ORIGINAL ARTICLE



Combination of platelet-rich plasma and platelet gel in treatment of resistance androgenic alopecia: A case series study

Elaheh Lotfi MD¹ | Najmeh Aramianpour MD² | Bahareh Salehi MD¹

¹Yousef Abad Skin and Hair Center, Tehran, Iran ²Kerman University of Medical Sciences, Kerman. Iran

Correspondence Elaheh Lotfi, Yousef Abad Skin and Hair Center, Tehran, Iran. Email. Elahehlotfiii@gmail.com

Abstract

Background: Androgenic alopecia is a common genetic disorder that characterized by progressive hair follicles and hair atrophy. Despite all available therapeutic techniques, there is low patient satisfaction rate. It seems finding new treatment options for androgenic alopecia is necessary. In the past decade, platelet-rich plasma (PRP), an autologous collection of concentrated platelets with hemostatic and tissue repairing effects, has received developing attention for androgenetic alopecia treatment as a valuable therapeutic technique.

Methods: In this study, 8 patients suffering from resistance androgenic alopecia were enrolled. The PRP and platelet gel were prepared, and a total volume of 10 cc of the combination of PRP and platelet gel were injected in the scalp androgen-related areas using 23-gauge syringe. The treatment was performed one month and 3 months after first injection (three times). The hair pull test was done before treatment. The outcome was evaluated 3, 6, and 9 months after treatment by hair pull test, dermoscopy, photography, and patient's satisfaction.

Results: A significant reduction in hair loss was observed before and after treatment. Hair count (density) increased from average number of 72 (hair/cm²) to 210 hair/cm²). Also, the hair diameter was significantly increased before and after treatment for all patients (p < 0.05). After the treatment, the pull test was significantly decreased in 8 patients (p < 0.05).

Conclusion: This study supports the combination therapy of PRP and platelet gel for resistance androgenic alopecia treatment. This technique is an uncomplicated, feasible, and cost-effective treatment option for resistance androgenic alopecia, with high patient satisfaction.

KEYWORDS

androgenic alopecia, platelet gel, platelet-rich plasma, treatment

1 | INTRODUCTION

Androgenic alopecia is the most common and non-scarring alopecia that is related to the reduction and eventual terminal scalp hairs loss because of peripheral androgens in individuals with a genetic predisposition.¹ In the patients, who suffer from androgenic alopecia, there is a high prevalence of depression because hair loss effects on their appearance and their psychology.² There are a large number of drugs that are used for androgenic alopecia treatment.² Minoxidil and finasteride are commonly used. Other treatments like polydeoxyribonucleotide, those relating interfollicular placental extract, and microneedle devices are also utilized. In resistance androgenic alopecia, medical treatment is insufficient, so the patients looking for another treatment option. PRP (platelet-rich plasma) can be another choice. This technique has recently obtained popularity in the androgenic alopecia treatment due to its potential ability to stimulate and hasten hair regrowth.³ PRP is an autologous product prepared by a patient's own blood centrifugation. PRP composed of concentrated human platelets in a small amount of plasma and has a group of proteins contain chemokines, various growth factors, like transforming, fibroblast, epidermal, and endothelial growth factors and cytokines.⁴⁻⁶ PRP that is prepared from the patient's own blood called autologous PRP.⁷ For the first time, PRP was clinically utilized by Ferrari et al., and they used PRP in cardiac surgery.^{8,9} PRP research has since developed. It now uses in a variety of field like venous ulcers treatment, burn healing, and skin rejuvenation.¹⁰⁻¹² The literature has recommended that PRP is effective for androgenic alopecia treatment.^{13,14} So in the present study, we used PRP in combination with platelet gel to evaluate the effect of this combination in patients with resistance androgenic alopecia.

2 | PATIENTS AND METHODS

In this case series study, we studied 8 patients (2 men and 6 women) aged 25–47 years, who had resistance androgenic alopecia, were accepted to undergo combination of PRP and platelet gel treatment. Patients on anticoagulant therapy and patients with hematological clotting disorders, iron deficiency, thyroid hormone deficiency, anemia, psychiatric and chronic diseases, other dermatological disorders leading to hair loss as well as who had used medical treatment for androgenic alopecia were excluded in this study. Verbal and written approvals were gained from all of the patients. All procedures were done with a single surgeon. The PRP was prepared from every single patient's own blood. Platelet gel were prepared, and the PRP and platelet gel were combined with the ratio of ³/₄ to ³/₄, respectively. Combination therapy was performed at 1 and 3 months after the first injection (three times for each person) with local anesthesia.

2.1 | Preparation of PRP

Double-spin method was used for PRP preparation. 20 milliliter of fresh blood was aspirated into citrate-phosphate-dextrose anticoagulant (ACD) vacutainers (under aseptic condition). The tubes are centrifuged at 900 g for 15 min. The first centrifugation named "soft spin" that divides the blood into 3 layers, RBC layer (intermediate layer), acellular plasma layer named platelet poor plasma (PPP) (upper layer), and a PRP layer called the "buffy coat" (lower layer). Buffy coat with PPP is collected in another tube. The tube is androgenic alopeciain centrifuged at 2500 g for 15 min, this centrifuge



FIGURE 1 Scalp area injection

called "hard spin." This allows the platelets (PRP) to separate from PPP. Finally, PRP is gathered in another sterile tube.

2.2 | Preparation of platelet gel

Gel was made with the platelet concentrate accompanied by 10% calcium gluconate (1/3 of total volume) and thrombin. The needed thrombin was collected in sterile tubes as clots. In order to obtain blood serum, the tubes were centrifuged (700 g, 10 min). The thrombin was divided in microtubes and froze. The key points of adding thrombin to the platelet concentrate in coagulation are activation of platelet, prompt of the coagulation cascade, and development of the fibrin clot. So thrombin caused fibrinogen convert to fibrin, the fibrin is cross-linked via a coagulation factor and connected to network of fibrin. The formation of gel follows the principle of nonlinear compaction polymerization.

2.3 | Intervention

Platelet-rich plasma and platelet gel combined with the ratio of ³/₄ PRP and ³/₄ platelet gel. Area of the scalp was cleaned, and injections of combination of PRP and platelet gel were performed at a 1.5-2.5-mm-deep intradermal area using a 23-gauge needle in the androgen-related areas of scalp (Figure 1). A total volume of 10 cc were injected. Treatment sessions were done at 1 and 3 months after the first injection (three times for each person) with local anesthesia. The patients were follow-up 3, 6, and 9 months after treatment. No analgesics and antibiotics were given to the patients.

2.4 | Assessment criteria

The patients were evaluated before and 3 and 6 months after treatment, for hair density (n/cm²) and hair diameter (μ) via the dermoscope (DE350 wireless polarizing). The hair pull test was done before treatment and 3, 6, and 9 months after treatment. To evaluate overall hair volume, growth, fullness, and quality, global pictures were taken by camera (D60 Nikon) before and at 9 months after the combination therapy.

2.5 | Statistical analysis

IBM SPSS, version 23. was utilized for all statistical analysis. A p value <0.05 was considered significant.

3 | RESULTS

3.1 | Hair density and diameter

Hair density was evaluated based on the dermoscopic photographs for each patient before and after treatment (Figure 2). The results showed a significant increase in hair density and diameter after treatment before and 3, 6, and 9 months after treatment in all patients (Figure 3). Hair count (density) significantly increased from average number of 72 (hair/cm²) to 115, 153, and 210 (hair/cm²) after 3, 6, and 9 months, respectively (p < 0.05). Also, the hair diameter was significantly increase before and 3, 6, and 9 months after treatment, for all patients (p < 0.05) (Figure 4). The average number of hair diameter increased from 35 μ to 57 μ , 68 μ , and 83 μ after 3, 6, and 9 months, respectively (p < 0.05).

3.2 | Hair pull test

3, 6, and 9 months after the combination therapy, all patients showed a significant decrease in the hair pull test results (p < 0.05) (Figure 5). The hair pull test decreased from the average number 6

to 2, 1 and 0 after 3, 6, and 9 months of treatment, respectively (p < 0.05).

3.3 | Photographic alterations

Several photographs were taken from all areas with an alopecia patch before and after the treatment. The comparison of pre- and post-treatment series of photographs showed significant improvement in patents with resistance androgenic alopecia (Figure 6). Also, the patients did not report any side effect.

4 | DISCUSSION

Hair loss has a significant effect on psychological distress and is accompanied by low confidence and unhappiness. Androgenic alopecia is the most usual hair disorder with no effective treatment.

Treatment choices for androgenic alopecia are restricted and contain oral finasteride (FDA approved) and topical minoxidil that is used alone or in combination.^{15,16} However, these treatments have several side effect; minoxidil increase other body hairs, and in some cases, it is associated with headache and oral finasteride caused loss of libido and inhibits genital growth in a male fetus and its forbidden to use in pregnant women.^{16,17} Recently, PRP has attracted attention in many fields like orthopedic surgery, plastic surgery, and cardiac surgery due to its potential effect in rapid wound healing, decreased infection, skin rejuvenating, reduced chance of hypertrophic keloids and scars.^{18,19} The PRP mechanisms that are effective for hair loss have been studied by many experiments in vivo and in vitro. It is known that various growth factors included in PRP are the main functional components responsible for hair regrowth management and growth factors can active the trans-differentiation and proliferative phase of stem cells and hair and develop new follicular units. Also, it has plasma proteins, namely fibrin, vitronectin, and fibronectin. This cocktail is essential for tissue repair and regeneration.²⁰ It has been reported that bFGF stimulate the in vitro papilla cells proliferation and so that plays an important role in elongating hair shaft.²¹ PDGF is diagnosed as the most important PRP growth factor



FIGURE 2 (A) Hair diameter before treatment, (B) increase in hair diameter after treatment, and (C) increase in hair count after treatment (dermoscopy ×10)



FIGURE 3 Patient hair density before treatment and 3, 6, and 9 months after combination therapy. ***p < 0.0001, **p < 0.001, *p < 0.00



FIGURE 4 Patient hair diameter before treatment and 3, 6, and 9 months after combination therapy. ***p < 0.0001, **p < 0.001, *p < 0.001

for hair growth stimulation that can promote the anagen stimulation and maintenance²² and has key role in interaction of epidermis follicle, simplifying the dermal papilla development.²³ Also, dermal papilla produces IGF-1 that it has been proven it can enhance keratinocytes proliferation and avoid hair follicles from entering the regression period.²⁴ Moreover, in androgenic alopecia, the expression of IGF-1 is downregulated,²⁵ and therefore, its supplement has positive effects on androgenic alopecia. VEGF is a major inducer of revascularization of hair and increases hair growth.²⁴ Also PRP induce perifollicular angiogenesis that it is an important factor for hair follicle regrowth in androgenic alopecia.²⁶ We used double spin method to prepare PRP. PRP combined with platelet gel. This combination can stimulate the dermal papillary cells' proliferation and inhibit their apoptosis. The growth factors in platelet gel are in higher levels so we used the combination of the PRP and platelet gel for androgenic alopecia treatment. In the study of Torkamaniha et al., allogeneic platelet gel was applied to treat the dystrophic epidermolysis



FIGURE 5 Patient hair pull test before treatment and 3, 6, and 9 months after combination therapy. ***p < 0.0001, **p < 0.001, *p < 0.

bullosa (DEB) hand wounds in a group of children. They reported that this gel dressing significantly accelerates epithelialization and wounds healing.²⁷ Positive effect of PRP on androgenic alopecia was evaluated in several studies. In our study, the results of hair pull test were negative, 6 months after combination therapy. Also, we checked the patients for hair density and hair diameter, and our results showed that the hair density and hair diameter significantly increased 3 and 6 months after combination therapy. Similarly, digital images displayed an overall picture of positive growth and hair density after 3 and 6 months. This outcome is comparable with the study of Besti et al. This study reported significant improvement in hair density and significant reduction in hair pull test after PRP injection.²⁸ In another research with 10 patients, hair growth was observed in 6 patients after 7 days and in the rest of patients after 15 days and after 3 months, all of the patients had significant hair growth after PRP treatment²⁹ whereas in our study, the hair growth was significantly increase 3 and 6 months after combination therapy in all patients. In another study, a peak of hair density was seen at 3 months with PRP.³⁰ In the study of Uebel et al., it is has reported that significant increase in hair density and growth stimulation was seen when platelet plasma growth factors used for pretreatment of follicular units before their implantation.³¹ In summary, PRP can be an effective technique for androgenic alopecia treatments.

5 | CONCLUSION

Considering the side effects of finasteride and long-term period needed for minoxidil application, a therapy with minimal side effects and short periodic treatment is needed for the androgenic alopecia patients. PRP is an effective alternative technique in the treatment of resistance androgenic alopecia with no remarkable adverse effects. Related to its low cost and high safety profile, PRP hair treatment is **FIGURE 6** Global photography of patients at baseline and 9 months after combination therapy



a hopeful technique for patients who suffering from thinning hair and hair lost.

5.1 | Limitation

Our study sample size is very small. Thus, further studies are needed with large sample size.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

L. E. performed the research. A. N. designed the research study. S. B. analyzed the data.

ETHICAL APPROVAL

The authors state that the patients have given their informed consent for contribution in the study, photographs, and all details.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Elaheh Lotfi D https://orcid.org/0000-0002-5262-0231

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