

Liquid Gold – A Review of Platelet Rich Plasma on Facial Skin and Hair

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Abstract

The complex anatomy of the human face makes it a challenge for treating aging signs. Chronological aging process and photoaging affects the quality of the skin. Many treatment options such as hyaluronic acid injections, botulinum toxin injections and skin resurfacing like microdermabrasion and chemical peels maybe associated with certain risk factors and may pose as economic burden to the patients. PRP was found to be suitable, feasible and minimally invasive option which involved least patient risk and proved to be cost effective. PRP has a virtue of delivering a high concentration of growth factors to target tissues and potentially improve wound healing and scarring parameters.

Keywords: Platelet-rich plasma, growth factors, rejuvenation, photoaging skin, androgenic alopecia.

Introduction

The complex anatomy of the human face makes it a challenge for treating the aging signs. Chronological aging and photoaging process affects the quality of skin. In over four decades, platelet rich plasma (PRP) has emerged as an invaluable treatment option and finds its utilisation in a variety of fields.¹ PRP is traditionally employed in periodontal therapy, maxillofacial surgery, orthopedics and sports medicine.² Platelet-rich plasma (PRP) is a new biotechnology product of heightened interest in cell-based therapy and tissue engineering. PRP has gained popularity in recent years for treating elite athletes and celebrities.³ Face and neck revitalization with Platelet-rich plasma injections have shown to be an easy-to-perform technique in face and neck rejuvenation

Platelet-rich plasma (PRP) (*syn.* autologous platelet gel, plasma-rich growth factors and platelet-concentrated plasma) means "abundant platelets that are concentrated into a small volume of plasma."⁴ The body's inherent capacity to repair and regenerate is enhanced by PRP because it contains various growth factors and cytokines.

Various studies have proved that the platelets comprise of myriad variety of biologically active proteins which includes vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), epidermal growth factor (EGF), transforming growth factor beta (TGF- β), fibroblast growth factor (FGF) and insulin-like growth factors (IGF-1, IGF2). The influence of these biological factors is shown on various cellular processes which include homing of stem cells, cellular migration, cellular proliferation and cellular differentiation. Also, it is responsible for angiogenesis, the activation of macrophages, collagen and matrix synthesis.⁵

Thus, PRP was found to be a suitable and feasible option which is minimally invasive, autologous treatment modality involving least patient risk and also proved to be cost effective.⁶

Materials And Methods

Various articles on PRP were collected and reviewed. The literature search was done from 01/02/2020 to 20/02/2020 in PUBMED and Google scholar. The search was as follows ("Pharmacol Res Perspect"[Journal] OR "prp"[All Fields]) AND ("esthetics"[MeSH Terms] OR "esthetics"[All Fields])

PRP Preparation

All the protocols of PRP preparation followed a generic method. Under strict aseptic conditions as well as optimum temperature regulations (20-22°C), the process were carried out. Blood was withdrawn and collected with an anticoagulant in order to inhibit platelet coagulation. Whole blood is centrifuged to separate red

blood cells subsequently to concentrate platelets. In order to achieve higher therapeutic benefits the platelets required to be sequestered in high concentrations and in a viable state at the same time, such that they actively secrete growth factors. The entire procedure of preparation of platelets can be carried out either manually or using automated devices.

Various techniques have been described for the preparation of platelets manually. Manual double spin method is preferred over the earlier single spin method. The American Association of Blood Bank technical manual describes the procedure in which it states that "Platelet Rich Plasma is separated from whole blood by 'light – spin' centrifugation and then the platelets are subject to 'heavy spin' centrifugation which removes the supernatant plasma".⁴

The platelet yield depends on some conditional parameters like size and shape of the container, rate, time of spin and anticoagulant use.

Current protocols vary greatly for PRP preparation and lack of comparative studies to standardize the PRP procedural parameters was observed. In contrast to automated devices, there are several commercially available PRP kits, their high cost often precludes their use. Furthermore, even patient parameters such as status of hydration, infection, lipidemia and haematocrit play a role in final PRP characteristics.² Also their applications are vague because each technique lead to a different product with dissimilar biology and efficacy.

There is a common step in which all the methods are used for differential centrifugation so as to separate the patient's whole blood into three layers - plasma, buffy coat and red blood cells, based on density.¹

The secret of PRP lies in the fact that during the first 10 minutes when the coagulation is initiated, the GFs are actively secreted and will be destroyed after an hour of the

procedure. Thus, it should be injected within that particular time frame. It has been found that the therapeutic benefits of activated platelets remain active for about 8 hours, and it can be exercised within that time period.⁷

PRP Classification

The classification of FIT PAAW described by DeLong et al is composed of 7 critical components which are as follows¹

1. Force of centrifugation
2. Iteration or sequence of centrifugation
3. Time of centrifugation
4. Platelet concentration
5. Anticoagulant use
6. Utilization of an Activator including the type and amount
7. Composition of White blood cells

Indications

1. Chronological Aging
2. Photoaging
3. Hyperpigmentation
4. Melasma
5. Post acne scars
6. Traumatic scars
7. As a primer before aesthetic procedures
8. Contour defects treated with PRP and fat grafts
9. Androgenic Alopecia
10. Alopecia Areata

Application of PRP for Skin Rejuvenation

In chronological and photo aging there is decreased production of fibroblast and collagen synthesis, cell replacement in the epidermis of the facial skin decreases and results in sagging, wrinkling and skin thinning. Furthermore, there are alterations in the interaction of these fibroblasts with other cells such as dermal mast cells,

keratinocytes and adipocytes which play a critical role during skin ageing.⁵

Actinic elastosis also known as photoaging is another important aspect to be considered. In actinic elastosis accumulation of abnormal elastin occurs in the dermis of the skin. UV radiation exposure of human skin will lead to incorporation of various macromolecules in skin (e.g. proteins, DNA, RNA and vitamin D) which contributes to the generation of reactive oxygen species (ROS), which are involved in extra cellular matrix (ECM) degradation and subsequent skin ageing.⁸ Continuous stimulation of collagen synthesis by various growth factors and cytokines is required for skin cell replacement processes.

PRP has been reported to increase skin elasticity by stimulating the removal of photo damaged Extracellular Matrix (ECM) components and inducing the synthesis of new collagen by dermal fibroblasts via various molecular mechanisms.⁴ Another possible reason for improving aging of the skin is its ability to stimulate the hyaluronic acid synthesis.⁷ Acceleration of hyaluronic acid production is another mechanism of PRP for skin rejuvenation.⁹ Moisturization of the skin is affected by hyaluronic acid which acts by binding and retaining capacity of water molecules. This causes swelling which gives volume and skin turgor. Thus, raise in hyaluronic acid level shows improvement in the appearance of the skin.⁷ Overall skin elasticity is enhanced since PRP also promotes cell proliferation, extracellular matrix synthesis and helps in the adjustment of the collagen fibers diameter.⁹

The augmentation of the normal healing process is limited to the mitogenic effects of PRP and is theoretically non-mutagenic, as they bind to the membrane receptors and induce signal transduction mechanisms. The growth factors (GFs) that are released by PRP do not enter the cell or its nucleus. PRP is a promising modality among soft

tissue augmentation techniques. Three sessions of intradermal injections of PRP in patients have shown satisfactory results in face and neck rejuvenation and also scar attenuation.⁴

Patients who received intradermal or subdermal injections of PRP, topical applications or a combination of both for facial wrinkles, atrophic acne scars, photo-damaged skin or depressed skin areas generally report improvement of the affected areas within weeks of preliminary treatment.¹

Modes of PRP Application⁷

1. Topical application under occlusion
2. Direct intradermal injections (ID)

The use of PRP in combination with ultra-pulsed fractional CO₂ laser therapy in patients for three months showed improved results for facial wrinkles, skin texture and skin elasticity.⁵ Platelet-rich plasma minimizes erythema, edema, crusting and pigmentation after laser resurfacing. Hence it accelerates barrier recovery.¹⁰

Another combination of PRP therapy with micro-needling in the skin rejuvenation treatment which uses microneedles for puncturing hundreds of tiny micro-openings in the skin, have shown excellent results in patients.⁵

Fat grafts that are combined with PRP, enhanced maintenance of volume and facial scarring was minimised. With the addition of PRP it has been hypothesized that autologous facial fat grafting would be beneficial by increasing the longevity of the graft and also in reduction of recovery days.¹

PRP and Melasma Regression

Cayırlı et al described a procedure in which the Regen PRP kit was utilized and patients were subject to three sessions of PRP with 15 days of interval. The authors claimed that melanogenesis was inhibited by α -granules of platelets. They also witnessed an increase in angiogenesis, hyaluronic acid and collagen at the site of injection.⁷

Application for Hair Rejuvenation

Up to 80% of men and 50% of women during their lifetime are affected by the most common form of alopecia ,i.e, Androgenetic Alopecia (AGA). It is age-related disorder and is a chronic, nonscarring defect marked by a progressive reduction in the diameter, length and pigmentation of the hair.²

AGA has a specific characteristic feature which is shortening of anagen hair phase causing miniaturization of terminal hair to vellus hair. The quality of a person's life may be impaired significantly with the diagnosis of AGA, irrespective of age and gender.¹¹

Since the growing rate of interest in hair restoration has increased, to assess the efficacy of PRP as a treatment modality for AGA, various number of investigations are being conducted.² For AGA, the current treatment options are focused mainly on hair follicle promotion as well as cell proliferation and differentiation during the hair growth cycle.¹¹ Multiple successful studies are reported which have demonstrated PRP efficacy as a treatment modality for androgenetic alopecia. Sub or intradermal injections of PRP into the affected scalp regions have been tried.¹²

In the randomized control trial conducted by Khatu et al, PRP was injected in ten patients with male pattern baldness, resulted in an increased hair count growth in seven patients.¹² It showed a mean gain of 22.09 follicular units per centimeter, hair follicles increased from 71 follicular units to 93 follicular units. 45 patients with alopecia areata were involved in a similar randomized double-blind placebo-controlled study in which one half of the scalp were given intralesional injections of PRP, triamcinolone acetonide or placebo and had shown satisfactory results with PRP treatment.¹

Upon degranulation of the growth factors and cytokines that are released from activated platelet form central to the

supposed mechanism of action of PRP, with enhanced cell proliferation and tissue vascularization which ultimately leads to increased hair follicle stimulation.³

Carlos J. Puig et al, have conducted a Double-Blind, Placebo-Controlled Pilot Study on the Use of Platelet-Rich Plasma in Women with Female Androgenetic Alopecia. This study included 26 women (treatment group, n =15; placebo group, n= 11), out of these, 13.3% of the treatment subjects (Vs 0% of the placebo subjects) have shown significant improvement in hair loss, rate of hair loss, hair thickness and ease of managing/styling hair and 26.7% (Vs 18.2% of the placebo group) reported that their hair felt coarser or heavier after the treatment.⁸

There has been proven angiogenic effect on the hair follicle induced by Platelet-rich plasma. It exerts functionality in hair growth. Although PRP is used as an independent therapy, it can be an addition with hair transplant therapy to increase the survival rate of the implanted follicular unit with increased density. Dermal papilla apoptosis is thus prevented by prolonging the anagen phase of the hair cycle phase due to induced higher level of fibroblast growth factor-7 (FGF-7) by PRP around the dermal papilla (DP).⁷

PRP and Its Safety

The observation regarding the concept of safety says that the GFs that are released do not penetrate the cell or its nucleus. They are only attached to the membrane receptors to induce mechanisms of signal transduction. It is devoid of any serious adverse effects because the mechanism of PRP is autologous in preparation. Local reactions such as pain and infection were observed only when strict asepsis was not followed. Also, PRP does not transmit the three well-known viral infections - Hepatitis B and C and HIV.⁷

Pearls for Practicing PRP

Topical anesthetic cream when applied prior to the procedure, helps in delivering painless injections to the patients and a pleasant experience is ensured. Among the variety of forms of topical applications, an ointment of lignocaine (10%), prilocaine (10%) and phenylephrine (0.25%) was more effective according to the author.¹³ Some of the studies quoted the use of 30 G needles have shown to minimize injection pain.¹⁴ There is no consistent single method for optimal PRP concentration dosing.¹⁵ The volume of injection typically ranges from 0.8 to 12 cm.^{3,1}

Contraindications of PRP include the following¹⁶

1. Sepsis
2. Cancer
3. Chemotherapy
4. Platelet dysfunction syndrome
5. Critical thrombocytopenia
6. Hypofibrinogenemia
7. Hemodynamic instability
8. Anticoagulation therapy
9. Acute and chronic infections
10. Chronic pathological conditions of the liver
11. Severe metabolic, systemic disorders and skin disease like systemic lupus erythematosus, porphyria and allergies
12. Heavy nicotine, drug and alcohol consumption

Some significant adverse effects of PRP which are primarily not related to PRP per se may occur, such as infection, skin discoloration, bruising, pain in the injected area, allergic reaction (a rare occurrence) and thrombosis

Limitations of PRP

1. Baseline for concentration of platelets within the patient's whole blood (0%) are not documented. Lack of standardization in preparation and dosage of autologous blood concentrates have not been documented

2. Inadequacy and variability in outcome assessment
3. Ideal depth of penetration of the injection
4. No long term follow-ups
5. No reported studies of negative effects of PRP and is generally assumed as autologous products are intrinsically safe and this aspect requires critical evaluation.
6. No evidence has been observed that PRP will remain localize at the site of injection.
7. Safety of autologous blood products in the presence of cell, growth factor and platelet activating adjuncts has not been documented.¹⁷
8. Clinical application of PRP in bone repair remains a subject of controversy

Future Trends

The role of PRP is being widely investigated and shows promise as a short term agent which may assist in simultaneous healing of several musculoskeletal tissues after trauma or elective surgery .¹⁸

PRP is considered to play a role in infection healing which is being widely investigated and holds promising results since it is antibacterial in nature. It is shown to have antimicrobial proteins which are secreted by the platelets and hence it is a bacteriostatic agent too.⁴

Increasing evidence points to the fact, that PRP aids in autologous fat graft survival for a longer period. This plays a key role in wound healing. Hence PRP can be used in diabetic patients where wound healing is slow and fastens the process.¹⁹

Conclusion

There are number of potential advantages in using PRP. It has a virtue of delivering a high concentration of growth factors to target tissues and potentially improve wound healing and scarring parameters.²⁰ The bright future for a safe, efficient, aesthetic and cosmetic intervention

particularly in wound healing, skin rejuvenation and hair restoration treatment is shown by PRP itself.⁵

Altogether, in the regeneration of damaged skin cells and reversing the processes of aging by neo-angiogenesis and new collagen synthesis makes it a great and a new concept. PRP seemed to be a beneficial autologous product that would provide some well-tolerated alternative to currently existing therapies.¹⁰

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Legends Figures And Table



Fig. 1: Drawing Blood



Fig. 2: Centrifugation Blood



Fig. 3: Formation of PRP Blood

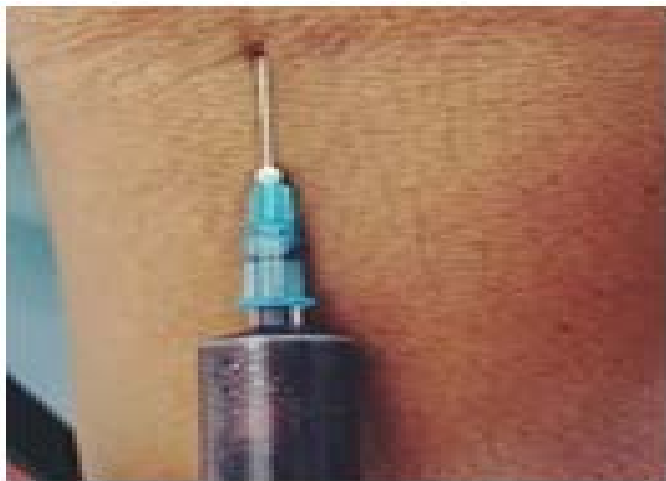


Fig. 4: Injection of PRP Blood

Application of PRP	Uses
Face and neck	For removing aging signs (chronological and photoaging)
	To treat pigmentations (melasma)
	To treat acne and scars
Scalp	To treat alopecia
	To provide good texture and volume of hair
	Along with hair transplantation to retain the longevity
Laser + PRP	Along with the CO ₂ Lasers for better results
	As a primer before laser and chemical peels
Facial fat grafting + PRP	Reduces recovery time and increases the vascularization
Wound healing (future trends)	Acts as a bacteriostatic agent

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