdermal drug delivery. PRP was applied during the initial phase of each cycle to initiate regenerative signaling cascades, followed by mesotherapy to enhance follicular nutrition and stimulate metabolic pathways. Microneedling served both as a mechanical stimulus and a vector for enhanced transdermal absorption of therapeutic compounds.

Noticeably, the first visible clinical signs of improvement, such as reduced shedding, early shaft thickening and resolution of perifollicular erythema appeared around the eighth week of treatment, consistent with the timescales for activation of angiogenic and mitogenic pathways reported in the literature [8]. Figure 3 offers a chronological comparison: the pre bleaching scalp exhibits Stage IV androgenetic alopecia with preserved dermal integrity, while the post bleaching state reveals diffuse alopecia worsened by chemical trauma. An estimated 70 % reduction in hair density was observed following the bleaching procedure, accompanied by clinical signs of inflammation, barrier disruption and tissue fragility.

In response, the combination therapy proved effective. As shown in figure 2, digital image analysis using pixel-based segmentation revealed an increase from 152,275 to 475,436 hair associated pixels, which represent a 212% increase in hair shaft coverage. This clinical improvement was confirmed by visual inspection, which improved hair distribution, improved scalp coverage and restored volume in previously thinned areas. These findings corroborate the scientific evidence for integrative treatment. Najafizade et al. [9], in a comparative review, emphasized the mechanisms of PRP and mesotherapy, noting that their combined use enhances both autologous regenerative factors and pharmacologically active agents. Similarly, Alves and Grimalt [4] and Gkini et al. [8] reported superior results with combinations of PRP and mesotherapy when compared to either therapy alone, particularly when injections and intervals between sessions are consistent.

This report is notable for its innovative approach, due to the successful regeneration of a scalp compromised not only by androgenetic alopecia but also by chemical hair damage, a clinical scenario that remains largely underrepresented in the literature. Most existing studies, including the meta-analysis by Hausauer and Jones [10], focus on conven-

tional presentations of AGA without concomitant exogenous damage. This report highlights both effective follicular regrowth and dermal recovery in a patient presenting dual pathogenic challenges: hormone induced follicular miniaturization and chemical induced cytotoxicity. The observed results highlight the potential of multimodal regenerative therapy in the treatment of complex and multifactorial scalp disorders, where traditional monotherapies may be insufficient.

**Figure 3.** Scalp evolution through stages of androgenetic alopecia and recovery. Top row: acute injury with significant follicular loss; Bottom left: alopecia prior to chemical damage; bottom right: improved hair density after combined regenerative therapy.

In this context, this case suggests that the combination of PRP, mesotherapy with bioactive compounds and microneedling may offer a promising multimodal approach for managing complex presentations of androgenetic alopecia. The improvement observed may reflect cumulative or synergistic effects of the combined interventions rather than the isolated action of any single component. Further studies are needed to evaluate the reproducibility, efficacy and safety of this integrative strategy before it can be considered for broader clinical application.

## 4. Conclusion

Androgenetic alopecia is a prevalent and multifactorial condition that exerts significant aesthetic and psychosocial burdens on affected individuals. In more complex cases, especially those complicated by exogenous factors such as chemical trauma, therapeutic outcomes with conventional monotherapies are often limited.

This case report presents an example of successful clinical recovery through a standardized, multimodal regenerative protocol combining platelet rich plasma (PRP), intradermal mesotherapy with targeted bioactive agents and microneedling. The strategy led to improvement in hair shaft thickness, follicular density and overall scalp integrity, even in the presence of prior chemical injury. The protocol was well tolerated, reproducible and yielded visible results within a short timeframe, highlighting its potential for broader clinical application in similarly challenging cases.

As a detailed account of a real-world therapeutic success, this case reinforces the importance of case reports as valuable tools for scientific dissemination, especially in emerging or underexplored therapeutic combinations. By documenting the protocol's structure, timing and measurable outcomes, this report contributes to the evolving framework for standardized regenerative treatment in androgenetic alopecia. Further studies with larger populations will be essential to validate these findings, refine the protocol and establish this approach as a reliable option in evidence-based dermatologic practice.

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**Conflicts of Interest:** The authors declare no conflicts of interest.

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