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REVIEW ARTICLE

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Platelet-rich plasma, the ultimate secret for youthful skin elixir and hair growth triggering

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Summary

The clinical application of platelet-rich plasma (PRP) is based on the increase in the concentration of growth factors that are released from alpha-granule of the concentrated platelets and in the secretion of proteins which are able to capitalize on the healing process at the cellular level. It has been invented to restore the natural beauty by starting the natural rejuvenation process of the skin and aiming to make it function as a younger one and to keep the skin youthful and maintain it. Besides that, it is also emerged to include hairs as a new injectable procedure to enable stimulating hair growth locally and topically; preventing its fall; improving hair shaft, hair stem, and its caliber; increasing its shine, vitality, and pliability; and declining hair splitting and breakage. Thus, youth is in your blood as it has a magical power imposed in the platelet factors. There is, however, no standardization of the techniques besides insufficient description of the adopted procedures. Not long, autologous platelet-rich plasma (PRP) has surfaced strongly in diverse medical specialties including plastic, wound healing and diabetic ulcers, orthopedic, trauma, ocular surgery, dry eye for eyelid injection, urology for urinary incontinence, sexual wellness, cutaneous surgery, sport medicine, dentistry and dermatology, and aesthetic applications. PRP proved to promote wound healing and aid in facelift, volumetric skin, skin rejuvenation, regeneration, and reconstruction; improve wrinkling; stimulate hair growth; increase hair follicle viability and its survival rate; prevent apoptosis; increase and prolong the anagen hair growth stage; and delay the progression to catagen hair cycle stage with increased density in hair loss and hair transplantation. The aims of this extensive review were to cover all PRP application aspects that are carried out in aesthetic dermatology and to assess the literature on platelet-rich plasma outcomes on main aesthetic practices of general dermatology. A literature review was conducted by searching through PubMed, Biomedical Library database, Google Scholar, and Research Gate for the terms PRP, platelet-rich plasma, platelet-rich fibrin matrix, platelet preparations, platelet application therapy, platelet growth factors, platelet facial, platelet facial rejuvenation, platelet hairs, and platelet wound healing, from inception till 2017, and they were combined using Boolean operators. All those retrieved articles in English language were looked at and explored thoroughly.

[Correction added on September 26, 2017, after first online publication: "Plasma" was changed to "Platelet" in the article title.]

KEYWORDS
aging skin, anti-aging, collagen, fibroblast, hair density, hair growth, hair transplant, plasma, platelet, platelet-rich plasma, rejuvenation

1 | PRP—THE FOUNDATION

Platelet-rich plasma is an autologous product that is manufactured from patients' own venous blood limiting the potential risk of disease transmission.[1]

The word plasma implies "copious platelets that are mounted on into a miniature quantity of plasma." PRP consists of a volume of plasma with platelet concentrations higher than the basal levels, from 1 000 000/μL platelet count to approximately threefold to eightfold superior amount as compared to the normal peripheral blood (range 150 000-350 000 μL),[1] which are achieved by means of centrifugation.[2]

The use of autologous PRP has the advantage of eliminating the risk of cross-contamination, as well as the transmission of microbial diseases or immune reactions.[2]

The use of PRP in liquid or gel form has shown an improvement in the cicatrization process.[2]

The direct injection of PRP at the site of the lesion, without the need for activation, is an attractive and palpable alternative because activation can be supposedly attributed to the trauma caused by the needle and/or the residual collagen, resulting in the reduction of costs and the preparation time.[2]

The therapeutic use of PRP in the past 20 years has been demonstrated to be a safe, resourceful, and effective treatment, but special consideration should be paid in infection cases, autoimmune diseases, anemia, cancer, steroid and NSAID intake, and those with low platelet level.[2]

Different platelet concentrations are achieved by different methodologies with results that in many instances are not well defined as to the improvement of cicatrization. The increase in the rotation force is known to supply a higher platelet concentration; nonetheless, too high forces could lead to early activation of the platelets which would lose the growth factors in the supernatant plasma with rupture of the tubes incurring losing the therapeutic efficiency of PRP.[2] Therefore, the quality of the obtained material determines the efficacy of it, which is inconsistent in many studies.[2]

Those growth factors of the activated platelets are involved in the different stages of the healing process, such as inflammation, collagen synthesis and remodeling, tissue granulation, and angiogenesis to promoting tissue restoration.

It has been thought that platelets help in the process of hemostasis and minimize bleeding during surgery; however, now its benefit extended to promote wound healing by inducing secretions of various factors, namely growth factors, cytokines, and proteins including platelet-derived growth factor (PDGF), transforming growth factor (TGF), vascular endothelial growth factor (VEGF), insulin-like growth factor (IGF), epidermal growth factor (EGF), and interleukin (IL)-1, which are excreted by the α-granules of concentrated platelets (Table 1).[3,4]

TABLE 1 Platelet factors[4]: Platelets release large amounts of the followings with different functionalities

Growth factors of the PRP	Functions
PDGF—platelet-derived growth factor (ie, PDGF-AA, PDGF-BB, and PDGF-AB)	A mitogen for fibroblasts and smooth muscle cells and involved in angiogenesis, formation of fibrous tissue, and re-epithelialization; increases the collagen content. Acts on stem cells of the follicles, stimulates the development of new follicles, and promotes neovascularization.[15] Promotes blood vessel growth, cell replication, and skin formation.
TGF—transforming growth factor (ie, TGF-β1 and TGF-β2)	Increases the collagen content and early rate of gain of strength in wounds, and promotes growth of matrix between cells and bone metabolism.
VEGF—vascular endothelial growth factor	Involved in anagen-associated angiogenesis, which is an important factor in active hair growth. Influences growth of normal and pathological dermal structures.[14] Promotes blood vessel formation.
IGF—insulin-like growth factor	A regulator of normal physiology in nearly every cell type in the body.
FGF-2—fibroblast growth factor-2	FGF-7: located in the DP cells and prolongs the anagen phase of the hair cycle and delays progression into the catagen/telogen phase.[4,6] Promotes growth of specialized cells and blood vessel formation.
EGF—epidermal growth factor	Promotes cell growth and differentiation, blood vessel formation, and collagen formation.
Various pro- and anti-inflammatory cytokines such as interleukin-4 (IL-4), IL-8, IL-13, IL-17, tumor necrosis factor-alpha, and interferon-alpha[15]	Stimulates fibroblast and collagen synthesis.
Fibrin, fibronectin, and vitronectin	Cell adhesion molecules.
Thrombin[1]	Has biological and adhesive properties

Platelet-rich plasma also includes concentration of protein growth factors. Besides, PRP contains fibrin, fibronectin, and vitronectin, which are known to act as cell adhesion molecules (Table 1).[5] Thus, PRP plays a key role in cell migration, attachment, proliferation and differentiation, and extracellular matrix (ECM) accumulation.[5]

Besides that, PRP has shown a remarkable induction effect on the skin as it stimulates proliferation of dermal fibroblast and adipose-derived stem cells and it acts as a scaffold for soft tissue augmentation injectables such as HA and fat filler and transplantation and helps in mitigating acne scars and nasolabial fold.[4,6]

Thicker collagen was observed in those who received PRP injection, and the scientific explanation for that lay in the upregulating levels of collagen I and matrix metalloproteinases 1 and 2 (MMP1 and MMP2).[6] With this in mind, PRP specifically has attracted the attention of dermatologists in the aesthetic field for skin rejuvenation.[7]

The technique employed by Yuksel et al[5]:

For PRP preparation, 8 mL of blood was collected from each volunteer just before each procedure. The tube with cell extraction kit and Ficoll was centrifuged at 3200 rpm for 8 minutes in a standard laboratory centrifuge. After centrifugation, 2 layers were formed over the parser gel and erythrocytes remained under it. Platelet-poor plasma (PPP) was the yellow fluid at the top of the tube, and it was collected using a syringe. PRP was the buffy coat over the parser gel and was withdrawn with a long cannula. We obtained approximately 1.5 cc PRP and 6.5 cc PPP from each individual at each procedure. PRP was applied to the individual's forehead, malar area, and jaw using a dermaroller and injected by a 27-gauge injector into the wrinkles of crow's feet. After PRP application, the whole face of the individual was draped by a thin gauze sponge soaked with PPP and let to stay on face for 30 minutes. PRP was obtained from autologous blood of each individual thrice during the study and applied at 2-week intervals.

2 | PRP AND THE SKIN REJUVENATION

Skin aging is characterized by cellular changes and alterations in dermal extracellular matrix proteins caused by intrinsic and extrinsic factors. During aging, there is degeneration of connective tissue and the hyaluronic acid polymers decrease in skin. Skin aging means flattened dermal-epidermal junction, dermal atrophy, and less fibroblasts.[5]

Activation of dermal fibroblasts is essential for rejuvenation of aged skin.[5] Remodeling of the extracellular matrix is necessary for rejuvenation of aged skin, and activated fibroblasts play a role in this process. Matrix metalloproteinase proteins (MMPs) are involved in the aging process by degradation of collagen and ECM proteins.[7]

As PRP contains several growth factors and cell adhesion molecules, it was hypothesized that PRP might play a role in the activation of fibroblasts and synthesis of collagen and other matrix components, and thus skin rejuvenation.[5]

Platelet-rich plasma induces increased expression of type I collagen, MMP1 and MMP2 in human skin fibroblasts.[7]

Platelet-rich plasma improves skin color and texture; it increases its tissue tension, to level the relief and to reduce wrinkle depth.

Activated PRP was shown to stimulate dermal fibroblast proliferation, and also activated PPP was reported to increase type I collagen.[5]

Platelet-rich plasma was used for face and neck revitalization and reported to be an easy-to-perform technique in face and neck rejuvenation.[5]

Platelet-rich plasma was found to have the capacity to increase dermal elasticity by keratinocyte and fibroblast proliferation and collagen production.[5]

Its ability to stimulate hyaluronic acid synthesis is another possible reason for improving aging skin. Hyaluronic acid affects skin moisturization by binding and retaining capacity of water molecules which cause swelling and give volume and skin turgor. Thus, increase in hyaluronic acid level will improve the appearance of the skin.[5] Therefore, PRP will accelerate rejuvenating the aging skin by various growth factors and cell adhesion molecules.[7]

The Yuksel et al[5] study assessed the skin firmness-sagging, wrinkle state, and pigmentation disorder with 3 applications of PRP at 2-week intervals and showed an improvement in the skin firmness-sagging and wrinkle state.

In recent years, PRP application has started to take part in cosmetic dermatology for skin rejuvenation and the PRP was supposed to affect skin aging by its contents according to the observations of Yuksel et al.[5]

Moreover, PRP has been reported to augment dermal elasticity by stimulating the removal of photodamaged extracellular matrix (ECM) components and inducing the synthesis of new collagen by dermal fibroblasts via various molecular mechanisms which made the PRP a frontier of interest in aesthetic medicine. In fact, PRP induces remodeling of the ECM, which requires activation of dermal fibroblasts, which is essential for rejuvenation of aged skin.[3] PRP can also be used as a mesotherapy for skin rejuvenation.

In recent studies, injection of PRP in the face and neck for revitalization obtained good results.[3]

3 | DIFFERENT TECHNICALITY OF PRP

A variety of techniques have been tried for the clinical use of PRP in skin rejuvenation; however, a clearly defined way is unavailable.

- Topical application under occlusion
- Direct intradermal injections (ID).

Platelet-rich plasma can be used as an adjuvant to lasers or microneedling. It is usually performed once in every 4-6 months for 1 year and then yearly as maintenance therapy.

Monthly ID injections of PRP in 3 sessions have shown satisfactory results in face and neck rejuvenation and scar lessening.

Also PRP has been combined with fractional ablative lasers (carbon dioxide) for deep wrinkles and severe photodamaged skin and proved to be effective in lessening it with less downtime.

A split-face, blinded trial had shown that PRP injections on monthly bases for 3 consecutive months yielded good results for infra-orbital rejuvenation with no downtime.

Various numbers of products and brands are available in the market nowadays for skin rejuvenation such as mesotherapy solutions, adipose-derived stem cells, and stem cell solution, and whether PRP can be mixed with them to boost up and enhance the aesthetic results needs further clinical trials. However, some do practice it without any scientific evidence or dosing.

Also, there is lacking evidence for any comparative studies to contrast PRP with other treatments such as topical cosmeceutical preparations of growth factors, to be used after fractional laser resurfacing. All these need a further study with follow-ups.

4 | SCARS AND CONTOUR DEFECTS

Platelet-rich plasma has become a promising modality for soft tissue augmentation (volumetric) techniques. PRFM has been used as a filler to correct deep nasolabial folds without any adverse effects. It can be mixed with autologous fat transfer as an adjuvant and has proved to result in greater vascularity, less cysts and vacuoles, and lesser fibrosis with overall improved survival and quality of fat grafts as compared to saline. It also maintains fat graft survival in patients with facial contour defect up to 2 years. Fat can be mixed with PRP to treat traumatic scars, in combination with fractional laser resurfacing, to attain better results.

Platelet-rich plasma injections followed by fractional carbon dioxide resurfacing laser had yielded good results in treating acne scars and in skin rejuvenation.

5 | PRP AND MELASMA REGRESSION

A single paper by Çayırlı et al[8] was retrieved which claimed effectiveness of PRP for regressing melasma. The authors claim to utilize the RegenKit for 3 sessions, 15 days apart. He claimed that the α-granules of the platelet inhibit the melanogenesis via delayed extracellular signal-regulated kinase activation. Also the witnessed improvement could be explained by the volumetric PRP at the site of injection. With increasing of angiogenesis and collagen and extracellular matrix, including hyaluronic acid and the later provide the glue of the skin attained.[8]

6 | PRP APPLICATIONS

Data regarding application of PRP in dermatology and aesthetics are described in the literature.

7 | PRP TECHNIQUES

There are different techniques employed for preparation of PRP, and there is no single standardization for its procedure.

Platelet-rich plasma (PRP) can be prepared either manually or by an automated digital device. It has to be performed under aseptic state and should be prepared with anticoagulant tubes, such as citrate dextrose solution formula A (ACD-A) or sodium citrate. Then, the platelet will be impounding in high concentrations to secret its active factors, GFs, which will exercise the therapeutic benefits.[9]

There are many advocated methods for its extraction, and one of them, namely the manual double-spin method, was approved by the American Association of Blood Banks, who stated that the PRP is separated from the whole blood by light spin centrifuge where RBCs and WBCs will settle down in the tube as they are the heaviest and then a heavy spin applied on the supernatant plasma (top yellow buffy coat layer) to separate the platelet-poor plasma at the top from the platelet-rich plasma at the bottom (main active part). Then, an activator will be added (calcium chloride ($CaCl_2$) or thrombin) to trigger coagulation whereby platelet GFs degranulate and yield activated PRP,[9] and thus to convert fibrinogen into fibrin.[6]

The double-spin technique is favorable over the single-spin technique as into where the therapeutic benefits of the platelets prevail. The secret lies within the first 10 minutes where the GFs actively secreted when coagulation initiated and will be finished within an hour of the procedure. Thus, action should be taken into consideration to inject it within that time frame. It has been found that the activated platelet remains active for about 8 hours, and thus, it exercises its therapeutic benefits within that number of hours.[9]

Manual centrifuges are not recommended, not only due to their potential for product contamination but also due to their decreased efficiency in platelet recovery (30%-70%) as compared to automated devices.[10]

Variations in key properties of the PRP, including platelet concentration and the type and use of a clot activator, may markedly influence the different biological effects.[10]

Platelet-rich plasma preparations containing optimal platelet counts of more than 1 000 000 platelets/μL have been shown to release platelet α-granules sufficient for obtaining satisfactory results. α-Granules release chemokines, cytokines, and growth factors that stimulate cell proliferation and differentiation.[11]

8 | PRECAUTIONS OF CERTAIN DRUGS

Any patients to undergo the PRP inject should refrain from any antiplatelet drugs such as aspirin and nonsteroidal anti-inflammatory drugs for at least 2 weeks prior to the PRP practice.[9]

9 | PRP KITS

There are numerous PRP cell extraction kits and preparation protocols that are distributed and promoted for its preparations differently according to the manufacturer (Table 2). Usually, those kits are equipped with a butterfly 21-G needle; vacutainer kit; calcium chloride; 2-mL syringe; and 30-G needle.[7]

TABLE 2 Categorization of platelet according to its yielded concentrates and examples of provided companies' kits (Arshdeep[9])

P-PRP (pure platelet-rich plasma)	L-PRP (leukocyte- and platelet-rich plasma)	P-PRF (pure platelet-rich fibrin)	L-PRF (leukocyte- and platelet-rich fibrin)
P-PRP concentrate consists of an undetermined fraction of buffy coat, containing a large number of platelets, but most leukocytes are not collected. After the first slow-spin centrifugation, only the superficial buffy coat layer is pipetted out and prepared for next centrifugation	L-PRP consists of most of the platelets, along with leukocytes and some residual RBCs, suspended in fibrin-rich plasma. It differs from P-PRP only on the means of buffy coat layer collection in which PPP along with the entire buffy coat layer and superficial 1- to 2-mm layer of RBCs is pipetted out	The term PRF is used synonymously with platelet-rich fibrin matrix (PRFM). When P-PRP is mixed with activator and allowed to incubate for some time, a stable PRFM clot can be collected which has useful applications. Very low amounts of leukocytes are collected owing to a specific separator gel used in the device.	Blood is collected without any anticoagulant and immediately centrifuged. A natural coagulation process then occurs, and 3 layers are formed: the RBC base layer, acellular plasma top layer, and L-PRF clot in the middle, which harvests platelet and leukocyte growth factors into the fibrin matrix. There is no biochemical modification of the blood; that is, no anticoagulants, thrombin, or $CaCl_2$ is required. When pressed between 2 gauzes, the PRF clot becomes a strong membrane which also has potential applications.
Eg, Anitua's plasma rich in growth factors (PRGF). Such as cell separator PRP, Vivostat PRF, PRGF-Endoret, or E-PRP Such as cell separator PRP, Vivostat PRF, or Anitua's PRGF	Eg, Plateltex (Bratislava, Slovakia) and RegenACR® kit (Regen Laboratory, Mollens, Switzerland). These protocols employ gelifying agents or a separator gel within the centrifugation kit to enhance the complete collection of the buffy coat layer. Automated systems for L-PRP are PCCS and SmartPReP. The manual PRP preparation process is not clearly defined; it might randomly lead to P-PRP or L-PRP. Such as Curasan, Regen, Plateltex, SmartPReP, PCCS, Magellan or GPS PRP Such as Curasan, Regen, Plateltex, SmartPReP, PCCS, Magellan or GPS PRP	Eg, Fibrinet PRFM kit (Cascade Medical, NJ, USA). Such as Fibrinet	Eg, Choukroun's PRF. Such as Titanium-prepared PRF and Intra-Spin L-PRF System Such as Choukroun's PRF

P-PRP and L-PRP exist in an inactivated liquid form and can be activated and transformed into a P-PRP gel and an L-PRP gel, respectively.[16]

However, these tailored kits can be quite expensive and inconsistent about the platelet concentrates as compared to the manual process, and they tend to conceal its true value and clinical benefits of the demanded platelet amounts. In fact, we need to ensure those kits' feasibility, concentration, and activation of platelets gained.[9]

Various PRP kits have been approved by the US Food and Drug Association (FDA), for example, SmartPReP®, PCCS®, and BioMet GPSII®.

Ehrenfest et al had argued and have proposed a categorization of platelet according to its yielded concentrates into 4 groups depending upon their leukocyte and fibrin contents.

10 | PRP INDICATIONS

The collected data that had been analyzed from peer-reviewed journals show a wide range of dermatological indications ranging from skin rejuvenation and anti-aging, to hair restoration and to acne scarring.[9]

11 | PRP AND ITS SAFETY

It had been observed that the GFs released do not penetrate the cell or its nucleus; however, they only get attached to the membrane receptors and induce signal transduction mechanisms. And as the PRP mechanism is autologous preparation, it is devoid of any serious side effects. The only reactions observed are local reactions such as local pain and local infection if strict local sterilization was not adopted. Also PRP does not transmit the 3 well-known viral infections (hepatitis B and C and HIV). However, some raised concern about the transmission of Creutzfeldt-Jakob disease (mad-cow disease) with bovine thrombin. Some had refuted this theory and state that the virus prion was found in the neural tissue of the cattle and thrombin isolated from blood will be processed by heating. Moreover, postoperative bleeding was attributed to bovine thrombin-induced factor V deficiency. On the other hand, it has been found that adding an activator such as 10% $CaCl_2$ would eliminate this risk automatically. The concept of bovine thrombin is unpopular, and new alternatives such as human recombinant thrombin, thrombin

receptor agonist peptide (TRAP), autologous thrombin (prepared simultaneously with some of the available kits), or type I collagen were investigated.[9]

12 | PRP AND HAIR LOSS

The new trends nowadays concerning hair loss therapies and the clinical studies findings seems to stress emphasis more on biological approaches rather than the used to know alternative traditional therapies, as the findings were found to be encouraging by influencing the stem cells at the hair plug area for hair growth (follicle morphogenesis). This works by escalating the survival of hair follicle cells through its anti-apoptotic effects on dermal papilla cells and possibly stimulating hair growth by elongating the anagen phase of the hair cycle.[12]

13 | PRP AND ANDROGENIC ALOPECIA

Androgenetic alopecia (male pattern baldness) (AGA) is the most common hair loss disorder affecting up to 80% of men and up to 40% of women with Caucasian heritage.

Androgenetic alopecia is a nonscarring progressive miniaturization of the hair follicle with a typically characteristic pattern distribution in genetically predisposed men and women.[13] For majority of the patients, alopecia causes severe attendant psychosocial implications due to altered appearance, which in turn leads to depression and anxiety symptoms.[1]

In AGA, individual follicles "miniaturize" and either disappear or become vellus-like hairs. Therefore, the number of follicular units and the number of follicles in the follicular units decrease with time.[10]

It has been postulated that PRP stimulates the stem cells of the hair follicle bulge area (dermal papilla (DP) cells) to proliferate and differentiate.[9]

Fibroblast growth factor 7 (FGF-7) and beta-catenin are claimed to be the potent stimuli for hair growth when PRP is injected in the dermal papilla, and the PRP induced faster telogen-to-anagen transition phase.[4]

One of the clinical encountered problems in the clinical dermatology is androgenic alopecia in both genders. The PRP had been tried on androgenic alopecia as a mesotherapy and had shown good results. Greco et al and Lopez et al had noticed a considerable change in hair diameter and hair thickness, respectively.

There are many proposed ways for PRP application in androgenic alopecia:

- Interfollicular PRP injection, from deep to surface in retrograde way in the treated area.
- PRP mesotherapy, where the scalp is microtunneled by a microneedling way, 1 mm, with interfollicular injection; then, the PRP can be sprayed or splashed on the treated area and left overnight.

14 | PRP AND OTHER ALOPECIAS—ALOPECIA AREATA, TELOGEN EFFLUVIUM, AND FEMALE PATTERN HAIR LOSS

Platelet-rich plasma has been well proved to help in patients with alopecia areata (AA) and telogen effluvium (TE). However, not much published data exist in the literature in this regard.[9]

According to Kumaran,[9] a randomized double-blind, placebo- and active-controlled, half-head study evaluated PRP in 45 patients with AA. Three sessions employed with monthly gap showed an increase in hair regrowth and decrease in hair dystrophy and burning/itching sensation at 1-year follow-up, when compared with intralesional triamcinolone acetate or placebo.

Greco et al tried it in a single patient with AA as a mesotherapy, with positive subjective findings at 10-month follow-up. This can be explained by the fact that in patients with AA and TE, spontaneous remissions can occur solo or with the traditional medications such as minoxidil and finasteride, and thus, attribution to PRP will be weakly argued.[9]

Female pattern hair loss (FPHL) is the most frequently encountered type of alopecia in women in the clinical setting. Typically present clinically with prominent thinning of scalp hair, decreased hair counts, and are preserved frontal hairline.[11]

Intraperifollicular platelet-rich plasma (PRP) injections have been shown to be therapeutically effective in inducing hair follicular regeneration in patients with alopecia.[11]

Platelet-rich plasma has been demonstrated to improve cutaneous ischemic conditions and to increase vascular structures around hair follicles.[14]

15 | PRP AND HAIR TRANSPLANT

Hair transplantation is reserved to those who want to have a hairy scalp and hate baldness. Follicular unit transplant (FUT) is the new applied technique and has shown favorable results.

Platelet-rich plasma has proved an angiogenic effect on the hair follicle, and thus, it exerts hair growth functionality. PRP can be used as an independent therapy or as an addition to hair transplant to increase the survival rate of the implanted follicular unit with increased density, by preventing dermal papilla apoptosis and prolonging the anagen phase of the hair cycle phase due to the higher level of fibroblast growth factor-7 (FGF-7) induced by PRP around the dermal papilla (DP).[6] Some proposed to pre-implant the hair to be treated by PRP and some gone for the interfollicular injection of PRP while transplanting the follicular unit and post-transplant, and some advocated mounting the hair follicle inside the PRP for about 15 minutes before implanting the hair follicle as shown by Uebel in 2006.[6] This has no clinical judgment basis as it was only an observation and not a clinical blinded trial.

This observation has shown an improvement in the hair density with induction of hair growth by the released growth factors of the activated platelets on the bulge area where the stem cells located

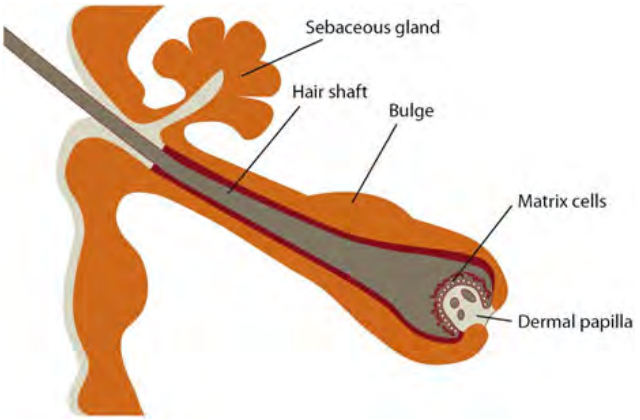

FIGURE 1 Hair bulge area[17]

and got differentiated into new follicles with prolongation in the anagen phase to keep hair growth and generate neovascularization.[4] After all, all claims remain a speculation with no clinical grounds.

It is also affirmed that the donor side and the recipient area should receive the PRP to improve the quality of the hair growth and minimize bleeding, stimulate wound healing, and reduce scarring in the donor side.[9]

A new anagen hair started after 4 months of transplant.[15] The actual fall was noticed as breakage of hair strand just above the skin surface rather than actual shedding of transplanted hair according to Garg.[15]

However, the spontaneous apoptosis of 15%-30% hairs mentioned by Uebel et al can be reduced by injected PRP significantly with PRP induced new vessel formation and effect of growth factors on stem cells of bulge region (Figure 1) and mesenchymal cells in dermal papillae.[15]

The combination of growth factors plays a pivotal role in tissue repair and regeneration, and the presence of plasma proteins acts as a scaffold in epithelial migration. The effect may result in anagen hair growth as early as 2 months.[15]

The role of growth factors in PRP is stimulating and nourishing transplanted follicular unit grafts.[15]

Platelet-rich plasma is the source of various growth and regulatory factors involved in cell growth and differentiation. PRP not only induces growth but also improves cell survival by its anti-apoptotic activity.[15]

16 | PRP AND SCIENTIFIC EVIDENCE

The subject of the PRP still remains debatable as the level of evidence from the available published data is low. There are no double-blind, randomized, placebo-controlled trials conducted on a large sample size to comprise a good quality level of evidence of the PRP.[9]

Platelet-rich plasma sounds to be the hopeful healing modality; however, the level of evidence remains low and it needs many RCTs to prove its efficacy.

17 | CONCLUSIONS

Platelet-rich plasma stays a mystery for its clinical benefits as an adjunct or solo treatment. Moreover, there are no evidence-based data regarding the exact concentration and dosing parameters that are promoted by commercial PRP kits which will resist many doctors from adopting it in the clinical setting as they are expensive and time-consuming. There is no consistency on how frequent to inject the PRP for how long. None is definitive for now, and all are just arbitrary.

Moreover, there are differences in PRP composition that is attained from differences in the samples retrieved from person to person. Also differences in manufacturing of the inoculate result especially from the routine of centrifugation and whether either bovine thrombin or calcium chloride are used in activation. The used end product may vary by the used volume and the number of injections administered, as well as the color, platelet count, the number or absence of leukocytes, and its protein content.[1]

There is a definite need for more extensive independent researches and double-blind clinical trials to prove the effectiveness, efficiency, and safety of PRP as a novel approach to clinical applications.[6,9]

The achievable role of PRP in dermatology and aesthetic medicine is an exciting frontier that may ultimately escort to superior therapies in the near future; nevertheless, according to the current evidence-based medicine (EBM), the level of evidence from the available published data is still scarce and low, as there are no double-blind, randomized, placebo-controlled trials conducted on a large sample size to comprise a good quality of evidence and support the claim of its benefits. Therefore, a vigorous caution should be exercised by the treating physician in its preparation and application during its procedures.[9]

In conclusion, PRP increases dermal collagen levels not only by growth factors, but also by skin needling (the mesotherapy technique "point by point"). PRP application could be considered as an effective (even a single application) and safety procedure for facial skin rejuvenation and skin thickness (increase in epidermis thickness).

Platelet-rich plasma has already been reported to augment tissue repair and regeneration process.

Lastly, some of my patients claim an improvement in the quality of their hair, stoppage of hair loss, and increase in density and thickness, and one said it became smoother and less fuzzy (sprayed). Thus, PRP beneficial effect on quantity and quality of hair regrowth was stated and affirmed by many authors.

Thus, patients' satisfaction further confirms the quality of the PRP results.

CONFLICT OF INTEREST

The author reports no conflict of interests in this work. The author alone is responsible for the content and writing of the manuscript.

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