

# Platelet-Rich Plasma Growth Factor Concentrated Spray (Keratogrow®) as a Potential Treatment for Androgenic Alopecia

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## Abstract

The objective is to investigate the safety and clinical efficacy of Autologous Platelet Rich Plasma Concentrated Spray (Keratogrow®), for hair loss. Autologous –PRP spray, prepared from a small volume of blood, was applied on the selected patients' scalps at least twice daily. Three months treatments were given for each patient. The effectiveness of the medication was measured by changes in hair regrowth after 3 months determined by physical exam and digital photography. At the end of the 3 cycles of treatment, the patients presented clinical improvement in the mean number of hairs, with a mean increase of hairs in the target area, and a mean increase in total hair density compared with baseline values.

## Introduction

Androgenetic alopecia (AGA), a hereditary and androgen-dependent progressive thinning of the scalp hair in a defined pattern, is a common dermatological disorder affecting more in men and occasionally in women, with significant negative impact on their social and psychological well-being. It commonly begins by 20 years of age and affects nearly 50% of men by the age of 50 years [1].

Platelet-rich plasma (PRP) is defined as a volume of the plasma fraction of autologous blood with an above baseline platelet concentration. It has been investigated and used in numerous fields of medicine. Recently, PRP has received growing attention as a potential therapeutic tool for hair loss [2]. The regenerative potential of PRP depends on the levels of growth factors released upon activation. Main growth factors (GFs) are platelet-derived growth factor (PDGF), transforming growth factor (TGF), vascular endothelial growth factor (VEGF) and insulin-like growth factor (IGF) with their isoforms. Growth

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factors released from platelets may act on stem cells in the bulge area of the follicles, stimulating the development of new follicles and promoting neovascularisation [3, 4].

Presently, there is limited published data regarding PRP's potential effect on hair. Twenty three patients of hair transplant were studied in 2005 after enriching the hair root grafts with PRP and without PRP [5]. Two areas (2.5 cm<sup>2</sup>) each were marked on the scalp and planted with 20grafts/cm<sup>2</sup>. After 1 year, the area implanted with the PRP-enriched grafts demonstrated an increase in follicular density of 15.7%. An *in vivo* study was performed wherein mice received subcutaneous injections of PRP, and their results were compared with control mice [6]. Activated PRP increased the proliferation of dermal papilla (DP) cells. Studies conducted reported that PRP shortened the time of hair formation significantly; the first hairs were observed in  $18 \pm 1$  days using 10% PRP, versus  $20 \pm 1$  days without PRP [7]. Also it was reported that injection of mice with activated PRP induced faster telogen-to-anagen transition than that was seen in control mice [8].

Treatment options for androgenic alopecia are very limited. Except scalp surgery, which is a surgical treatment option, FDA-approved drug therapies include finasteride and minoxidil. Minoxidil appears to prolong anagen phase and promote survival of dermal papilla cells and increase in hair follicle size. However, there are several reported side effects such as headache and increase in other body hairs for minoxidil. Finasteride also interferes with genital development in a male fetus and is contraindicated in pregnant women and those likely to become pregnant. Compared to minoxidil and finasteride PRP therapy is safe, cheap, and non-allergic and it appears to be a useful adjuvant in the management of Alopecia [9].

Varied methods of preparation of PRP have been reported in the literature. These include commercial kits and manual methods using laboratory centrifuge [10, 11]. The clinical effectiveness of each of these methods remains unclear and depends on several variables like centrifugation rate and time [12].

The study was conducted to investigate the clinical efficacy of PRP Growth Factor Concentrate Spray (Keratogrow®) prepared by Merisis therapeutics. PRP spray is safe, non-invasive, and non-allergic and it appears to be a useful adjuvant in

the management of Alopecia. The aim of our study was to evaluate the safety, efficacy and feasibility of PRP growth factor spray (Keratogrow®) for treatment of androgenic alopecia.

## Materials and Methods

Platelet-rich plasma therapy can be given to males and females in good general health in the age group of 30-50 years having mild to moderate AGA. In our study, 8 males and 2 female patients suffering with alopecia in the age group of 30-50 years were selected. After taking appropriate consent, they were given PRP Growth Factor Concentrate Spray (Keratogrow®) over a period of 3 months and their condition was assessed at regular intervals. The subjects who were systemically healthy, not presently under any medications were included in the study. An informed consent was obtained from all the participants included in the study. The study was in accordance with the ethical standards of the responsible committee and was approved by the Institutional Ethics Committee.

### Blood Sample Collection

Peripheral blood samples were collected from 10 subjects under aseptic conditions. Venous blood (20ml each) was drawn in BD vacutainer tubes containing EDTA from the study subjects. Baseline platelet counts for all the subjects were assessed using Abbott CELL-DYN 3700 System.

PRP Growth Factor Concentrate Spray (Keratogrow®) was prepared from the patients' blood according to the method developed by Merisis therapeutics. PRP Growth Factor Concentrate Spray (Keratogrow®) must be applied on the scalp at least twice daily, morning and evening. The effectiveness of the medication was measured by changes in hair regrowth after 3 months determined by physical exam and digital photography. A photograph using digital camera enables an objective measurement of hair growth parameters such as density, number of miniaturized and/or terminal hairs and hair growth on a selected area.

## Results

Hair growth were measured after 3 months of spray and compared with the baseline before treatment. All ten patients had good hair growth [Figures 1-10].

Platelets counts were measured before and after PRP preparation. The mean blood platelet count in our study was 226,778/ $\mu$ l. The mean platelet level in PRP was 1,000,200/ $\mu$ l. We recovered 80% of total

initial platelets and the procedure resulted in a 3- to 5-fold increase in platelet concentration. Platelets were highly purified, because only <0.1% from the initial red blood cells and leukocytes was present in the final PRP preparation. The values are shown in Table 1.

High concentrations of endothelial growth factor, epidermal growth factor, and fibroblast growth factor, insulin like growth factor, transforming growth factor and other cytokines were also found in PRP [Table 2].



Figure 1. Before

After 12 weeks



Figure 2. Before

After 12 weeks



Figure 3. Before

After 12 weeks



Figure 4.



Figure 5.



Figure 6.



Figure 7.



Figure 8.





Figure 9.



Figure 10.

**Table 1. Quantification of RBC and Platelets in Whole Blood and PRP**

Sl no	RBC count in blood (10 <sup>6</sup> /μl)	RBC count in plasma(10 <sup>6</sup> /μl)	Platelet count in blood /μl	Platelet count in plasma/μl	Fold concentration
1	4.05 ± 0.28	0.02 ± 0.00	2,51000/μl	13,65000/μl	5x
2	4.10 ± 0.24	0.00 ± 0.00	1,84,500/μl	7,78000/μl	4x
3	4.09 ± 0.26	0.03 ± 0.01	2,69000/μl	1,078000/μl	4x
4	4.03 ± 0.25	0.01 ± 0.00	1,69000/μl	7,86500/μl	5.5x
5	4.05 ± 0.27	0.01 ± 0.00	2,09000/μl	8,27000/μl	4x
6	4.05 ± 0.26	0.01 ± 0.00	1,39000/μl	7,86500/μl	5x
7	4.10 ± 0.24	0.00 ± 0.00	2,71000/μl	11,48500/μl	4x
8	4.09 ± 0.23	0.02 ± 0.01	2,10000/μl	9,40000/μl	4.5x
9	4.03 ± 0.25	0.01 ± 0.00	3,26000/μl	12,98000/μl	4x
10	4.05 ± 0.274	0.01 ± 0.00	2,27000/μl	9,94500/μl	4x
		Mean	2,26778/μl	10,00200/μl	<b>4.5x</b>

**Table 2. Quantification of Cytokine and Growth Factor Concentration in Whole Blood and PRP Growth Factor Concentrate Spray (Keratogrow®)**

Cytokine and growth factor concentrates	Whole blood	PRP
PDGFA	3.3 ± 0.9 ng/ml	17 ± 8 ng/ml
VEGF	155 ± 110 pg/ml	955 ± 1030 pg/ml
TGFβ	35 ± 8 ng/ml	120 ± 42 ng/ml
IGF1	105.30 ± 48.44 ng/ml	110.30 ± 45.44 ng/ml
EGF	129 ± 61 pg/ml	470 ± 320 pg/ml
FGF-2	5 ± 50 pg/ml	226 ± 95 pg/ml

## Discussion

Despite the growing interest in regenerative medicine, few trials investigating PRP's efficacy on hair growth have been published. PRP was injected in 20 patients, males and females, with AGA [13]. Three months after the first treatment a significant increase in hair density was noted. After a series of three intradermal platelet-rich fibrin matrix injections, a significant increase in hair density after 6 months was

observed [14]. The efficacy of simultaneous application of PRP with micro needling for AGA treatment was proposed [15].

The beneficial effects of PRP in Androgenic Alopecia can be attributed to various growth factors released from platelets, causing improvement in the function of hair follicle and promotion of hair growth. PDGF signals are involved in both epidermis-follicle interaction and the dermal mesechyme interaction required for hair canal formation and the growth of dermal mesenchyme [16]. Antiapoptotic effects of

activated PRP have been suggested as one of the major contributing factors stimulating hair growth [17]. PRP-induced activation of anti-apoptotic regulators, such as the Bcl-2 protein and Akt signaling, prolongs the survival of dermal papilla cells during the hair cycle. In addition, the upregulation of FGF-7/b-catenin signaling pathways with PRP treatment is suggested to stimulate hair growth by inducing follicular stem cell differentiation as well as prolonging the anagen phase of the hair growth cycle [18, 19].

In our study, Keratogrow was prepared from 20 ml of blood according to the method developed by DiponEd BioIntelligence. At the end of the three cycles of treatment, the patients presented clinical improvement in the numbers of hair and total hair density. Besides, sufficient number of platelets was obtained in all patients by using our PRP preparation system. It was demonstrated that the optimal platelet concentration for the induction of angiogenesis in human endothelial cells was 1,500,000 platelets/ $\mu$ L whereas excessively high concentrations of platelets were suggested to decrease the angiogenic potential [20]. In this study, a mean of 1,000,200 platelets/ $\mu$ L in the PRP preparation could effectively stimulate follicular and perifollicular angiogenesis, which is suggested to be one of the major factors in active hair growth.

Concluding, PRP Growth Factor Concentrate Spray (Keratogrow®) spray may serve as a potential treatment for hair loss for AGA, with encouraging results. Besides it is a safe and noninvasive technique. Considering its excellent safety profile and relatively low cost, PRP Growth Factor Concentrate Spray (Keratogrow®) spray hair treatment is a promising treatment option for patients with thinning hair.

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