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The Efficacy of Platelet-Rich Plasma in the Field of Hair Restoration and Facial Aesthetics—A Systematic Review and Meta-analysis

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Abstract

As a promising alternative to traditional treatment, platelet-rich plasma (PRP) is being used to encourage hair growth through the release of growth factors and cytokines. In addition to hair restoration, PRP's multifactorial capabilities can also be used to treat aging skin, facial scarring, and acne. The purpose of this review is to critically examine the success of PRP in the field of dermatology, with specific attention to the role of PRP in hair restoration. Where possible, meta-analyses were used to evaluate the efficacy of PRP. In androgenetic alopecia (AGA) patients, 3 monthly PRP injections (1 session administered every month for 3 months) exhibited greater efficacy over placebo as measured by change in total hair density (hair/cm^2) over the treatment period (mean difference: 25.61, 95% CI: 4.45 to 46.77; $P = .02$). The studies included in the meta-analysis used a half-head design, which may have influenced the results because of the effects PRP can induce. Controlled studies suggest that 2 to 4 sessions of PRP combined with traditional therapies and procedures can help minimize acne scarring and facial burns, improve aesthetic results, and decrease recovery time. However, data for these indications are lacking and are less robust in design. In conclusion, to achieve an improvement in hair restoration in patients with mild AGA, 3 initial monthly PRP injections should be given. Only upon completion of rigorous, randomized, controlled studies can standardized and effective PRP protocols for treating dermatology conditions such as acne scarring, facial burns, and aging skin be determined.

Keywords

alopecia areata, androgenetic alopecia, facial aesthetics, meta-analysis, platelet-rich plasma

Introduction

Platelet-rich plasma (PRP) therapy involves concentration and administration of an autologous solution containing platelets found in whole blood. Through the activity of discharged growth factors and cytokines released from α granules found within platelets, PRP can promote cell survival, proliferation, and angiogenesis.[1-3] PRP can be used in a wide array of dermatology-based applications because of its multifactorial capabilities and anti-inflammatory effects.[4] For instance, PRP can promote hair growth and follicle survival by activating the protein kinase B pathway (Figure 1).[1,5] The anti-inflammatory effect of PRP can combat localized microinflammation associated with hair loss conditions such as androgenetic alopecia (AGA).[4,6,7] PRP has also been found to improve the density of collagen fibers through activating fibroblasts, which can smooth scarring and rejuvenate skin's appearance.[8,9]

There are many questions surrounding the use of PRP such as its effectiveness in a dermatology setting, what protocols dermatologists should be using, and whether these protocols should change based on the condition being treated. Addressing these questions can be difficult as many protocol parameters could influence the efficacy of PRP

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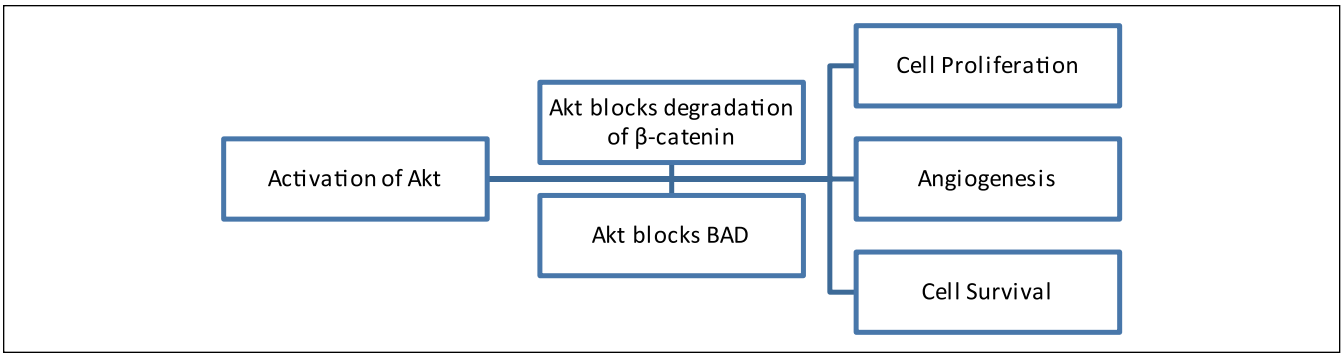

Figure 1. Platelet-rich plasma can promote hair growth and follicle survival by activating the protein kinase B pathway. Akt indicates protein kinase B; BAD, Bcl-2–associated death promoter. Adapted from Rapaport et al[10] and Gupta and Carviel.[1]

including the frequency and number of PRP sessions, presence of an activator, and the exact specifications of the collection system. This article will specifically examine the role of PRP in hair restoration by evaluating its efficacy in AGA, alopecia areata (AA), cicatricial alopecia (CA), as well as other potential facial aesthetic applications (eg, acne scarring, aging facial skin, burns, and facial procedures). Based on these results, we will make consensus protocol recommendations to aid the application and integration of PRP in the field of dermatology.

Methods

A literature search was conducted (PubMed) March 1, 2018, and updated June 11, 2018. The following search terms were used: *PRP, platelet-rich plasma, hair, alopecia, facial scarring, skin rejuvenation, facial burns*, and *facial surgery*. In vitro studies and case studies were excluded. Clinical trials that evaluated the direct injection of PRP as a monotherapy treatment for patients with AGA, CA, or AA (diagnosed prior to treatment) were included. To generate a meta-analysis, we required a minimum of 3 studies reporting the mean change from baseline for the same outcome metric. A GRADEpro assessment, based on Cochrane methodology, was used to grade the quality of evidence for studies included in the meta-analysis.[11] For hair restoration studies, outcome measures such as hair density (total hairs/cm^2), hair count (total hairs/0.65 cm^2), hair diameter (mm), hair shedding, and epidermal changes were examined. The meta-analysis was conducted using RevMan 5.3 (Copenhagen, Denmark). Owing to the expansive field of aesthetic applications, only 4 potential facial aesthetic PRP applications were assessed: PRP as a treatment for acne scarring, aging skin (eg, wrinkles and nasolabial folds), facial burns, and facial procedures (eg, facelifts and graft implantations). Efficacy was measured using the mean difference (MD) between outcome measures, and heterogeneity was evaluated using the percentage of variation across studies that is due to heterogeneity rather than chance (I^2 statistic).[12,13] The reported efficacy was compared with a control group and $P < .05$ was considered significant.

Results

PRP as a Treatment for Hair Loss

Androgenetic Alopecia. Twenty-three studies met inclusion criteria and used PRP as a monotherapy for treatment of AGA (Table 1). Seven randomized, controlled trials (RCTs) were included[14-20]; all but one used a half-head design.[11] Four studies evaluated the efficacy of PRP in female pattern hair loss (4/23 = 17%),[14,15,21,22] 10 studies evaluated the efficacy of PRP in male pattern hair loss (10/23 = 43%),[17-19,23-27] and 8 studies evaluated PRP both in male and female pattern hair loss (9/23 = 39%).[16,28-35] PRP was most commonly delivered once a month for 3 months (6/23 = 26% of studies)[17-19,22,29,32,33,35] with 47% of studies (11/23) using some form of activation prior to injection (eg, calcium gluconate).[15-19,22,25,28,31-33] Platelet concentrations within PRP solutions varied from 2 to 6 times baseline platelet count, with 3 times baseline platelet count the most common concentration reported (Table 1). Eight studies reported the leukocyte status of their PRP solutions: Two studies used a PRP solution rich in leukocytes,[21,34] 3 studies used a leukocyte-poor PRP solution,[16,32,35] 2 studies used PRP solutions that might include leukocytes,[17,18] and 1 study used a leukocyte-free PRP solution.[14] Interfollicular PRP injections (0.05 to 0.2 mL/cm^2) were the most common method used.[17,18,22,29,30] Approximately 50% of studies (6/12 = 50%) that reported needle gauge (G) used a 30-G needle when injecting PRP,[17-19,29,32] and the Regen system was the most commonly reported PRP kit/lab device used (4/23 = 17%) (Table 2).[17,24,26,31] Averaging across studies, each patient had a total of 3.9 sessions of PRP at 3.5-week intervals and were age 37.6 years. Only 26% (6/23) of studies were considered high quality, providing results from placebo-controlled, randomized, and blinded trials (Table 3).[14-18]

Efficacy was measured among AGA studies using a wide array of outcomes including but not limited to hair count

Table 1. Trial Characteristics of Studies Investigating the Efficacy of Platelet-Rich Plasma (PRP) as a Treatment for Hair Loss.

Study	Trial Characteristics	Treatment Groups	Centrifugation and Collection System Details	Characteristics of PRP Solution Used	Injection Details	Patient Characteristics
Androgenetic Alopecia						
1 PRP Session						
Gentile et al, 2017[17] (Study 2)	Not randomized 2 PRP techniques Not blinded	Regen PRP Arthrex PRP	Regen Blood Cell Therapy Arthrex Angel System	Activated (CG) 5-fold increase OWB	25-G needle 1 mL per treatment section 1 session	N = 6 men Age: 40.8 ± 11.3 HN IIIa to IIIv
Puig et al, 2016[14]	Randomized (TA) Placebo-controlled Double-blinded (E and S)	PRP Saline	Angel PRP system	Leukocyte-free Not activated 2.75 to 3.4 × PC	Subcutaneous injection 10 mL per session 1 session	N = 26 women Age: ≥ 18 years Ludwig II
PRP Session Every Week						
Lee et al, 2015[21]	Randomized (TA) 2 PRP techniques Single-blinded (E)	CD34++ PDRN PRP PDRN PRP	SmartPReP2 platelet concentrate system	Leukocyte-rich Not activated	Intraperifollicular injection 0.05 to 0.1 mL/cm^2 12 or 13 sessions	N = 40 women Age: 33.2
Marwah et al, 2014[23]	Not randomized Not controlled Not blinded	PRP	Not reported	Not reported	6 sessions	N = 10 men II to III
Tawfik and Osman, 2018[15]	Randomized (TA) Placebo-controlled (1/2) Double-blinded	PRP Saline	1200 *g* 15 mins 2000 *g* 10 mins	Activated (CG)	Intradermal injection 4 sessions	N = 30 women Age: 29.3 ± 6.56 Ludwig I to III
PRP Session Every 2 Weeks						
Ayatollahi et al, 2017[24]	Not randomized Not controlled Not blinded	PRP	RegenLab PRP Kit-Regen ACR 1500 *g* 5 mins	Not activated	Intradermal injection 0.05 ml per area 5 sessions	N = 15 men Age: 39 ± 9.7 HN III to VI Hair loss: 36 months (median)
Khatu et al, 2014[25]	Not randomized Not controlled Not blinded	PRP	1500 rpm 6 mins 2500 rpm 15 mins	Activated (CC)	2 to 3 cc 4 sessions	N = 11 men Age: 20 to 40 H II to IV
Singhal et al, 2015[28b]	Not randomized Controlled Not blinded	PRP No PRP	1500 rpm 6 mins 2500 rpm 15 mins	Activated (CC)	8 to 12 cc 4 sessions	N = 16 men, 4 women Age: 25 to 35
Starace et al, 2018[22]	Not randomized Not controlled Not blinded	PRP	My Cells system 2500 rpm 10 mins	Not activated	25-G needle Interfollicular injection 1 cc per injection 4 sessions	N = 10 women Age: 47.1 Ludwig I to III Hair loss: 7.9 years
PRP Session Every 3 Weeks						
Borhan et al, 2015[26c]	Not randomized Not controlled Not blinded	PRP	Regen Lab Device 3400 rpm 5 mins	Not activated	32-G needle Superficial dermis injection 0.05 to 0.1 mL per injection 4 sessions	N = 17 men Age: 32.7 ± 11.3 HN II to VI Hair loss: 6.6 years

(continued)

Table 1. (continued)

Study	Trial Characteristics	Treatment Groups	Centrifugation and Collection System Details	Characteristics of PRP Solution Used	Injection Details	Patient Characteristics
Gkini et al, 2014[29d]	Not randomized Not controlled Single-blinded (E)	PRP	RegenKit BCT-3 1500 *g* 5 mins	Activated (CG) 5.8× OWB	27 G needle 0.05 to 0.1 mL/cm^2 3 sessions 5.5 × 10^7 to 1.1 × 10^8 platelets/cm^2	N = 20 men, 2 women Age: 34 ± 11.8 HN II to V, Ludwig I to 3
Kachhawa et al, 2017[27]	Not randomized Placebo-controlled (1/2) Not blinded	PRP Saline	1200 rpm 4 mins 2400 rpm 4 mins	Not reported	1 to 2 cc per injection Intradermal injection 6 sessions	N = 50 men Age: 34 NH III to VI
PRP Session Every 4 Weeks						
Alves and Grimalt, 2016[16]	Randomized (LR) Placebo-controlled (1/2) Double-blinded (E and S)	PRP Saline	Omnigrafter-Proteal 460 *g* 8 mins	Leukocyte- poor Activated (CC) 3× OWB	30-G needle 0.15 mL/cm^2 per area 3 sessions	N = 12 men, 13 women Age: 39 HN II to V, Ludwig I to III
Anitua et al, 2017[30e]	Not randomized Not controlled Single-blinded (E)	PRP	BTI System IV 580 *g* 8 mins	Leukocyte-poor Activated 2× OPB	30-G needle 3 to 4 cm^3 per injection 5 sessions 1.4 × 10^3 to 1.8 × 10^3 platelets/cm^2	N = 13 men, 6 women Age: 45 ± 11 N III to VI, Ludwig II
Cervelli et al, 2014[20]	Randomized Placebo-controlled (1/2) Single-blind (E)	PRP Saline	Cascade-Selphyl-Esforax 1100 *g* 10 mins	May include leukocytes Activated (Ca+)	0.1 mL/cm^2 3 sessions	N = 10 men Age: 32.7 ± 10.6 HN IIa to IV
Ferrando et al, 2017[31a,f]	Not randomized Not controlled Not blinded	PRP	Omnigrafter 460 *g* 1800 rpm 8 mins	Activated (CC)	Intradermal injection 0.1 cc/cm^2 6 sessions	N = 19 men, 59 women Age: 18 to 72 Ebling scale II to IV
Gentile et al, 2018[32]	Not randomized Placebo-controlled (1/2) Not blinded	PRP Saline	260 *g* 10 mins	Not activated	30-G needle Interfollicular injection 0.2 ml/cm^2 3 sessions	N = 18 men, 5 women Age: 21 to 70 HN I to V, Ludwig I to II
Gentile et al, 2017[17] (Study 1)	Randomized (TA) Placebo-controlled (1/2) Double-blind (E and S)	PRP Saline	CPunT Preparation System 1200 rpm 10 mins	Not activated	30-G needle Interfollicular injection 0.2 mL/cm^2 3 sessions	N = 18 men Age: 37.4 ± 9.4 HN II to IVa
Gentile et al, 2015[17]	Randomized (TA) Placebo-controlled (1/2) Double-blind (E and S)	PRP Saline	Cascade-Selphyl-Esforax system 1100 g 10 mins Platelet-rich lipotransfer 1200 rpm 10 mins	May include leukocytes Activated (Ca+)	30-G needle Interfollicular injection 0.1 mL/cm^2 3 sessions	N = 23 men Age: 34.7 ± 11.7 HN IIa to IV
Mapar et al, 2016[19]	Randomized (SQ) Placebo-controlled (1/2) Single-blinded	PRP Saline	PRP tube Tubex 3000 rpm 6 mins 3300 rpm 3 mins	Activated (CG) 3-fold increase in BPC	30-G needle Deep dermis injection 2 sessions	N = 19 men Age: 25 to 45 N IV to VI

(continued)

Table 1. (continued)

Study	Trial Characteristics	Treatment Groups	Centrifugation and Collection System Details	Characteristics of PRP Solution Used	Injection Details	Patient Characteristics
Hausauer and Jones, 2018[35a,g]	Randomized (TA) 2 PRP techniques Single blinded	PRP	Eclipse PRP kit 3500 rpm 10 mins	Leukocyte-poor Not activated 4 to 6× OWB	32-G needle Subdermal injection 0.2 to 0.5 mL per aliquot 2 to 4 sessions	N = 30 men, 10 women Age: 43.75 NH II to V, Ludwig I2 to III Hair loss: 6.45 years
PRP Session Every 12 Weeks						
Kang et al, 2014[33a]	Not randomized Comparator Not blinded	PRP Placental extract	SmartPReP2 APC+	Not activated 5.9-fold increase OPB	Interfollicular injection 0.05 to 0.1 mL/cm^2 2 sessions 7.4×10^7 to 1.5×10^8 platelets/cm^2	N = 15 men, 11 women Age: 37.11 ± 10.5
Schiavone et al, 2014[34a]	Not randomized Not controlled Not blinded	PRP	GPS III Platelet Separation System Glo PRP	Leukocyte-rich Scalproller Fibrin matrix 3.5 to 4× BPC	24- to 26-G needle Superficial cutaneous injection 0.2 to 0.3 mL per injection 2 sessions 2.0×10^8 to 3.0×10^8 platelets injected per session	N = 42 men, 22 women Age: > 20 H II to V, Ludwig I to II
Alopecia Areata						
PRP Session Every Month						
El Taieb et al, 2017[36]	Randomized (TA) Placebo-controlled Comparator Not blinded	PRP Minoxidil Panthenol	3000 rpm 10 mins	Activated (CG)	3 sessions total	N = 39 men, 51 women Age: 21.09 Hair loss: 28 ± 16.15 months
Trink et al, 2013[37]	Randomized (TA) Placebo-controlled (1/3) Comparator Double-blind (ES)	PRP TRA Placebo	70 *g* 8 mins	Activated (CG) 3.5× OWB	Intralesional injection 3 sessions total	N = 20 men, 25 women Age: 28.03 Hair loss: 4.52 years
Singh, 2015[38]	Not randomized Not controlled Not blinded	PRP	Not reported	Not reported	Subfollicular injection 6 sessions total	N = 20 Age: 25 to 35

Abbreviations: 1/2, half-head design; 1/3, 3 lesions treated on each patient, 1 lesion per treatment; BPC, baseline platelet count; CC, calcium chloride; CG, calcium gluconate; E, evaluator; H, Hamilton classification; LR, left or right side of scalp; Mins, minutes; N, Norwood classification; NH, Norwood Hamilton classification; Not blinded, open label or the study did not specify that blinding occurred; OPB, over peripheral blood; OWB, over whole blood; PC, baseline platelet concentration; PDRN: polydeoxyribonucleotide; SQ, square assignment; S, subject; TA, treatment allocation; TRA, triamcinolone acetonide.

[a]Concomitant hair loss treatment(s) were allowed (or recommended) during study protocol (eg, finasteride).

[b]Fifteen-day interval between sessions.

[c]Treated every 3 weeks for the first 3 sessions and 6 weeks for the last session, 4 sessions total.

[d]Treated every 3 weeks for a total of 3 sessions + 1 booster session at month 6.

[e]Two additional reminder injection doses were administered at months 4 and 7.

[f]Injected in affected areas for 3 monthly sessions, followed by 3 bimonthly sessions and 2 or 3 annual follow-up sessions.

[g]Two different PRP regimens used: 3 monthly PRP sessions + 1 booster session 3 months later vs PRP sessions every 12 weeks (2 sessions total).

Table 2. The Frequency of 510(K)-Cleared Systems in Androgenetic Alopecia Studies[39a].

System	Centrifugation Details	Amount of Blood Required	Frequency (n = 23)
RegenKit Blood Cell Therapy (Regen Lab SA)[40]	3400 rpm to 3660 rpm 5 minutes	8mL autologous blood required to prepare 4 to 5 mL	17% of studies (4/23)[19,24,26,31]
Arthrex Angel System (Arthrex)[41]	3500 rpm 3 minutes 3000 rpm 8 minutes	120 mL whole blood required to obtain 10 mL 3% hematocrit PRP	9% of studies (2/23)[13,19]
Cascade Selphyl system (Cascade Medical Enterprises, LLC)[42]	3100 rpm 10 minutes	18 mL whole blood required to obtain 9 mL PRP	9% of studies (2/23)[16,17]
Eclipse PRP system (Eclipse SmartPrep)[43]	3500 rpm 10 minutes	6 to 7 mL PRP per 11 mL tube	4% of studies (1/23)[35]
Harvest SmartPrep (Harvest Terumo BCT, Inc.)[44,45]	2500 rpm 3 minutes 2300 rpm 9 minutes	3 to 4 mL PRP per 30 mL blood volume	9% of studies (2/23)[20,30]
Biomet GPS III (Biomet Orthopedics)[46,47]	3400 rpm 15 minutes	52 mL whole blood to obtain 6 mL PRP	4% of studies (1/23)[34]

Abbreviation: PRP, platelet-rich plasma.
Twenty-six percent of the included studies (6/23) used a system not included in the above list during PRP preparation, and 22% of studies (5/23) did not report the system used.

(total hairs/0.65 cm^2),[17,18] total hair density (total hair/cm^2),[16-18] terminal hair density (terminal hairs/cm^2),[17,18] hair diameter (mm),[15,22,30,32] hair shedding,[14,26] and epidermal changes.[17,18,32] Four included studies compared the impact of PRP (3 sessions at 1-month intervals) on mean change in hair count, as defined as total hairs/0.65 cm^2 from baseline, with placebo-treated patients.[14-18] Three of these studies found that PRP exhibited greater efficacy over placebo (all 3 studies $P < .05$),[17,18] whereas 1 study did not find a significant difference between these 2 treatments ($P > .05$).[16] Terminal hair density (terminal hairs/cm^2) was evaluated in 3 placebo-controlled studies.[17,18] In 2 of these studies, 3 PRP sessions administered at 1-month intervals exhibited greater efficacy over placebo with response to mean change in terminal hair density by end of treatment ($P = .0003$ for both studies).[17,18] PRP also exhibited a greater efficacy over baseline measurements in hair diameter (mm) in 4[15,22,30,32] of the 5 studies that evaluated this endpoint (all studies $P < .05$).[15,22,24,30,32] It was found both that interfollicular[22,30] and intradermal injections[15,24] made a significant impact in hair diameter. Across all included studies that evaluated epidermal change (4 studies), PRP-treated patients had a statistically significant increase in epidermal thickness compared with baseline measurements ($P < 0.05$ for all 4 studies).[17,18,22,32] Half these studies reported the use of interfollicular injections, suggesting this depth may be required to create an epidermal change.[17,18] Two included studies evaluated hair shedding through a self-assessment questionnaire.[14,26] One study reported very little improvement in hair shedding 26 weeks posttreatment with 60% (9/15) of PRP-treated patients reporting no improvement, 13.3% (2/15) reporting some improvement, and 13.3% (2/15) reporting substantial improvement.[14] Conversely, in a study by Borhan and colleagues,[26] 71% (12/17) of patients reported a slight to moderate change in hair shedding 4 weeks posttreatment. The major differences between these studies, such as time of evaluation and number of sessions, may have contributed to the differences in shedding improvement. PRP was found to exhibit a greater efficacy over placebo across all controlled studies that evaluated hair density (all studies $P < .05$).[15-18,27,29] Three of these studies used an interfollicular injection, 2 studies used an intradermal injection, and 2 studies did not report injection depth.[15,17,18,27,29] According to the meta-analysis conducted, 3 PRP sessions administered at 1-month intervals exhibited greater efficacy over placebo with response to mean change in total hair density (hairs/cm^2) by end of treatment (MD: 25.61, 95% CI: 4.45 to 46.77; $I^2 = 23\%$, $P = .02$) (3 studies, pooled n = 58) (Figure 2).[16-18] These results suggest that PRP is an effective treatment for AGA; however, the quality of evidence from these trials is low. Risk of bias and imprecision were judged as serious with inconsistency and indirectness considered not serious. Only one included study directly compared PRP with a comparator.[30] In this study, PRP (2 sessions at 12-week intervals) was compared with placental extract in a nonrandomized fashion.[30] A statistically greater level of improvement in hair thickness and overall clinical improvement was found with PRP-treated patients compared with placental extract–treated patients ($P = .027$ and $P = .023$, respectively).[30]

AGA studies suggest that disease severity, disease duration, the type of PRP kit used, and injection frequency can influence the efficacy of PRP in AGA patients, whereas the age and gender of the patient, concomitant treatment, and leukocyte status may not (Table 4). Owing to inconsistent evidence, it is unclear whether platelet concentration, number of platelets injected, number of sessions, needle size, injection depth, and activation can influence the efficacy of PRP in AGA patients (Table 4). Further research is required

Table 3. Quality of Evidence. Grading of Studies Based on Modified Guidelines Provided by the Oxford Center for Evidence-Based Medicine, 2009[47].

Level of Evidence	PRP as a Treatment for AGA (n = 23)	PRP as a Treatment for AA (n = 3)	PRP as a Treatment for Acne Scarring (n = 8)	PRP as a Treatment for Aging Facial Skin (n = 14)	PRP as a Treatment for Facial Burns (n = 1)	PRP as an Adjunct Treatment During Facial Procedures (n = 9)
High-quality RCTs (strong evidence)	26% of studies (6/23)[14-19]	33% of studies (1/3)[37]	50% of studies (4/8)[48-51]	21% of studies (3/14)[50,58,59]	0% of studies (0/1)	33% of studies (3/9)[55-57]
Moderate-quality trials (moderate evidence)	30% of studies (7/23)[17,21,27-30,35]	33% of studies (1/3)[36]	38% of studies (3/8)[58-60]	21% of studies (3/14)[8,49,54]	100% of studies (1/1)[61]	67% of studies (6/9)[62-67]
Low-quality, nonrandomized, open-label, observational studies (low evidence)	43% of studies (10/23)[20,22-26,31-34]	33% of studies (1/3)[38]	12% of studies (1/8)[68]	57% of studies (8/14)[69-76]	0% of studies (0/1)	0% of studies (0/9)

Abbreviations: AA, alopecia areata; AGA, androgenetic alopecia; moderate evidence, lack of controls, randomization, or lack of blinding; PRP, platelet-rich plasma; RCT, randomized, controlled trial; strong evidence, placebo-controlled, randomized, blinded at an investigator, evaluator or patient level; weak evidence, not randomized, no controls, open label.

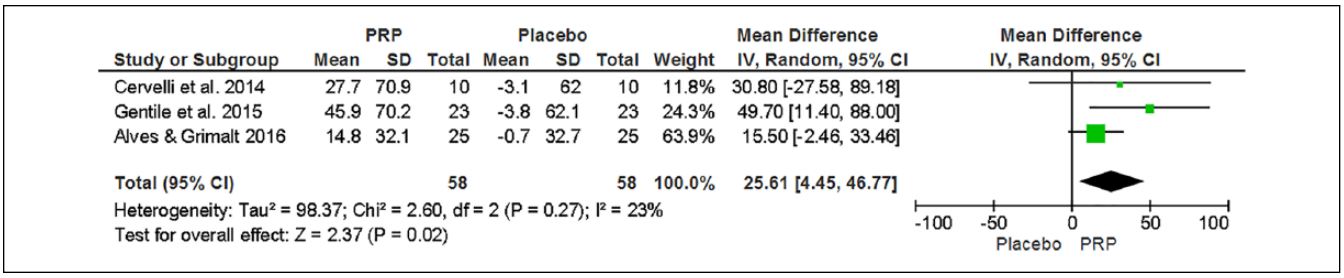

Figure 2. Three studies evaluated the impact of 3 monthly platelet-rich plasma (PRP) sessions (1 session per month) on hair density (total hairs/cm^2) in patients with androgenetic alopecia (pooled N = 58 participants). Mean change from baseline to end of treatment was used as the unit of measure. IV indicates inverse variance.

to determine which factors play a more significant role in the success or failure of PRP as a treatment for AGA.

Alopecia Areata. Three patchy AA studies met inclusion criteria; however, not enough quantitative data were included to conduct a meta-analysis.[36-38] Only 2 studies (2/3 = 67%) were randomized and controlled, comparing PRP with a placebo and an active comparator (minoxidil or triamcinolone acetonide).[36,37] One study used a half-head design,[37] and PRP sessions were delivered monthly across all included studies (Table 1).[36-38] Two studies evaluated the efficacy of PRP both in men and women,[36,37] and one study did not report gender.[38] Two studies also reported the use of activation (calcium gluconate)[36,37] and only one study reported platelet concentration (3.5× whole blood).[37] None of the studies included information on leukocyte status, needle gauge, or the collection system used. The depth of injection varied across studies reporting both intralesional injections[37] and subfollicular injections.[38] Most studies used a single-spin technique (2/3 = 67%),[36,37] with each patient on average receiving 4 PRP sessions. The average age of the patient included in these studies was 24.6 years. Only one study was considered to give high-quality evidence, providing results from a placebo-controlled, randomized, and blinded trial (Table 3).[37] Efficacy was measured across AA studies using hair regrowth and relapse rates.[36-38]

Across all studies that measured hair growth (2/3 = 67% of studies), patchy AA patients treated with PRP had a significantly greater improvement in hair growth compared with placebo-treated patients (both studies $P < .05$).[36,37] Relapse rates reported in PRP-treated patients were low and ranged from 5% to 31%, 6 to 9 months post-PRP treatment.[37,38] PRP-treated patients were found to achieve improvements in hair restoration parameters (eg, hair regrowth, pigmentation) earlier than comparator treatments (eg, minoxidil, triamcinolone acetonide).[36,37] A greater number of patients had fully pigmented hair at beginning of hair regrowth when treated with PRP (96% of patients) compared with triamcinolone acetonide-treated patients (25% of patients).[37] In addition, PRP induced hair regrowth and reduced short vellus hair and yellow dots earlier than minoxidil ($P < .05$).[36] The lack of quantitative data limits the ability to understand how significant these data are and what factors could contribute to PRP's success as an AA treatment. Further research in the use of PRP in AA is needed.

Cicatricial Alopecia. Unfortunately, after an examination of the literature, there were no CA studies that met the inclusion criteria. Thus, as only case studies have been published, it is difficult to determine the efficacy of PRP in scarring alopecia conditions.

Other Aesthetic Applications of PRP

PRP has also been investigated in several other aesthetic applications such as acne scarring,[48-51,58-60,68] aging skin (eg, wrinkles and nasolabial folds),[8,52-54,69-78] facial burns,[61] and facial procedures (eg, facelifts and graft implantations)[55-57,62-67,78] (Table 5). In these studies, the efficacy of PRP was measured through scar severity scales, patient-oriented questionnaires, and gained volume achieved. Half of the acne scarring studies (4/8 = 50%) were classified as high quality, providing results from placebo-controlled, randomized, and blinded trials (Table 3).[48-51] Conversely, 57% (8/14) of aging facial skin studies[69-76] and 67% (6/9) of facial procedure studies[63-67] were graded as low-quality and moderate-quality studies, respectively (Table 3).

PRP was found to induce statistically significant improvements in acne scar severity when combined with microneedling[48,49,58-60] and erbium fractional lasers.[68] However, these scar severity improvements induced by PRP combinations did not outperform results obtained from comparator treatments (eg, trichloroacetic acid combinations and CO_2 fractional laser treatments).[48-51] PRP significantly improved severity of nasolabial folds, color homogeneity, and signs of photoaging.[69-71,77] In a randomized, half-head, single-blind study, no statistical differences were found between PRP (1 session every 2 weeks, 6 sessions total) and mesotherapy (epidermal growth factor, insulin-like growth factor 1, basic fibroblast growth factor, thioredoxin, copper tripeptide-1, multivitamins, amino acids, and minerals) in skin hydration, turgor, smoothness, and vitality.[52] However, in lipofilling

Table 4. Factors That Could Contribute to the Success or Failure of PRP as a Treatment for Hair Loss.

Characteristics	Is There Evidence to Suggest This Factor Can Influence Efficacy?	Evidence from AGA Studies
Disease Severity	Yes	In uncontrolled, nonrandomized study by Schiavone et al, adjusted odds ratios ranged from 3.0 (95% CI, 0.8 to 11.1) to 4.1 (95% CI, 1.04 to 16.3), for "moderate" patients and 7.0 (95% CI, 1.2 to 41.1) to 8.4 (95% CI, 1.2 to 57.7) for "severe and very severe" patients compared with "very mild and mild" patients.[34]
Disease Duration	Yes	In Alves and Grimalt's[16] randomized, placebo-controlled study, a statistically significant correlation between mean total hair density and disease duration was found with PRP when compared with placebo ($P < .05$). In patients with disease duration > 10 years, hair density (median $\pm$ SD) was significantly greater among PRP-treated patients compared with placebo ($P < .05$). Conversely, in patients with a disease duration ≤ 10 years, there were no statistically significant differences in hair density (median $\pm$ SD) between PRP-treated patients and placebo-treated patients ($P > .05$).
Age of the Patient	No	Age did not significantly affect hair count ($P > .05$), hair thickness ($P > .05$) or degree of disease progression ($P > .05$) in PRP-treated AGA patients at month 3 or month 6 in comparator study by Kang et al.[33]
Gender	No	Gender did not significantly affect hair thickness ($P > .05$), degree of disease progression ($P > .05$), or hair count ($P > .05$) in PRP-treated AGA patients at month 3 or month 6 in comparator study by Kang et al.[33] No differences in response to PRP among men and women were found using linear regression in study by Hausauer and Jones[35] ($P = .78$).
Concomitant Treatment	No	Concomitant treatment did not significantly affect degree of disease progression ($P > .05$), hair count ($P > .05$), or hair thickness ($P > .05$) in PRP-treated AGA patients at month 3 or month 6 comparator study by Kang et al.[33]
PRP Kit Used	Yes	In study by Gentile et al,[17] significantly greater hair density and follicular unit density was achieved with Arthrex Angel System compared with Regen Cell Therapy ($P < .05$).
Platelet Concentration	Not clear	Hair loss studies with low and high platelet concentrations have reported significant improvements in hair restoration parameters (eg, hair density).[31,32] In randomized study by Lee et al,[21] platelet counts were not significantly correlated with improvement in hair thickness ($P > .005$).
Number of Platelets Injected	Not clear	Hair loss studies that have found statistically significant improvements in hair restoration parameters (eg, hair diameter) varied widely in number of platelets injected (1.4×10^3 to 1.5×10^8 platelets/cm^2).[30,32] Volume and concentration of platelets are influenced by the collection system chosen, which can affect the number of platelets injected.
Leukocyte Status	No	In a randomized study by Lee et al,[21] white blood cell counts were not significantly correlated with improvements in hair thickness ($P > .05$).
Number of Sessions	Not clear	Hair loss studies that have found statistically significant improvements in hair restoration parameters (eg, hair density, hair diameter) varied widely in number of PRP sessions used (1 to 13 sessions).[16,21,32]
Needle Size	Not clear	Studies of PRP injected with different needle sizes (25 to 32 gauge) found significant improvements in hair restoration parameters (eg, hair density, hair diameter).[16,31,32] It is unknown whether needle size could affect platelet viability.
Injection Depth	Not clear	Hair loss studies that use different injection depths (eg, interfollicular, dermal) have found significant improvements in hair restoration parameters (eg, hair density, hair diameter).[15,26,30]
Injection Frequency	Yes	In a study by Hausauer and Jones,[35] a greater increase in hair count was found with PRP sessions every 4 weeks compared with PRP sessions every 12 weeks ($P < .001$).
Activator Used	Not clear	Hair loss studies with and without activation found significant improvements in hair restoration parameters (eg, hair density, hair diameter).[15,17,18,29,30] In a study by Gentile et al, activation with calcium gluconate did not induce a statistically significant difference in growth factor concentrations (eg, platelet-derived growth factor BB and transforming growth factor β1).[22]

Abbreviations: AGA: androgenetic alopecia; No, there is evidence this factor does not have a statistically significant impact on PRP results; Not clear, evidence across PRP studies concerning this factor is inconclusive and requires further study; PRP, platelet-rich plasma; Yes, there is evidence this factor may have a statistically significant impact on PRP results.

Table 5. Trial Characteristics of Studies Investigating the Efficacy of PRP in Facial Aesthetic Applications.

Study	Trial Characteristics	Treatment Groups	Centrifugation and Collection System Details	Characteristics of PRP Solution Used	Injection Details	Patient Characteristics, Yrs
Acne Scarring						
PRP Session Every 2 Weeks						
El-Domyati et al, 2018[48]	Randomized (TG) Controlled (1/2) Single-blinded (E)	Microneedling + topical PRP microneedling alone trichloroacetic acid + microneedling	252 *g* 10 mins 1792 *g* 5 mins	Activated (CG)	Topical application 6 session	N = 6 men, 18 women Age: 27.33 ± 4.05 Scar: 6.63 ± 4.03
Nofal et al, 2014[49]	Randomized (TA) Comparator-controlled Single-blinded (E)	PRP injection trichloroacetic acid + chemical reconstruction Skin needling + topical PRP	150 to 200 *g* 10 mins 1500 to 2000 *g* 15 mins	No leukocytes Activated (CC) 4 to 4.5× BPC	Intradermal injection or topical application 0.1 to 0.3mL per injection 3 sessions	N = 14 men, 31 women Age: 25.5 ± 0.35
PRP Session Every 3 Weeks						
Ibrahim et al, 2017[58]	Not randomized Controlled (1/2) Single-blinded (E)	Microneedling + topical PRP Microneedling alone	2500 rpm 10 mins 3500 rpm 10 mins	Activated (CG)	Topical application 4 sessions	N = 35 Age: 24.7 ± 6.8
PRP Session Every 4 Weeks						
Asif et al, 2016[59]	Not randomized Controlled (1/2) Not blinded	Microneedling + PRP microneedling + distilled water	293.88 *g* 5 mins 690.94 *g* 17 mins	Activated (CC) 5-fold BPC	Intradermal injection + topical application 0.1 mL/cm^2 3 sessions 11.7 × 10^8 platelets/cm^2	N = 25 men, 25 women Age: 25.72
Chawla et al, 2014[60]	Not randomized Comparator-controlled (1/2) Not blinded	Microneedling + PRP microneedling + vitamin C	1500 rpm 10 mins 3700 rpm 10 mins	Activated (CG) 4.5× BPC	2 mL per injection 4 sessions	N = 21 men, 9 women Age: 27.5
Gawdat et al, 2014[50]	Randomized (LR) Controlled (1/2) Single-blind (E)	Fractional CO_2 laser + PRP (injection) Fractional CO_2 laser + saline Fractional CO_2 laser + PRP (topical)	150 *g* 15 mins 400 *g* 10 mins	Activated (CC)	Intradermal injection 0.2 mL per injection 3 sessions	N = 12 men, 18 women Age: 24.8 ± 4.3
Lee et al, 2011[51]	Randomized (LR) Controlled (1/2) Single-blind (E)	CO_2 fractional resurfacing + PRP CO_2 fractional resurfacing	Prosys PRP 3000 rpm 3 mins 4000 rpm 3 mins	Not activated	Intradermal injection 0.3 mL per injection 2 sessions	N = 10 men, 4 women Age: 28.1
Zhu et al, 2013[68a]	Not randomized Not controlled Not blinded	PRP (injection + topical) + erbium fractional laser	1500 rpm 10 mins 3000 rpm 20 mins	Activated (CG)	2 sessions	N = 5 men, 17 women Age: 28

(continued)

Table 5. (continued)

Study	Trial Characteristics	Treatment Groups	Centrifugation and Collection System Details	Characteristics of PRP Solution Used	Injection Details	Patient Characteristics, Yrs
Aging Facial Skin						
1 PRP session						
Abuaf et al, 2016[8]	Not randomized Placebo-controlled (1/2) Not blinded	PRP Saline	Regen Lab Kit 3000 rpm 5 mins	Activated (CC)	30-G needle Intradermal injection 0.15 mL per injection 1 session	N = 20 women Age: 43.65 ± 2.43
Elnehrawy et al, 2017[69]	Not randomized Not controlled Not blinded	PRP	388 *g* 7 mins 1376 *g* 5 mins	Activated (CC)	27-G needle Intradermal injection 1 session	N = 20 women Age: 36.90 ± 8.21
Mehryan et al, 2014[70]	Not randomized Not controlled Single-blinded (E)	PRP	1600 to 1800 *g* 6 mins 2000 *g* 5 mins	Activated (CC) 3 to 4× OWB	30-G needle Intradermal injection 1.5 mL per injection 1 session	N = 10 Age: 41.2
Lee et al. 2018[74]	Not randomized Not controlled Not blinded	PRP	3200 rpm 5 mins	Not activated	27-G needle Intradermal injection 0.33 mL per injection	N = 2 men, 29 women Age: 38
Sevilla et al, 2015[77]	Not randomized Controlled (1/2) Double-blinded (E and S)	Growth factor concentrate + PRP Growth factor concentrate	380 *g* 15 mins 2700 *g* 10 mins	Not activated	28- and 30-G needle Dermal injection 2.5 ml per injection 1 session	N = 8 men, 72 women Age: 42.1 ± 10.1
PRP Session Every 2 Weeks						
Gawdat et al, 2017[52]	Randomized (LR) Controlled (1/2) Single-blinded (S)	PRP Mesotherapy	150*g* 15 mins 400 *g* 10 mins	Activated (CC)	Intradermal injection 3 mL per injection 6 sessions	N = 20 women Age: 41 ± 5.156
Petrov, 2016[78]	Randomized (TA) Controlled Not blinded	Fractional CO_2 laser Local therapy or physio-procedures Fractional CO_2 + PRP + microneedling	NR	NR	30-G needle 2 sessions	N = 232 Age: > 18
Yuksel et al, 2014[75]	Not randomized Not controlled Not blinded	PRP + microneedling	3200 rpm 8 mins	Not activated	27-G needle	N = 10 Age: 50 ± 8
PRP Session Every 3 Weeks						
Díaz-Ley et al, 2015[71]	Not randomized Not controlled Not blinded	PRP	PRGF-Endoret 580 *g* 8 mins	Activated	Intradermal and deep dermis injection 3 sessions	N = 3 men, 7 women Age: 34 to 59

(continued)

Table 5. (continued)

Study	Trial Characteristics	Treatment Groups	Centrifugation and Collection System Details	Characteristics of PRP Solution Used	Injection Details	Patient Characteristics, Yrs
Ulusal, 2016[76b]	Not randomized Not controlled Not blinded	PRP Hyaluronic acid	1800 rpm 20 to 50 mins	Not activated	30-G needle Deep dermis and hypodermis injection 3.6 ± 2.0 sessions	N = 94 women Age: 53 ± 5.6
PRP Session Every 4 Weeks						
Cameli et al, 2017[72]	Not randomized Not controlled Not blinded	PRP	Cascade system 1100 rpm 8 mins	Leukocyte-poor Not activated	30-G needle Intradermal injection 4 mL per injection 3 sessions	N = 12 women Age: 45 to 65
Hui et al, 2017[53]	Randomized (TA) Controlled Blinded (E)	PRP + CO_2 laser Saline + CO_2 laser	1200 rpm 10 mins 3500 rpm 5 mins	Activated (CG)	0.1 mL per injection 3 session	N = 13 women Age: 42.08
Redaelli et al, 2010[73]	Not randomized Not controlled Not blinded	PRP	Regen Lab Kit 3500 rpm 5 mins	Activated (CC)	30-G needle 4 mL per injection 3 sessions	N = 23 Age: 47
Shin et al, 2012[54]	Randomized (TA) Controlled Single-blinded (E)	PRP + fractional laser Fractional laser alone	3000 rpm 5 mins 3000 rpm 5 mins	Activated (CC)	Topical application 3 sessions	N = 22 women Age: 43.7 ± 6.0
Facial Burns						
1 PRP Session						
Gentile et al, 2014[61]	Not randomized Controlled	SVF-enhanced autologous fat grafting Fat grafting + PRP Centrifuged fat grafting	Cascade system 3300 rpm 10 mins	Includes leukocytes Activated (C)	0.5 mL per injection 1 session	N = 10 men, 10 women Age: 21 to 69
Facial Procedures						
1 PRP Session						
Costa et al, 2015[62]	Not randomized Controlled Not blinded	PRP + facelift Superwet technique + facelift	NR	Activated (T + CC)	4 mL per injection 1 session	N = 95 men, 994 women Age: 58
Fontdevila et al, 2014[55]	Randomized (TA) Controlled Double-blinded	Fat injection + PRP Fat injection	1800 rpm 8 mins	Activated (CC)	1 session	N = 33 men, 16 women Age: 46

(continued)

Table 5. (continued)

Study	Trial Characteristics	Treatment Groups	Centrifugation and Collection System Details	Characteristics of PRP Solution Used	Injection Details	Patient Characteristics, Yrs
Gennai et al, 2017[63]	Not randomized Controlled Not blinded	PRP + single procedure Procedures alone	2000 rpm 4 mins	NR	1 session	N = 7 men, 58 women Age: 49.7
Keyhan et al, 2013[56]	Randomized (LR) Controlled (1/2) Double-blinded	PRP + fat platelet-rich fibrin + fat	NR	Activated (CC)	1 session	N = 8 men, 17 women Age: 45
Powell et al, 2001[57]	Randomized (LR) Controlled (1/2) Single-blinded (E)	PRP (injection + spray) + procedure Procedure only	5600 rpm 2400 rpm	Activated (T + CC) 3 to 6× OWB	18- or 14-G needle 20 mL of PRP 1 session 10.0× 10^6 to 20.0× 10^6 platelets injected	N = 8 women
Rigotti et al, 2016[64]	Not randomized Controlled Not blinded	SVF-enriched + fat Expanded adipose-derived stem cells Fat + PRP	300 *g* 15 mins 700 *g* 17 mins	Leukocyte-poor Activated (T + CC) 5.4- to 7.3-fold BPC	1 session	N = 2 men, 11 women Age: 56.2
Sasaki et al, 2015[65]	Not randomized Controlled Not blinded	Fat grafting PRP-assisted fat grafting SVF-assisted fat grafting PRP/SVF-assisted fat grafting	NR	NR	Transdermal injection 0.4 mL per injection 1 session	N = 9 men, 227 women Age: 62.3 ± 2.2
Vick et al, 2006[66]	Randomized (LR) Controlled (1/2) Not blinded	PRP + blepharoplasty Blepharoplasty	NR	Activated (T + CC)	6 drops per injection 1 session	N = 5 men, 28 women Age: 26 to 84
Willemsen et al, 2014[67]	Not randomized Controlled Single-blinded (E)	Fat grafting + PRP MACS + fat grafting MACS-lift + fat grafting + PRP	3000 rpm 15 mins	Activated (CC)	3.45 cc per injection 1 session	N = 82 women Age: 35 to 65

Abbreviations: 1/2, half-head design; BPC, baseline platelet count; C, calcium; CC, calcium chloride; CG, calcium gluconate; E, evaluator; LR, left or right side of face; MACS, minimal access cranial suspension; NR, not reported; OWB, over whole blood; PRP, platelet-rich plasma; S, subject; SVF, stromal vascular fraction; T, thrombin; mins: minutes; TA, treatment allocation; TG, treatment groups; yrs, years.

[a]Injection interval 1 to 2 months.

[b]Three treatments performed every 3 to 4 weeks apart, up to 5 additional sessions, then given at 8- to 10-week intervals.

Figure 3. Photo of a patient who has undergone 9 platelet-rich plasma treatments in combination with oral minoxidil, topical progesterone, and doxycycline therapy. The photo on the left is before treatment and the photo on the right is after treatment.

procedures, PRP significantly decreased the number of recovery days ($P = .019$) and had a greater improvement in facial volume and appearance in patient-based questionnaires compared with lipofilling alone ($P = .019$, $P < .01$, and $P = .039$, respectively).[67] As a result of inconsistent outcomes, meta-analyses for PRP in acne scarring, aging facial skin, facial burns, and facial procedures are not yet feasible.

Discussion

One of the main goals of this review was to determine the effectiveness of PRP in the field of dermatology. As determined through the conducted meta-analysis, it was found that 3 monthly PRP injections (1 PRP session every 4 weeks, 3 sessions in total) significantly improved hair density in AGA patients. In addition to total hair density, several AGA studies report a PRP-induced improvement in hair count, terminal hair density, hair shedding, and hair diameter.[14,15,17,18,22,26,30,32] This improvement is consistent with the results of other previously published meta-analyses and clinical experience (Figures 3 to 6) suggesting that PRP is an effective hair restoration treatment.[79-81] PRP could also be a beneficial adjunct to hair transplantation. In a small, controlled study, incorporating PRP treatment into a follicular unit extraction procedure resulted in greater hair density compared with control (saline).[82] This study also found that PRP treatment increased skin recovery and reduced catagen loss of transplanted hair.[82] An increase in hair density was also found with follicular units treated with PRP in a half-head study.[83]

The conducted meta-analysis using monthly PRP studies included patients with Norwood Hamilton scores between II and V.[16-18] Mapar et al[19] suggest the failure to observe a beneficial effect of treatment may be due to hair loss severity. Thus, the improvement in hair restoration found with monthly PRP injections may not extend to patients with more severe forms of AGA. In addition, the studies captured by the meta-analysis included men and women alike using a half-head design. This trial design may influence the results found as PRP can cause angiogenesis and cross-signaling between growth factors, which can affect placebo sites.[1,5] All 3 studies included in the meta-analysis used a total of 3 PRP sessions. The use of 3 sessions is recommended as Picard et al[84] reported a progressive effect of PRP from the first injection, which peaks after 3 to 5 injections and is attenuated with cessation of treatment. Thus, monthly PRP injections occurring for a minimum of 3 months may be necessary to ensure patients receive the optimal number of injections at an appropriate frequency.

There was a significant variability in the method of preparation and administration of PRP used across included hair loss studies such as activation, frequency, number of sessions, injection technique, and patient characteristics. Despite its frequent use, the role of activation remains unclear as a significant alteration in growth factor concentrations, which may influence outcomes, may not always occur.[20] Unfortunately, because of the limited number of studies, a meta-analysis comparing the results from monthly PRP injection with other injection frequencies (eg, PRP session every week) was not feasible. However, a recently published study[35] found monthly injections achieve better hair counts compared with quarterly injections ($p < .001$). Based on the evidence, initially prescribing monthly PRP sessions may be necessary to achieve an improvement in hair restoration parameters (eg, hair count, hair density).

Unfortunately, the included studies did not compare PRP with approved nonsurgical treatments. Minoxidil was compared with PRP in AA patients; however, minoxidil is not an approved treatment for AA.[36] PRP as a treatment for AGA has recently been compared with other approved nonsurgical AGA treatments in a network meta-analysis.[79] In this analysis, low-level laser therapy was considered the superior treatment based on relative effects when compared with PRP, finasteride, minoxidil, and dutasteride.[79] Further research using direct head-to-head studies are necessary to confirm this finding.

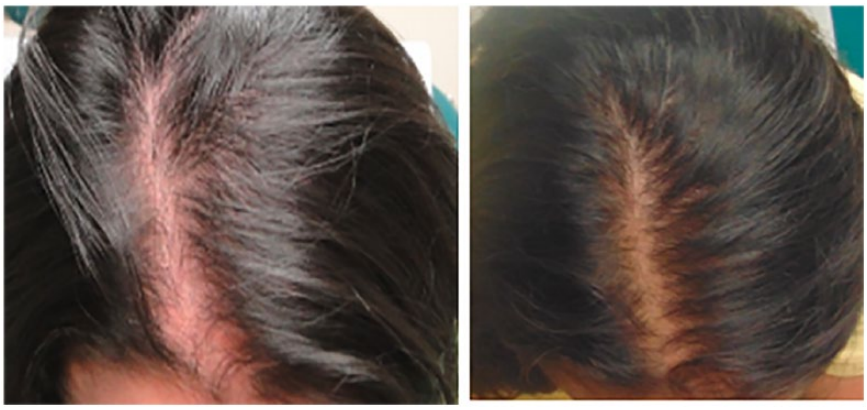

Figure 4. Photo of a patient who has undergone 9 platelet-rich plasma treatments in combination with minoxidil, Nutrafol (Nutraceutical Wellness Inc., NY, NY), and topical finasteride therapy. The photo on the left is before treatment and the photo on the right is after treatment.

Figure 5. Photo of a patient who has undergone 4 platelet-rich plasma treatments in combination with spironolactone therapy. The photo on the left is before treatment and the photo on the right is after treatment.

Figure 6. Photo of a patient who has undergone 4 platelet-rich plasma treatments in combination with oral minoxidil therapy. The photo on the left is before treatment and the photo on the right is after treatment.

PRP protocols should be altered based on the condition being treated because disease factors (eg, severity) can influence efficacy. Based on the evidence found, a PRP injection (3 times baseline platelet count) once a month for 3 months using a 27- or 30-G needle is an effective treatment for AGA. Comparatively, the results collected from controlled PRP studies suggest 2 to 4 sessions of PRP combined with traditional facial aesthetic therapies (eg, lasers, microneedling, fat graft injections) can effectively minimize acne scarring[49-51,60] and facial burns.[61] However, the addition of PRP during facial aesthetic surgeries did not statistically affect the prevalence of postsurgery edema, ecchymosis, and hematomas.[57,62,66,67] This result was unexpected as the adjuvant use of PRP has been successfully used to aid tissue regeneration and wound repair in surgeries outside the field of dermatology.[85,86]

Across included studies, topical PRP applications, direct injection PRP applications, and a combination thereof were used as adjunct treatments.[50,68] Subdermal PRP injections are recommended for hair restoration as they allow the PRP solution to be delivered directly to the base of the hair follicle, spread into a subdermal space, and possibly enter the interstitium.[87] Conversely, the PRP application chosen may not significantly alter the severity of acne scarring because differences between topical PRP and intradermally injected PRP were not significant ($P = .10$).[50] This may mean that the PRP solution does not need to reach a subdermal depth to effectively treat certain facial aesthetic conditions (eg, scarring), as is the case with effective hair restoration treatment.

Conclusion

PRP has been successfully used in a wide array of dermatological applications. Based on the evidence, monthly PRP treatments (3 sessions initially followed by a maintenance regimen) can significantly improve hair density, hair count, hair shedding, and hair diameter. These results may be restricted to patients with mild AGA (Norwood Hamilton II to V). Evidence has suggested that combining PRP (2 to 3 sessions) with traditional aesthetic therapies and procedures can improve outcomes (eg, improve aesthetic results, decrease recovery time). Owing to inconsistent measurements and protocols, however, comparisons between studies are limited. With further investigation using randomized, controlled studies, standardized and effective PRP protocols for dermatological conditions could be determined in the near future. Other potential impacts of PRP, specifically exploring the balance between apoptosis and stimulation as it relates to other dermatology-related conditions, is another future avenue to explore.

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