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Role of Platelet Rich Plasma in Treatment of Androgenetic Alopecia: Review Article

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ABSTRACT

Background: Androgens cause a progressive shortening of the anagen phase of hair growth, leading to the pattern of thinning hair known as androgenetic alopecia (AGA) in genetically predisposed men and women. Multiple biochemical processes allow activated platelet rich plasma (PRP) to promote stem cell proliferation and differentiation in the hair follicle bulge.

Objective: Review of the literature on role of platelet rich plasma in treatment of androgenetic alopecia.

Methods: These databases were searched for articles published in English in 3 data bases [PubMed – Google scholar- Egyptian Knowledge Bank] and Boolean operators (AND, OR, NOT) had been used such as [Platelet Rich Plasma AND Androgenetic alopecia OR AGA] and in peer-reviewed articles between October 2001 and October 2022; a 21-year date range was selected, and no language limitations. Documents in a language apart from English have been excluded as sources for interpretation was not found. Papers apart from main scientific studies had been excluded: documents unavailable as total written text, conversation, conference abstract papers and dissertations.

Conclusion: Blood flow to hair follicles is improved thanks to the platelet-rich plasma's ability to regulate angiogenesis. It has antiapoptotic and mitogenic actions that keep dermal papillae alive for longer, making it a promising treatment for alopecia. Evidence from the included clinical studies suggests that PRP therapy can be an effective treatment for AGA. Downtime, adverse effects, and potential safety concerns appear to be low.

Keywords: Platelet Rich Plasma, Androgenetic alopecia.

INTRODUCTION

Androgens cause a progressive shortening of the anagen phase of hair growth, leading to the pattern of thinning hair known as androgenetic alopecia (AGA) in genetically predisposed men and women. Male- or common-pattern baldness describes this disorder. Norwood-Hamilton pattern baldness in males and Ludwig pattern alopecia in women fall under this category [(1)].

Male and female hair thinning typically occurs between the ages of 12 and 40, and around half of the population shows some degree of this feature by the age of 50. Typical male pattern baldness manifests initially as a widening of the fronto-temporal receding area, followed by a narrowing of the mid-frontal area. As the vertex hair is lifted, the thickness of the hair often decreases, giving way to a spherical area [(1)].

Androgens cause a progressive loss of terminal hairs and a gradual increase in vellus hairs in afflicted areas by stimulating the shrinkage of genetically predisposed hair follicles [(2)]. Common baldness is also known by the titles male pattern hair loss (MPHL), male pattern alopecia, androgen-dependent alopecia, and female pattern hair loss (FPHL). **(3).**

Patients of white race are most afflicted, next those of Asian and African descent, and last those of Native American and Eskimo descent. In Caucasian males, the prevalence roughly parallels age, with 50% afflicted by age 50 and up to 80% impacted by age 70. The prevalence of this condition is very high in women after they hit menopause [(4)].

Patient's own blood is used to create platelet-rich plasma, also known as platelet-enriched plasma or platelet-rich concentrate. This plasma fraction has a platelet concentration that is higher than the baseline [(5)].

Although the optimal platelet count for PRP has not been determined, the concentrate should have a platelet count that is at least four to five times higher than the patient's baseline if it is to have any therapeutic impact. There are several various phases of tissue healing facilitated by activating autologous growth factors and proteins, such as collagen synthesis, granulation, and angiogenesis, all of which are included in this treatment technique [(6)].

Evidence suggests that the high concentration of bioactive chemicals in PRP and its ability to stimulate cell proliferation contribute to its ability to speed the recovery of damaged tissues **(Figure 1)** [(7)].

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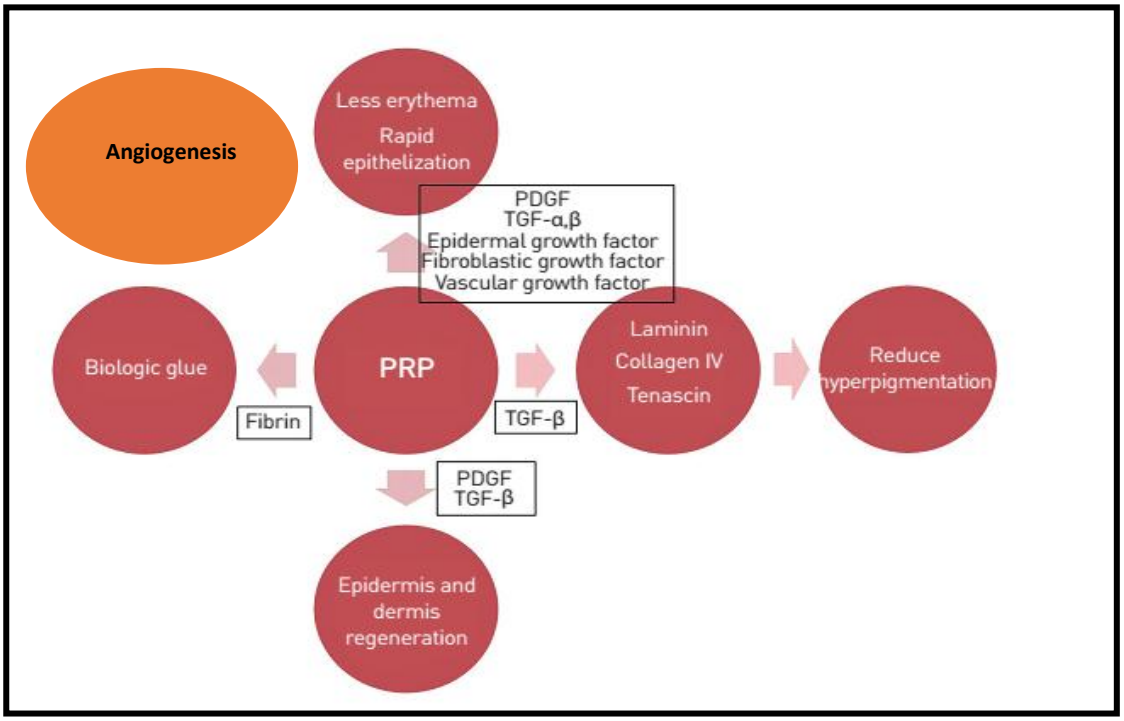

Figure (1): This diagram illustrates the functions of PRP and the bioactive compounds it contains [7].

Preparation of PRP:

A blood sample is taken from the patient during the course of treatment, with the utmost care to maintain patient safety. Depending on the individual's platelet count at baseline, the device, and the method used, 3–5 cc of PRP can be extracted from a 10-cc venous blood draw. Anticoagulants such citrate dextrose are used during the blood draw to prevent excessive clotting. The standard method for preparing platelet-rich plasma (PRP) for injection is differential centrifugation; this takes around 15 minutes [8].

Initially, RBCs are separated from plasma using differential centrifugation by performing a centrifugation (first spin) (RBC). Second centrifugation (second spin) is then performed to further concentrate the platelets, which are now suspended in the minimal amount of plasma [9].

Activation of PRP:

Plasma rich in platelets (PRP) is activated with platelet activators like thrombin or calcium chloride. A fibrin matrix is formed once CaCl2 is added and centrifuged, and growth factors are trapped inside this matrix until they are released 7 days later. As a result of its slower production over a longer time period, it finds more widespread usage in treatments like fat grafting and soft tissue augmentation [10].

Coagulation must be triggered during the PRP application for the blood plasma to activate and release the growth factors. After the second centrifugation, a solution of calcium chloride or calcium gluconate is applied. The growth factors PDGF, FGF, and IL-1 are released in a range of concentrations depending on how calcium activates PRP. Since PRP supernatants include many of these compounds, they play a crucial role in the proliferation of endothelial cells. Calcium is dosed to stimulate PRP and control the proliferation of endothelial cells [11].

Applications of PRP in treatment of androgenetic alopecia:

Multiple biochemical processes are activated by activated PRP to promote stem cell proliferation and differentiation in the hair follicle bulge [12]:

1. Transcriptional activation of beta-catenin is increased. Stem cell differentiation into hair follicle cells
2. Levels of bcl-2 were found to be up Anti-Apoptotic Dermal papilla cells have a high rate of survival.
3. Signal transduction cascades activation via protein kinase B (PKB) and extracellular signal-regulated kinases Helps the dermal papilla live longer.
4. Dermal papilla cells express fibroblast growth factor 7 Extends the hair's growth phase, known as anagen.
5. Results in higher levels of PDGF and VEGF Proangiogenic Strengthens the Perifollicular Vascular Network.

Endothelial Growth Factor (EGF) increase the anagen phase of papilla cells, which is essential for hair shaft elongation. They also cause stem cells to proliferate and undergo transdifferentiation, leading to the formation of new follicular units [13].

Hair follicles benefit from the increased blood flow and angiogenesis that is regulated by platelet-rich

plasma. Its mitogenic and antiapoptotic properties keep cutaneous papillae alive for longer [14].

Many studies have demonstrated that PRP is an effective treatment for androgenetic alopecia. Selecting these articles allowed us to get the most up-to-date picture of PRP for AGA from the medical literature. Lack of standardization in dose and administration techniques, assessment scales, and study methodology makes it challenging to compare results from different studies. Studies often gloss over important details, like platelet concentration, contaminant levels (like granulocytes), and injection depth. The field effect of PRP should also be taken into account, as it was in several split scalp studies comparing PRP with placebo [15].

Alves and Grimalt [16] found that among 25 patients with AGA were the subjects of a randomized, blinded, half-head investigation. In addition to being in Stages II–V on the Hamilton-Norwood scale and Stages I–III on the Ludwig scale, patients had not previously used any medications. Three PRP treatments were administered to each patient, one month apart, and the results were documented using both a phototrichogram and a global picture. There was a statistically significant increase in the mean number of anagen hairs, telogen hairs, hair density, and terminal hair density in PRP-treated areas compared to untreated areas at 6 months. Nonetheless, when compared to the control group, increased hair density was the only variable that increased statistically significantly. The study's authors recommended starting with three 1-monthly applications of PRP, then waiting 6 months before applying another three cycles, and finally administering maintenance PRP once every 6 months, for a total of three applications each year [16].

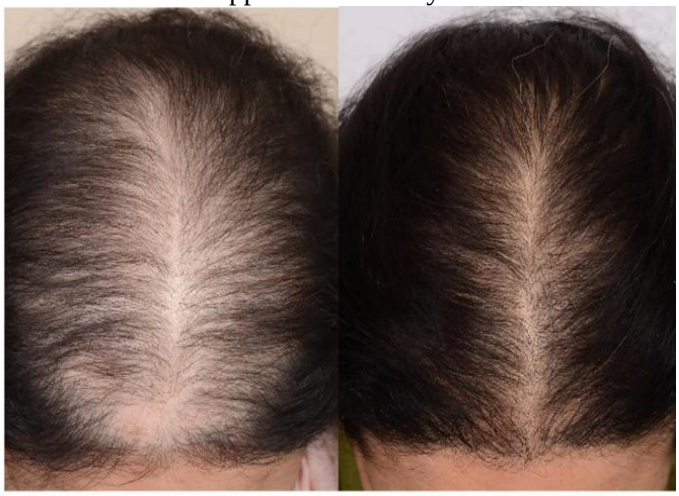

Figure (2): Before and after platelet-rich plasma treatment for 4 months, on an androgenetic alopecia patient (a 31-year-old woman) [15].

Advantages of PRP injection:

Platelet-rich plasma has been proposed as a promising new therapeutic modality due to its many benefits, including the fact that it is autologous, so it won't cause an allergic or foreign body reaction; it also has a low risk of infection because, according to some studies, it has anti-inflammatory and anti-infectious properties; it doesn't require any recovery time after treatment; it's easy to administer; it's cheap [17,18].

Because PRP is an autologous preparation, its infiltration is risk-free and well tolerated. There may be some modest local inflammation or post-puncture infection, although these are extremely uncommon side effects. There is no way for diseases like HIV or hepatitis B or C to be spread. Because it does not affect the nucleus, it cannot cause mutations [10].

Contraindications to PRP:

For properly selected individuals, autologous PRP treatment is generally safe. Patients who may benefit from PRP therapy should have a hematologic assessment beforehand to rule out coagulopathies and abnormalities of platelet function [19].

Absolute Contraindications include: platelet malfunction syndrome; anemic and thrombocytopenic individuals; hemodynamic instability; severe hypovolemia. Patients with unstable angina, those on anticoagulant or fibrinolytic medication, those with septicemia, and those with a local infection at the surgery site [20].

CONCLUSION

Blood flow to hair follicles is improved thanks to the platelet-rich plasma's ability to regulate angiogenesis. It has antiapoptotic and mitogenic actions that keep dermal papillae alive for longer, making it a promising treatment for alopecia. Evidence from the included clinical studies suggests that PRP therapy can be an effective treatment for AGA. Downtime, adverse effects, and potential safety concerns appear to be low. Evidence from the included clinical studies suggests that PRP therapy can be an effective treatment for AGA. Downtime, adverse effects, and potential safety concerns appear to be low.

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