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Evaluating Anti-Inflammatory Potential of Platelet-Rich Plasma in Scarring Alopecia: A Systematic Review

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ABSTRACT

Scarring alopecia, also known as cicatricial alopecia, is a group of hair loss disorders characterized by inflammatory destruction of hair follicles, leading to hair loss and scar tissue formation. Treating scarring alopecia is challenging due to the irreversible damage caused by the inflammatory process. Consequently, early intervention targeting inflammation is crucial for improving prognosis.[1] Recently, several reports have emerged supporting the use of platelet-rich plasma (PRP) as a non-conventional therapy for scarring alopecia, suggesting its potential benefits in mitigating inflammation and halting disease progression. While there is a growing body of evidence demonstrating the efficacy and safety of PRP in nonscarring alopecia, such as androgenetic alopecia (AGA) and alopecia areata (AA), there remains a scarcity of evidence regarding the clinical benefits of PRP in scarring alopecias.[2-7] In this study, we conducted a literature review exploring the effectiveness and safety of PRP in treating scarring alopecia. Eleven studies describing PRP treatment outcomes were identified. Overall, PRP demonstrated a positive impact, slowing disease progression with reduced signs of inflammation and no reported adverse effects. However, it is important to note that the evidence supporting the utility of PRP in scarring alopecias is currently limited to case reports. Therefore, immunomodulatory therapies should remain the mainstay therapy for scarring alopecias until further investigations are warranted.

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INTRODUCTION

Scarring alopecia, also known as cicatricial alopecia, is a hair loss due to the destruction of epithelial stem cells at the hair follicle bulge mediated by inflammation, infection, or other pathologic process.[1] This irreversible destruction of stem cells results in fibrous scar tissue and loss of functional hair follicles, leading to permanent hair loss.[1] Due to the nature of primary scarring alopecia irreversibly damaging the hair follicles, the treatment of scarring alopecia is very challenging. Early interventions are crucial to manage inflammation and prevent secondary pathological processes.[8] Intralesional and topical corticosteroids are considered the first-line therapies to target the inflammation in scarring alopecia.[9] Other treatments, including oral immunomodulating agents, antibiotics, and antifungals, are used depending on the type of scarring alopecia as well as other underlying factors.[9]

Platelet-rich plasma (PRP) therapies recently gained recognition as a potential treatment for hair loss, particularly in nonscarring alopecia.[5-7,10] PRP is an autologous serum obtained through venipuncture, which is then centrifuged to extract a high concentration of platelets, growth factors, and cytokines. These growth factors include platelet-derived growth factors (PDGF), vascular endothelial growth factors (VEGF), epidermal growth factor (EGF), transforming growth factor β (TGF-β), and fibroblast growth factor (FGF), all of which play critical roles in cell differentiation, fibroblasts proliferation, tissue angiogenesis, and regeneration.[11] Several studies, including a randomized controlled trial, have demonstrated improvements in hair density and growth in androgenic alopecia and alopecia areata when PRP is used as a treatment or as an adjunctive therapy.[5,6] The precise mechanisms are not fully understood, but it is believed that the growth factors in PRP modulate the immune response, reduce inflammation, and promote hair follicle growth. However, there is a lack of well-described studies regarding the use of PRP in scarring alopecias. Given the absence of a proven standard treatment for scarring alopecia, exploring PRP as a potential therapeutic option offers the opportunity for a new treatment for scarring alopecia. In this review, we summarized the current literature on the usage of PRP in different types of scarring alopecia.

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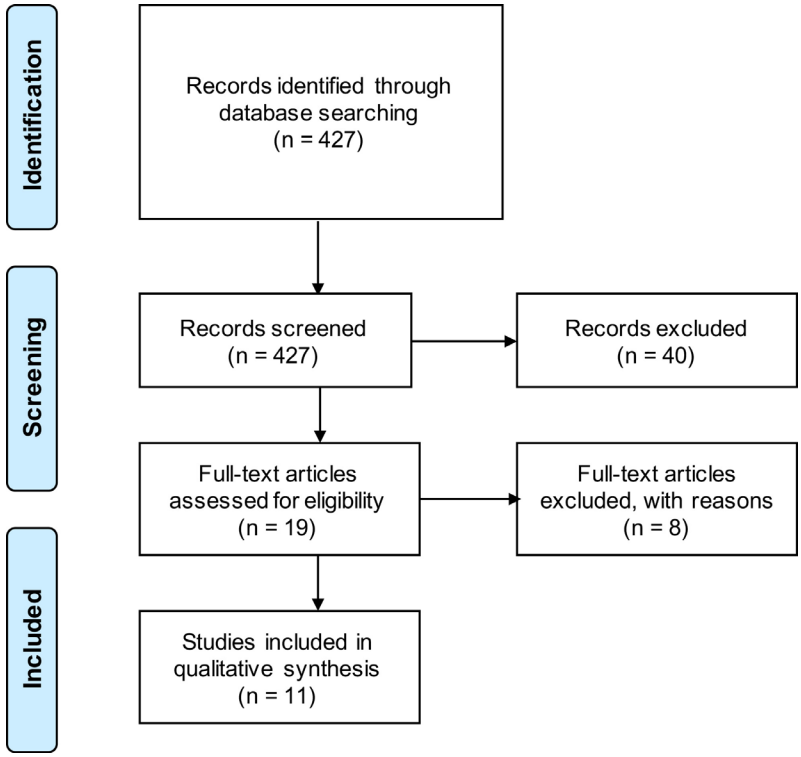
FIGURE 1. PRISMA Diagram. Process of inclusion of studies.



MATERIALS AND METHODS

A PubMed literature search was conducted that follows the PRISMA guidelines on May 2023 with the following keywords: "(scarring alopecia OR cicatricial alopecia OR lichen planopilaris OR lupus erythematosus OR pseudopelade OR frontal fibrosing alopecia OR central centrifugal cicatricial alopecia OR folliculitis decalvans) AND (PRP OR platelet rich plasma)" (Figure 1). Inclusion criteria included case reports, case series, and retrospective studies written in English that discuss PRP usage in various types of scarring alopecias. Exclusion criteria included articles not written in English, articles that discuss PRP treatment in nonscarring alopecias (ie, AGA, alopecia areata) or other dermatological or medical conditions, and articles unable to be retrieved. Study-related data, including study type, patient demographics, scarring alopecia type, PRP sessions/intervals, prior and concurrent treatments, PRP response, and adverse events, were analyzed (Table 1).

RESULTS

We found 11 relevant articles, including 10 case reports and 1 retrospective case series. These studies examined the effects of PRP treatment on 24 patients with different types of scarring alopecia. Overall, the case reports consistently showed improvement in inflammation after PRP treatment. However, the retrospective case series, which involved 10 patients, demonstrated mixed efficacy in addressing inflammation with PRP treatment (Table 1). In the following sections, we will discuss the use of PRP in each type of scarring alopecia.

Lichen Planopilaris (LPP)

Lichen planopilaris (LPP) is the most prevalent form of scarring alopecia characterized by lymphocyte-mediated inflammation, perifollicular erythema, and hyperkeratosis.[2] Among the included studies, the majority focused on LPP patients (n = 7). Overall, the literature demonstrated that PRP treatments had anti-inflammatory effects, leading to improvements in perifollicular inflammation and hair shedding.

Bolanča et al reported a case of a 25-year-old female with LPP presenting with heavy hair shedding, itching, and scalp inflammation.[12] Despite prior treatment with topical and intralesional steroids, no improvement was observed. After 3 sessions of PRP at monthly intervals as a standalone therapy, the patient experienced a complete resolution of itching and hair shedding, along with a significant reduction in perifollicular erythema and scaling.

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In another case, a 70-year-old female with LPP showed no improvement with topical and intralesional steroids and hydroxychloroquine.[13] After 3 sessions of PRP at monthly intervals combined with continued topical steroids and hydroxychloroquine, increased hair density and reduced perifollicular erythema and scaling were observed.

Jha et al reported increased hair density and thickness in 3 LPP patients who underwent 4 PRP treatments spaced 3 weeks apart, but details on inflammation status were limited.[14,15]

Klein et al presented a case of a 46-year-old female with LPP unresponsive to previous treatment, including antibiotics and intralesional corticosteroids.[16] However, when the patient initiated concomitant treatment of low-dose naltrexone and PRP sessions every 4 to 6 weeks for 3 months, she experienced a significant decrease in hair shedding and an increase in hair density on the scalp.

A retrospective case series by Svigos et al observed variable results among LPP patients treated with PRP. These included disease progression in one patient, increased shedding and inflammation in another patient, and indeterminate outcomes in 2 patients among 10 patients.[17] However, it remains unclear whether these changes were a result of natural disease progression or were aggravated by PRP treatment.

While most cases showed positive results with improvements in perifollicular inflammation and hair shedding, treatment response showed variability. Some patients experienced increased shedding and inflammation, highlighting the need for further research to determine the long-term efficacy and safety of PRP in managing LPP.

Frontal Fibrosing Alopecia

Frontal fibrosing alopecia (FFA) is a subtype of LPP that manifests with alopecia in the frontotemporal zone of the scalp.[3] Similar to LPP, FFA patients (n = 5 patients) demonstrated a positive response to PRP treatments. Özcan et al reported a case of a 44-year-old female with FFA who presented with a receding frontotemporal hairline, perifollicular erythema, scaling, and lichenoid papules on the scalp.[18] Prior to receiving PRP treatments, the patient underwent a 9-month course of topical/intralesional steroids, topical minoxidil, and oral hydroxychloroquine, but the disease continued to progress. Following a single session of PRP, there was an improvement in perifollicular erythema, scaling, and lichenoid papules, and hair shedding stabilized for up to 5 months.

In a retrospective case series by Svigos et al, improvements were observed in slowing disease progression among 3 patients with FFA, but no improvement was observed in 1 patient with FFA.[17]

Central Centrifugal Cicatricial Alopecia

Central centrifugal cicatricial alopecia (CCCA) is a common type of lymphocytic scarring alopecia that predominantly affects African American women. It is characterized by initial hair loss in the central area of the scalp, which gradually spreads outward. While the use of PRP in CCCA is still relatively limited, recent case reports have provided insights into its potential as an adjunctive therapy.

The first reported case involved a 53-year-old African American female with an 8-year history of CCCA that was unresponsive to various treatments. This patient demonstrated a notable 50% increase in hair density along the temporal hairline and scalp vertex after undergoing 3 PRP treatments at a 4-week interval.[13]

In another study, 2 African American females in their 50s, whose CCCA had already been stabilized with corticosteroids and other treatments, underwent PRP therapy.[19] These patients experienced a transient increase in hair density when PRP was performed on a monthly basis. However, when the PRP sessions were spaced out with 6-month intervals for maintenance therapy, a persistent decrease in hair density was observed. These findings support the notion that while PRP may be effective, it may require a shorter interval for maintenance therapy in stabilized CCCA patients. Further research is warranted to explore the effect of PRP and establish the optimal treatment protocol and interval for PRP therapy in CCCA.

Folliculitis Decalvans

Folliculitis decalvans, a neutrophilic scarring alopecia, has been explored as a potential target for PRP in a case report involving 2 patients.[20] Two male patients, aged 36 and 25, were treated with PRP after showing minimal improvement with other conventional therapies, including intralesional steroids and antimicrobial agents.

The treatment protocol involved 4 PRP sessions for the 36-year-old patient, with each session conducted at 5- to 6-week intervals. For the 25-year-old patient, 3 PRP sessions were administered at 6- to 9-week intervals. Following the PRP treatments, both patients exhibited decreased perifollicular erythema, scaling, pustules, and itching, indicating a positive response to the PRP therapy.

Scarring Alopecia Secondary to Discoid Lupus Erythematosus

In a case report by Polster et al, PRP was utilized in the treatment of scarring alopecia secondary to discoid lupus erythematosus (DLE).[21] A 48-year-old female with dyspigmented plaques and scarring alopecia initially responded to topical and intralesional corticosteroid injections. However, a relapse occurred, resulting in worsening DLE with increased areas of scarring alopecia. Due to the patient's intolerability to belimumab, PRP therapy was initiated at 3-month intervals. After the third visit, significant

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TABLE 1.

Summary of Current Literature on the Use of Platelet-Rich Plasma in Scarring Alopecia

Authors (Year)	Study type (Level of evidence)	Patient gender, age	Primary diagnosis	# of PRP treatments / interval	Previous trial of treatment	Concomitant treatments with PRP	Post-PRP outcome	Adverse effect
Lichen planopilaris								
Bolanca et al (2016)	Case report (4)	F, 24	LPP	3X / 4-week	TCS, ILTAC	None	Decreased perifollicular erythema, scaling, hair shedding, and itching	No
Saxena et al (2016)	Case report (4)	M, 24	LPP	2X / 10-month	None for 2 years	Unknown	Prolonged hair follicle survival after hair transplant	No
Dina et al (2018)	Case report (4)	F, 70	LPP	3X / 4-week	TCS, ILTAC, hydroxychloroquine	TCS, hydroxychloroquine	Decreased perifollicular erythema, scaling, and increased hair density	No
Jha (2018)	Case series (4)	Two M, age unknown	LPP	4X / 3-week	Unknown	Unknown	Increased hair density and thickness	No
Jha (2019)	Case report (4)	F, age unknown	LPP	4X / 3-week	Unknown	topical minoxidil	Increased hair thickness	No
Klein et al (2022)	Case report (4)	F, 46	LPP	3X / 4-6-week	ILTAC, clobetasol, topical minoxidil, finasteride, doxycycline, ketoconazole shampoo	Low-dose naltrexone (3 mg/day)	Increased hair density and decreased hair shedding	No
Svigos et al (2020)	Retrospective case series (4)	M, 44	LPP	4X / N/A	Doxycycline, minocycline, pioglitazone, tacrolimus	Finasteride, ILTAC, topical minoxidil, clobetasol, ketoconazole shampoo	Continued inflammation	No
	Retrospective case series (4)	F, 40	LPP	1X / N/A	Doxycycline, ILTAC, tacrolimus, clobetasol, mycophenolate mofetil, naltrexone	Finasteride, topical minoxidil, hydroxychloroquine, pioglitazone	Indeterminate	No
	Retrospective case series (4)	M, 27	LPP	2X / N/A	Doxycycline, ILTAC, topical minoxidil, clobetasol, ketoconazole shampoo, naltrexone, pioglitazone, fluocinolone acetonide	Finasteride, dutasteride, tacrolimus, excimer laser, topical minoxidil, spironolactone, topical naltrexone	Indeterminate	No
	Retrospective case series (4)	M, 50	LPP	2X / N/A	None	Finasteride, ILTAC, topical minoxidil, tacrolimus, clobetasol, naltrexone	Continued inflammation	No
Frontal fibrosing alopecia / Fibrosing alopecia in pattern distribution								
Ozcan et al (2019)	Case report (4)	F, 44	FFA	5X / 4-week	TCS, ILTAC, hydroxychloroquine, topical topical minoxidil	Unknown	Decreased perifollicular erythema, scaling, and hair shedding	No

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TABLE 1. (CONTINUED)

Summary of Current Literature on the Use of Platelet-Rich Plasma in Scarring Alopecia								
Authors (Year)	**Study type (Level of evidence)**	**Patient gender, age**	**Primary diagnosis**	**# of PRP treatments / interval**	**Previous trial of treatment**	**Concomitant treatments with PRP**	**Post-PRP outcome**	**Adverse effect**
Frontal fibrosing alopecia / Fibrosing alopecia in pattern distribution								
Svigos et al (2020)	Retrospective case series (4)	F, 59	FFA	3X / N/A	Finasteride, betamethasone	Doxycycline, ILTAC, hydrocortisone butyrate, topical minoxidil, tacrolimus	Decreased hair shedding and inflammation	No
	Retrospective case series (4)	F, 79	FFA	5X / N/A	ILTAC	Topical minoxidil, clobetasol, ketoconazole shampoo	Decreased hair shedding and inflammation	No
	Retrospective case series (4)	F, 67	FAPD	7X / N/A	Doxycycline, Clobetasol	Finasteride, ILTAC, topical minoxidil, tacrolimus, fluocinolone acetonide	Unspecified	No
	Retrospective case series (4)	F, 72	FFA	10X / N/A	None	Finasteride, doxycycline, ILTAC, topical topical minoxidil, oral minoxidil, tacrolimus, clobetasol, hydroxychloroquine, pioglitazone	Decreased hair shedding and inflammation	No
	Retrospective case series (4)	F, 73	FAPD	3X / N/A	Doxycycline, ILTAC, hydrocortisone, clobetasol	Topical minoxidil	No improvement	No
	Retrospective case series (4)	F, 63	FFA	2X / N/A	None	ILTAC, topical minoxidil, oral minoxidil	No improvement	No
Folliculitis decalvans								
Suh et al (2021)	Case series (4)	M, 36	FD	4X / 5-6- week	ILTAC, topical clindamycin, doxycycline, rifampin/clindamycin, ketoconazole shampoo, gentamicin ointment, oral isotretinoin	Unknown	Decreased perifollicular erythema, scaling, pustules, hair shedding, and itching	No
		M, 25	FD	3X / 6-9- week	ILTAC, doxycycline, minocycline, clindamycin, rifampin, trimethoprim-sulfamethoxazole, topical salicylic acid shampoo, topical clindamycin lotion, oral isotretinoin, oral corticosteroids	Unknown	Decreased perifollicular erythema, scaling, and pustules	No
Central centrifugal cicatricial alopecia								
Dina et al (2018)	Case report (4)	F, 53	CCCA	3X / 4- week	TCS, ILTAC, spironolactone, topical minoxidil	Unknown	Increased hair density	No
Larrondo et al (2022)	Case report (4)	F, 50s	CCCA	3X /1-month followed by 3X / 6-month	TCS, ILTAC, spironolactone, topical minoxidil	Topical minoxidil	Transient hair density increase only during the monthly treatments	No
			CCCA	3X / 1-month followed by 1X / 6-month	TCS, ILTAC	TCS, topical minoxidil	Transient hair density increase only during the monthly treatments	No
Discoid lupus erythematosus								
Polster et al (2022)	Case report (4)	F, 48	Scarring alopecia secondary to DLE	3X / 3-months	TCS, ILTAC	Unknown	Increased hair density	No

Abbreviations: y/o, years old; LPP, lichen planopilaris; FFA, frontal fibrosing alopecia; FAPD, fibrosing alopecia of a pattern distribution; FD, folliculitis decalvans; CCCA, central centrifugal cicatricial alopecia; DLE, discoid lupus erythematosus; TCS, topical corticosteroids; ILTAC, intralesional triamcinolone acetonide

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regrowth and improvement were observed globally, including areas affected by scarring alopecia.

PRP as an Adjuvant Therapy to Hair Transplant in Scarring Alopecia

In a case report by Saxena et al, the benefits of combining PRP with hair transplants in patients with scarring alopecia were demonstrated[22]The case involved a 24-year-old male diagnosed with lichen planopilaris (LPP). Prior to graft implantation, the patient received 2 PRP injections at 10-month intervals to enhance vascularity around the hair follicles. The combined approach of PRP and hair transplant resulted in optimal survival and growth of approximately 80% of the transplanted follicles, indicating the potential advantages of incorporating PRP as an adjuvant therapy to hair transplant procedures in the management of scarring alopecia.

DISCUSSION

The use of platelet-rich plasma (PRP) for the treatment of scarring alopecia has shown promising clinical outcomes in patients who have not responded to initial therapies. Although the number of reported cases is limited, PRP has demonstrated benefits in various types of scarring alopecia, including lichen planopilaris (LPP), frontal fibrosing alopecia (FFA), folliculitis decalvans, central centrifugal cicatricial alopecia (CCCA), and discoid lupus erythematosus.

While the hair growth effects of PRP in scarring alopecia require further validation through larger studies, it is important to highlight the valuable anti-inflammatory properties of PRP. PRP contains activated platelets and growth factors, such as PDGF, TGF-β, and FGF, which play a role in the healing process and promote the release of anti-inflammatory cytokines.[23] These anti-inflammatory effects can help attenuate the inflammation of hair follicles, which is a key driver of scarring alopecia.[23]

Additionally, PRP exhibits antimicrobial activity by releasing platelet microbial proteins (PMP) and promoting the activation of immune cells.[24] This antimicrobial effect can help control scalp infections that may worsen the inflammatory process, particularly in conditions like folliculitis decalvans.[25]

Moreover, the growth factors present in PRP, including TGF, EGF, and VEGF, have the potential to promote vascularization and improve blood perfusion to the hair follicles.[22,26] Adequate perfusion is crucial for the survival of transplanted grafts, as demonstrated in case studies of hair transplants in scarring alopecia. By enhancing vascularization, PRP may contribute to improved hair growth in these conditions.

PRP may also play a role in remodeling fibrous scar tissue, which hinders hair regrowth in scarring alopecia. The high concentration of activated platelets and growth factors in PRP can accelerate the healing process and restore the normal structure of the injured skin before the onset of fibrosis and scar formation.[3,4]

While the potential for hair regrowth with PRP in scarring alopecia has been suggested, it is important to maintain a conservative stance on this aspect until further evidence is available. The activation of signaling pathways involved in cell survival, proliferation, and differentiation of hair follicles by PRP's growth factors hints at the possibility of inducing hair regrowth.[27] However, it is essential to note that the presumed occurrence of hair regrowth once in a lifetime during embryogenesis makes the likelihood of significant hair regrowth with PRP uncertain.[28] The evaluation of PRP efficacy in treating scarring alopecia is limited by the current case reports. The lack of standardization in PRP treatment parameters, including intervals, doses, preparation methods, and concomitant treatments, as well as the absence of long-term follow-up assessments, poses challenges in evaluating the treatment efficacy of PRP alone. Future studies should determine the optimal treatment interval, duration, PRP quantity and concentration, and criteria for selecting treatment candidates to better assess the utility of PRP in scarring alopecias.

Regarding safety, PRP injections to the scalp are generally considered safe for nonscarring alopecias, with common side effects being injection site pain and transient pinpoint bleeding. However, there have been reports of scalp pruritus, prolonged tenderness, transient hair shedding, and other transient effects in patients with androgenetic alopecia.[29-31] It is important to note that there is limited data on the specific safety profile of PRP in scarring alopecia, and adverse effects such as flares or worsening of hair shedding may not be revealed due to the small number of reports. Prompt initiation of immunomodulatory therapies is crucial to prevent further inflammation in patients diagnosed with scarring alopecia.[8]

CONCLUSION

The evidence for the utility of PRP in scarring alopecias so far is limited to case reports and studies. While these reports show improvements in various aspects of scarring alopecia, such as perifollicular inflammation, scalp itching, hair shedding, and hair growth, it is important to interpret these findings with caution. The lack of standardization in treatment protocols and the presence of confounding factors in the studies make it challenging to determine the true role of PRP in scarring alopecias.

Although PRP appears to be a safe option when other conventional therapies have failed, it should not be considered as a primary treatment for scarring alopecias due to the limited evidence available. In summary, while the anti-inflammatory effects of PRP hold promise for the management of scarring

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alopecias, further research is needed to determine its true efficacy and optimal use in clinical practice.

DISCLOSURES

The authors have no conflicts of interest to disclose.

REFERENCES

1. Harries MJ, Paus R. The pathogenesis of primary cicatricial alopecias. *Amer J Pathol.* 2010;177(5):2152-2162.
2. Desai NS, Mirmirani P. Chapter 12 - Lichen Planopilaris. In: Miteva M, ed. *Alopecia.* Elsevier; 2019:143-150.
3. Alser OH, Goutos I. The evidence behind the use of platelet-rich plasma (PRP) in scar management: a literature review. *Scars, Burns & Healing.* 2018;4:2059513118808773-2059513118808773.
4. Deshmukh NS, Belgaumkar VA. Platelet-rich plasma augments subcision in atrophic acne scars: a split-face comparative study. *Dermatol Surg.* 2019;45(1):90-98.
5. Gupta AK, Cole J, Deutsch DP, et al. Platelet-Rich Plasma as a treatment for androgenetic alopecia. *Dermatol Surg.* 2019;45(10):1262-1273.
6. El Taieb MA, Ibrahim H, Nada EA, Seif Al-Din M. Platelets rich plasma versus minoxidil 5% in treatment of alopecia areata: A trichoscopic evaluation. *Dermatol Ther.* 2017;30(1).
7. Dubin DP, Lin MJ, Leight HM, et al. The effect of platelet-rich plasma on female androgenetic alopecia: A randomized controlled trial. *J Am Acad Dermatol.* 2020;83(5):1294-1297.
8. Pathoulas JT, Pupo Wiss IM, Flanagan KE, et al. Undiagnosed cicatricial alopecia among new patients undergoing platelet-rich plasma. *JAAD Int.* 2021;3:89-91.
9. Whiting DA. Cicatricial alopecia: clinico-pathological findings and treatment. *Clin Dermatol.* 2001;19(2):211-225.
10. Shapiro J, Ho A, Sukhdeo K, Yin L, Lo Sicco K. Evaluation of platelet-rich plasma as a treatment for androgenetic alopecia: A randomized controlled trial. J *Am Acad Dermatol.* 2020;83(5):1298-1303.
11. Pavlovic V, Ciric M, Jovanovic V, Stojanovic P. Platelet rich plasma: a short overview of certain bioactive components. *Open Med (Wars).* 2016;11(1):242-247.
12. Bolanča Ž, Goren A, Getaldić-Švarc B, et al. Platelet-rich plasma as a novel treatment for lichen planopillaris. *Dermatol Ther.* 2016;29(4):233-235.
13. Dina Y, Aguh C. Use of platelet-rich plasma in cicatricial alopecia. *Dermatol Surg.* 2019;45(7):979-981.
14. Jha AK. Platelet-rich plasma for the treatment of lichen planopilaris. *J Am Acad Dermatol.* 2018;79(5):e95-e96.
15. Jha AK. Platelet-rich plasma as an adjunctive treatment in lichen planopilaris. *J Am Acad Dermatol.* 2019;80(5):e109-e110.
16. Klein E, Karim M, Kim R, et al. Reversible hair loss in lichen planopilaris: regrowth with low-dose naltrexone and platelet-rich plasma. *J Drugs Dermatol.* 2022;21(6):671-673.
17. Svigos K, Yin L, Shaw K, et al. Use of platelet-rich plasma in lichen planopilaris and its variants: A retrospective case series demonstrating treatment tolerability without koebnerization. *J Am Acad Dermatol.* 2020.
18. Özcan D, Tunçer Vural A, et al. Platelet-rich plasma for treatment resistant frontal fibrosing alopecia: A case report. *Dermatol Ther.* 2019;32(5):e13072.
19. Larrondo J, Petela J, McMichael AJ. Transitory hair growth using platelet-rich plasma therapy in stabilized central centrifugal cicatricial alopecia. *Dermatol Ther.* 2022;35(11):e15798.
20. Suh S, Nguyen C, Zhao L, et al. The role of platelet-rich plasma therapy in refractory folliculitis decalvans. J*AAD Case Rep.* 2021;12:85-87.
21. Polster H, Kagha K, Luke J. Platelet rich plasma for the treatment of scarring alopecia due to discoid lupus erythematosus. *J Drugs Dermatol.* 2022;21(3):309-310.
22. Saxena K, Saxena DK, Savant SS. Successful hair transplant outcome in cicatricial lichen planus of the scalp by combining scalp and beard hair along with platelet rich plasma. *J Cutan Aesthet Surg.* 2016;9(1):51-55.
23. Moussa M, Lajeunesse D, Hilal G, et al. Platelet rich plasma (PRP) induces chondroprotection via increasing autophagy, anti-inflammatory markers, and decreasing apoptosis in human osteoarthritic cartilage. *Exp Cell Res.* 2017;352(1):146-156.
24. Drago L, Bortolin M, Vassena C, et al. Antimicrobial activity of pure platelet-rich plasma against microorganisms isolated from oral cavity. *BMC Microbiol.* 2013;13(1):47.
25. Xiong YQ, Yeaman MR, Bayer AS. In vitro antibacterial activities of platelet microbicidal protein and neutrophil defensin against Staphylococcus aureus are influenced by antibiotics differing in mechanism of action. *Antimicrob Agents Chemother.* 1999;43(5):1111-1117.
26. Garg S, Pandya I, Bhatt S. Follicular Unit Extraction (FUE) hair transplantation in combination with platelet rich plasma for the treatment of scarring alopecia: a case series. *Arch Clin Med Case Rep.* 2019;03.
27. Choi BY. Targeting Wnt/β-catenin pathway for developing therapies for hair loss. *Int J Mol Sci.* 2020;21(14).
28. Filbrandt R, Rufaut N, Jones L, Sinclair R. Primary cicatricial alopecia: diagnosis and treatment. *CMAJ.* 2013;185(18):1579-1585.
29. Roohaninasab M, Goodarzi A, Ghassemi M, et al. Systematic review of platelet-rich plasma in treating alopecia: Focusing on efficacy, safety, and therapeutic durability. *Dermatol Ther.* 2021;34(2):e14768.
30. Mercuri SR, Paolino G, Di Nicola MR, et al. Investigating the safety and efficacy of platelet-rich plasma (PRP) treatment for female androgenetic alopecia: review of the literature. *Medicina (Kaunas).* 2021;57(4).
31. Stojadinovic O, Morrison B, Tosti A. Adverse effects of platelet-rich plasma and microneedling. *J Am Acad Dermatol.* 2020;82(2):501-502.

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