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Efficacy of platelet-rich plasma in androgenetic alopecia patients

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Abstract

Background: Androgenetic alopecia (AGA), a patterned hair loss in both males and females, is a commonly occurring disease worldwide. Conventionally, no curative or satisfactory treatment is available for this condition. Therefore, in the current study, we aim to use platelet-rich plasma (PRP) as an alternative treatment option for the AGA patients.

Materials and Methods: A total of 30 patients (20 men and 10 women) with AGA were included in the study between February 2017 and November 2017. Blood (9 cc) from each AGA patient was collected in 10 cc syringe, and PRP was isolated using commercially available kit under sterilized conditions. Isolated PRP was injected in the bald areas of scalp of AGA patients. The whole procedure was repeated after one month (two treatment sessions), and patients were followed for six months. The efficacy of PRP for restoration of hair was assessed using parameters such as hair density, terminal to vellus hair ratio, photographs, pull test, physician global assessment score, and patient global assessment score.

Results: Mean hair density on first visit (before treatment) was $34.18 \pm 14.36/\text{cm}^2$ which was increased to $50.20 \pm 15.91/\text{cm}^2$ after 6 months of first treatment (P value <0.05). On a scale of three, mean scores of physician and patient global assessments were 1.45 ± 0.57 and 1.60 ± 0.62 , respectively. Mean percentage reduction of hair pulled was 29.2% (P value <0.05) after PRP treatment. Terminal to vellus hair ratio was increased in 60% of patients after PRP therapy. No remarkable adverse effects were noted in patients.

Conclusion: Results showed that PRP is an effective treatment option in androgenetic alopecia as indicated by higher hair density, satisfactory physician and patient global assessment scores, and increase in terminal to vellus hair ratio.

KEYWORDS

androgenetic alopecia, PRP, pull test, TrichoScan

1 | INTRODUCTION

Androgenetic alopecia (AGA) is characterized by a progressive loss of hair from the scalp.¹⁻³ It can start at puberty but its prevalence increases significantly with age in both sexes.⁴ Different medications

(such as minoxidil, flutamide, dutasteride, finasteride, and spironolactone) and cosmetic hair procedures including hair transplant are the available options for treatment of AGA.⁵ However, oral and topical medications are effective in maintaining only the existing hair but they do not have significant effect on hair restoration.⁶ Similarly,

TABLE 1 Shows demographic characteristics, various laboratory investigations, and assessment of AGA patients who underwent PRP therapy

Age (in years)			
Minimum	Maximum	Mean	S.D
19	47	28.7	7.74
Sex (n:30)			
Female	Male		
10	20		
Ludwig scale (n:10 females)			
Type I	Type II	Type III	Total
1	4	5	10
Norwood-Hamilton scale (n:20 males)			
Type III	Type IV	Type VI	Total
12	7	1	20
Vellus hair (6 Months, n:30)			
Decrease	Increase	Static	
22 (73.3%)	3 (60%)	5 (16.7%)	
Terminal hair (6 Months, n:30)			
Decrease	Increase	Static	
7 (23.3%)	18 (60%)	5 (16.7%)	
Serum androgen level (n:30)			
Normal	Increase		
26 (86.7%)	4 (13.3%)		
Serum vitamin D level (n:30)			
Normal	Decrease		
6 (20%)	24 (80%)		
Global assessment score (Mean) (0-3)			
Physician I	1.40		
Physician II	1.50		
Patient	1.60		

hair transplant surgery is an option only for those patients who are not completely bald.⁷ As conventional medical and surgical options for hair regeneration are not ideal for AGA patients, other biological options may be used.

Platelet-rich plasma (PRP) has already been employed in the treatment of conditions such as wound healing, diabetic foot ulcers, osteoarthritis, and skin rejuvenation.⁸ PRP is a mixture of several cytokines and growth factors that may help to restore lost hair.⁹ Vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), insulin-like growth factor (IGF), and transforming

growth factor (TGF) present in PRP are mainly involved in hair restoration in AGA.¹⁰⁻¹³ These growth factors may stimulate the stem cells located in the bulge region of dermal papilla which in turn can activate the proliferative phase of the hair cycle and is responsible for the growth of follicular unit.¹⁴ PRP therapy may therefore serve as a potential treatment option for hair restoration in the patients with androgenetic alopecia.^{15,16}

The complex process of human hair growth begins from the structures called hair follicles.^{17,18} In AGA, the hair follicles may become inactive due to loss of stem cells in the bulge region of hair follicle.¹⁹⁻²¹ This results in the conversion of terminal hair (which are large, pigmented hair) into vellus hair (which are short and depigmented).¹⁹ Studies indicate that the hair growth cycle may begin again if hair follicles are stimulated by external factors such as cytokines and growth factors.²²⁻²⁴ As PRP is a mixture of certain proteins, cytokines, and growth factors, it may play a role in restoring the hair in AGA patients by stimulating the hair growth cycle.²²⁻²⁴

Overall aim of this study was to evaluate the effectiveness and safety of the use of PRP in AGA patients. Briefly, PRP was isolated from blood under sterilized conditions and was injected in the scalp twice at an interval of 4 weeks. Six-month follow-up exhibited an increase in hair density, reduction in number of hair pulled in pull test, and satisfactory patient and physician global assessment scores. PRP seems effective treatment option for AGA patients in restoring the hair loss.

2 | MATERIALS AND METHODS

A total of 30 volunteers (20 males and 10 females) with AGA were enrolled. This study was carried out in Tissue Engineering and Regenerative Medicine Laboratory, Department of Biomedical Sciences, King Edward Medical University and the Department of Dermatology, Mayo Hospital Lahore from February 2017 to November 2017. All participants were ≥ 15 years of age (mean age 28.7 years). AGA was diagnosed in the patients by taking history and clinical examination. Following inclusion criteria were used: in males type III to VI on Hamilton-Norwood scale and in females type I to III on Ludwig classification, and patients having increased hair loss during the last 12 months. Patients with pregnancy, chronic disease like diabetes, any malignancy, thinning of scalp hair globally also in occipital areas, patients having inflammation of the scalp or any type of infection on scalp and who were on anticoagulant medication for the last five years were excluded from the study. In addition, at first visit, the serum levels of vitamin D (25-OH cholecalciferol) and androgen (testosterone) were measured by radioimmunoassay at a diagnostic facility.

2.1 | Isolation of platelet-rich plasma

Under sterile conditions, blood (9 cc) was taken from the antecubital vein of each patient. Blood was taken in commercially available PRP kit (Tray Life Tube Gel) containing preformed gel comprising a mixture of polymers that separates plasma and sodium citrate solution



FIGURE 1 A, Androgenetic alopecia on the left lateral temporal area before PRP therapy. B, Same area showing increase hair density 6 months after PRP therapy. C, Showing the frontal area of scalp before PRP therapy and (D) showing hair restoration 6 months after PRP therapy



FIGURE 2 Male patient with androgenetic alopecia on the frontal area (A) and back area (B) before PRP therapy and 6 months after PRP injection (C and D)

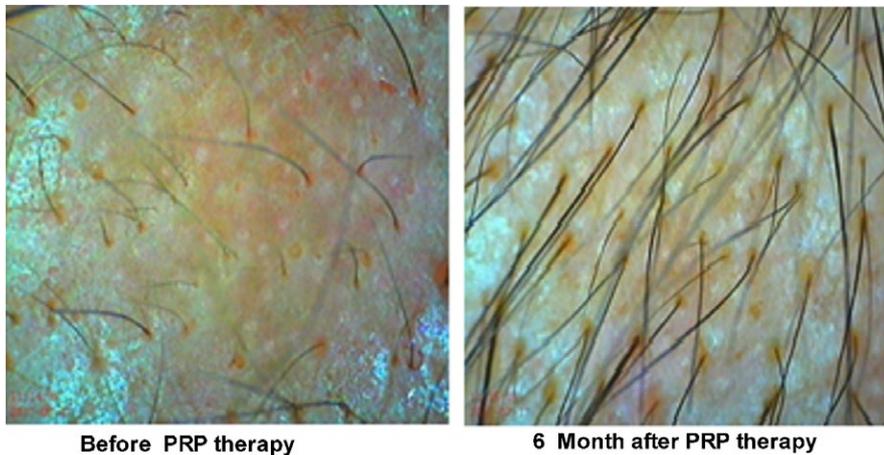


FIGURE 3 TrichoScan results before therapy and 6 months after PRP therapy

which acts as an anticoagulant, and centrifugation was done at 1000 RPM for 10 minutes. Trapped red blood cells and upper 1 mL of platelet poor plasma were discarded while remaining platelet-rich plasma was taken in syringes for use in patients.

2.2 | Platelet-rich plasma Injections

On the affected areas of scalp, local anesthetic gel was applied 1 hour before giving injections. The affected area was cleaned with spirit swab. Injections of platelet-rich plasma (PRP) in a concentration of 0.05-0.1 mL/cm² were given into the affected areas of the scalp at 1 cm distance using Nappage technique²⁴ in which injections are given at a depth of 1.5-2.5 mm deep in the skin. Procedure was repeated after 4 weeks. The patients were followed for a total duration of 6 months.

2.3 | Assessment

All patients were assessed for a period of six months (1st visit: before PRP injections, 2nd visit: after 1 month of 1st PRP session, 3rd visit: 3 months after 1st PRP session, 4th visit: 6 months after 1st PRP session). The treatment outcomes were assessed by taking macroscopic photographs, pull test, trichoscopic photomicrographs, physician global assessment score (PhGAS), and patient global assessment score (PaGAS).

Photographs were taken by the same photographer at the same distance every time using standard Nikon camera. Pull test was performed at each visit in which 20-60 hairs from their base were grasped firmly between the index, middle fingers, and thumb and then pulled away from the scalp. Pull test was considered positive when more than 10% of the hair were pulled away from the scalp. In TrichoScan, all important parameters of hair (such as number, ratio of terminal, and vellus hair) were measured by analysis of the digital images using epiluminescence microscopy (ELM). PhGAS was performed by two independent evaluators using following criteria (0: poor; 1: satisfactory; 2: good; 3: excellent). Similarly, PaGAS was evaluated using the same criteria and scale as mentioned above for PhGAS.

2.4 | Statistical Analysis

Version 23 of Statistical Package for the Social Sciences (SPSS) was used for statistical analysis of the data. Kolmogorov-Smirnov test was used to test normality of quantitative variables. Density of hair was expressed as mean \pm standard deviation (SD). Differences in the density of hair between the first and last visit were assessed by paired sample *t* test. All tests performed were two-tailed, and *P*-values less than 0.05 were considered statistically significant.

3 | RESULTS

Out of 30 patients, there were 20 men (66.7%) and 10 women (33.3%). Mean age of the patients was 28.7 \pm 7.4 years with minimum age 19 years and maximum age 47 years with the high percentage of age range between 21 and 25 years. A total of 56.7% patients confirmed family history of androgenetic alopecia. None of the enrolled patients had any systemic disease, infection, or inflammation. Only two patients were on antihypertensive therapy. A total of 16.7% of females had type III Ludwig scale, and 40% of males were having type III Norwood scale (Table 1).

Pull test was positive with mean number of hair pulled on first visit 11 \pm 4.05, and mean number of hair pulled on last visit was 7.7 \pm 3.8. Mean percentage reduction of hair pulled was 29.2%. *t* Test showed *P*-value <0.05 which was statistically significant between the groups.

Mean PhGAS was 1.40 \pm 0.62 and 1.50 \pm 0.62 for physician 1 and physician 2, respectively. Mean PaGAS was 1.60 \pm 0.62 (Table 1). These results of PhGAS and PaGAS indicate improvement in hair growth after use of PRP (*P*-value <0.05).

In 60% of the patients, terminal to vellus hair ratio increased while it remained static in other patients. Mean density of hair on first visit was 34.18 \pm 14.36/cm², and on final visit, it was 50.20 \pm 15.91/cm² (*P*-value <0.05).

The representative pictures of two patients before and after PRP treatment are shown in Figure 1 (female) and Figure 2 (male). A marked increase in hair density can be seen in these pictures and was determined by TrichoScan (Figure 3).

4 | DISCUSSION

Androgenetic alopecia is a very common disorder of hair worldwide. In the current study, we found beneficial results of use of PRP therapy in AGA patients. Based on the results, we concluded that PRP therapy is a safe and effective technique for restoration of hair with no side effects. After its recognition and development in 1970, PRP was first used in 1987 in the procedure of open heart surgery in Italy.^{25,26} After its first successful use, PRP therapy became popular in mid 1990s for the treatment of many other diseases. Since then PRP therapy has been successfully used in different medical fields such as dentistry, cosmetic surgery, pain management, and sports medicine.^{27,28} PRP involves collection of whole blood of the patient which is taken in an anticoagulant followed by centrifugation to separate PRP from red blood cells, and from plasma which is poor in platelets. Baseline blood platelet count in humans is approximately 200,000 per μL , and there is approximately fivefold increase in platelets in therapeutic PRP.²⁹ Studies indicate that platelet-rich plasma therapy can prolong anagen phase of hair growth cycle as it increases the levels of different growth factors like PDGF and VEGF and induces angiogenesis at the site of injection.³⁰ The overall procedure of its isolation and use in patients indicates that this therapy is inexpensive and safe with no side effects. Overall results indicate that PRP could be applied in AGA patients to stimulate hair follicle and ultimately to promote the growth of hair. In our study, by using trichoscopic photomicrographs, hair density increased from 34.18/cm² at first visit to 50.20/cm² at last visit. Gkini et al³¹ also observed significant increase in hair density at 3 and 6 months of PRP use.³¹ Similar results were found by other researchers in which they found clinical improvement in the mean number of hair.³² In current study, the hair pull was also reduced after six months of treatment. The mean number of hair pulled decreased from 11 on first visit to 7.7 after six months of follow-up. This is also comparable to the studies conducted by Gkini et al³¹ and Tawfiq and Osman³³ in which number of pulled hair were decreased after PRP treatment. Other studies recently performed by Uebel et al,¹⁴ Puiget et al,³⁴ and Borhan et al³⁵ also observed a significant improvement in the density of hair and stimulation of growth of hair when treated with PRP. In addition, terminal to vellus hair ratio was also significantly increased at last follow-up (6 months after first PRP injection) in most of the patients.

There are certain limitations of the study. First, the follow-up is short that is of six months. It was not a multicentric study so limiting its generalizability.

5 | CONCLUSION

PRP therapy is an effective method of hair restoration in androgenetic alopecia patients in both men and women.

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REFERENCES

- McElwee KJ, Shapiro JS. Promising therapies for treating and/or preventing androgenic alopecia. *Skin Therapy Lett.* 2012;17:1-4.
- Alfonso M, Richter Appelt H, Tosti A, Viera MS, García M. The psychosocial impact of hair loss among men: a multinational European study. *Curr Med Res Opin.* 2005;21:1829-1836.
- Leavitt M. Understanding and management of female pattern alopecia. *Facial Plast Surg.* 2008;24:414-427.
- Kaliyadan F, Nambiar A, Vijayaraghavan S. Androgenetic alopecia: an update. *Indian J Dermatol Venereol Leprol.* 2013;79:613-625.
- Otberg N, Finner A, Shapiro J. Androgenetic alopecia. *Endocrinol Metab Clin North Am.* 2007;36:379-398.
- Dinh QQ, Sinclair R. Female pattern hair loss: current treatment concepts. *Clin Interv Aging.* 2007;2:189-199.
- Sclafani AP. Application of platelet-rich fibrin matrix in facial plastic surgery. *Facial Plast Surg.* 2009;25:270-276.
- Eppley BL, Woodell JE, Higgins J. Platelet quantification and growth factor analysis from platelet-rich plasma: Implications for wound healing. *Plast Reconstr Surg.* 2004;114:1502-1508.
- Weibrich G, Kleis WK, Hafner G, Hitzler WE. Growth factor levels in platelet-rich plasma and correlations with donor age, sex, and platelet count. *J Craniomaxilla fac Surg.* 2002;30:97-102.
- Sánchez-González DJ, Méndez-Bolaina E, Trejo-Bahena NI. Platelet-rich plasma peptides: key for regeneration. *Int J Pept.* 2012;5:519.
- Su HY, Hickford JG, The PH, Hill AM, Frampton CM, Bickerstaffe R. Increased vibrissa growth in transgenic mice expressing insulin-like growth factor 1. *J Invest Dermatol.* 1999;112:245-248.
- Tavakkol A, Elder JT, Griffiths CE, et al. Expression of growth hormone receptor, insulin-like growth factor 1 (IGF-1) and IGF-1 receptor mRNA and proteins in human skin. *J Invest Dermatol.* 1992;99:343-349.
- Arshdeep K. Platelet-rich plasma in dermatology: Boon or a bane? *Indian J Dermatol Venereol Leprol.* 2014;80:5-14.
- Uebel CO, da Silva JB, Cantarelli D, Martins P. The role of platelet plasma growth factors in male pattern baldness surgery. *Plast Reconstr Surg.* 2006;118:1458-1467.
- Blumeyer A, Tosti A, Messenger A, et al. Dermatology Forum (EDF). Evidence-based (S3) guideline for the treatment of androgenetic alopecia in women and in men. *J Dtsch Dermatol Ges.* 2011;9:1-57.
- Schipper HS, Prakken B, Kalkhoven E, et al. Adipose tissue-resident immune cells: key players in immunometabolism. *Trends Endocrinol Metab.* 2012;23:407-415.
- Perez-Meza D. The Use of SVF and PRP for the treatment of Scarring and non-Scarring Alopecias. Programs and abstracts. 1st Meeting of the SILATC; Las Vegas, NV. September 27, 2016.
- Price VH. Androgenetic alopecia in women. *J Invest Dermatol.* 2003;8:24-27.
- Morgan BA. Developmental biology: a hair-raising tale. *Nature.* 2011;471:586.
- Anousha Y, Whiting D, Rufaut NW, Sinclair R. Miniaturized hairs maintain contact with the Arectorpili muscle in alopecia areata but not in androgenetic alopecia. *Int J Trichol.* 2012;4:154-157.
- Garza LA, Yang CC, Zhao T, et al. Bald scalp in men with androgenetic alopecia retains hair follicle stem cells but lacks CD200-rich and CD34-positive hair follicle progenitor cells. *J Clin Invest.* 2011;121:613-622.

22. Wong CH, Yoo HG, Kwon OS. Hair growth promoting effects of adipose tissue-derived stem cells. *J Dermatol Sci*. 2010;57:134-137.
23. Crabtree JS, Kilbourne EJ, Peano BJ, et al. A mouse model of androgenetic alopecia. *Endocrinology*. 2010;15:2373-2380.
24. Gimble JM, Katz AJ, Bunnell BA. Adipose-derived stem cells for regenerative medicine. *Circ Res*. 2007;100:1249-1260.
25. Mammucari M, Gatti A, Maggiori S, Bartoletti CA, Sabato AF. Mesotherapy, definition, rationale and clinical role: a consensus report from the Italian society of Mesotherapy. *Eur Rev Med Pharmacol Sci*. 2011;15:682-692.
26. Platelet-rich plasma evidence. Results by year graph, PubMed.gov, National Center for Biotechnology Information, U.S. National Library of Medicine, retrieved 23 March 2016.
27. Mishra A, Woodall J, Vieira A. Treatment of tendon and muscle using platelet-rich plasma". *Clin Sports Med*. 2009;28(1):113-125.
28. Arora NS, Ramanayake T, Ren YF, Romanos GE. Platelet-rich plasma: a literature review. *Implant Dent*. 2009;18(4):303-310.
29. Marx RE. Platelet-rich plasma: evidence to support its use. *J Oral Maxillofac Surg*. 2004;62(4):489-496.
30. Jain R, De-Eknamkul W. Potential targets in the discovery of new hair growth promoters for androgenic alopecia. *Expert Opin Ther Targets*. 2014;18:787-806.
31. Gkini MA, Kouskoukis AE, Tripasianis G, Rigopoulos D, Kouskoukis K. Study of platelet rich plasma injections in the treatment of androgenetic alopecia. *J CutanAesthet Surg*. 2014;7(4):213-219.
32. Gentile P, Garcovich S, Bielli A, Scioli MG, Orlandi A, Cervelli V. The effect of platelet-rich plasma in hair regrowth: a randomized placebo-controlled trial. *Stem Cells Transl Med*. 2015;4(11):1317-1323.
33. Tawfik AA, Osman M. The effect of autologous activated platelet-rich plasma injection on female pattern hair loss: A randomized placebo-controlled study. *J Cosmet Dermatol*. 2018;17(1):47-53.
34. Puig CJ, Reese R, Peters M. Double-blind, placebo-controlled pilot study on the use of platelet-rich plasma in women with female androgenetic alopecia. *Dermatol Surg*. 2016;42:1243-1247.
35. Borhan R, Gasnier C, Reygagne P. Autologous platelet rich plasma as a treatment of male androgenetic alopecia: study of 14 cases. *J Clin Exp Dermatol Res*. 2015;6:292.

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