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ORIGINAL RESEARCH

Comparative study to determine the role of platelet rich plasma therapy in Androgenetic alopecia

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ABSTRACT

Background: Androgenetic alopecia (AGA) is a common condition affecting self-image and psychological well-being. Current treatments provide partial hair regrowth, leading to exploration of alternative therapies like platelet-rich plasma (PRP). **Objectives:** To evaluate the efficacy of PRP therapy in patients with AGA. **Materials and Method:** This prospective, comparative, cross-sectional study included 100 male patients with AGA, divided into two groups (PRP + topical minoxidil + oral dutasteride, and topical minoxidil + oral dutasteride). PRP injections were administered at 4-week intervals for 3 months. **Results:** Elevated oxidative stress (MDA) was found in 31% of patients, and mean DHT levels were 7.85 nmol/ml (Grade I-III) and 27.89 nmol/ml (Grade IV-VI). Tricoscopic findings revealed yellow spots and miniaturization.After 3 months, 87% of patients showed improvement in hair loss grade, with better results in the PRP group. Patient satisfaction scores were higher in the PRP group, with a mean grade reduction of 1.03 compared to 0.85 in the non-PRP group. Most patients (84%) reported no adverse effects, with temporary pain being the most common side effect in the PRP group. Dermoscopy findings revealed yellow spots and miniaturization. **Conclusion:** PRP therapy, combined with minoxidil and dutasteride, is a safe and effective treatment for AGA, promoting hair regrowth and reducing hair loss.

Keywords: Androgenetic alopecia, platelet-rich plasma (PRP) therapy, minoxidil, dutasteride, hair regrowth.

INTRODUCTION

Hair has a crucial function in self-image, social perception as well as psychological and social well-being.[1]Alopecia refers to the condition when hair is missing or lost in an area where it is normally expected to be present. This ailment can manifest as either localized or diffuse, and can be either temporary or permanent. It can affect individuals of both sexes and all age groups. Alopecia is a manifestation that occurs as a result of several causes and can be roughly categorized into two types: nonscarring, which is the most prevalent, and scarring.[2]

While current pharmacotherapies can effectively slow down the progression of AGA (androgenetic alopecia), they only provide partial hair regrowth and require continuous use to maintain the density of the regenerated hair. As a result, many individuals with androgenetic alopecia opt for surgical intervention, which is often combined with FDA-approved pharmacological treatments and emerging regenerative medicine techniques. Platelets have become a valuable resource in regenerative medicine due to their significant role in the inflammatory and healing response. This is because platelets release a large amount of biologically active proteins from their α-granules when they come into contact with injured tissues. [3]

Proponents of platelet-rich plasma (PRP) technology argue that it can enhance the healing process of both hard and soft tissues.[4]In addition, the role of PRP for the treatment of pattern hair loss has been demonstrated. Studies conducted in a laboratory setting show that the presence of PRP affects the production of β-catenin, a crucial protein in the Wnt/β-catenin signaling pathway that controls the formation of hair follicles and the proliferation of hair matrix cells.[5-7]A study examined PRP's impact on hair follicle microcirculation and proliferation using scalp biopsies and CD31/Ki67 markers. CD34+ cells,

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essential for hair growth, are present in the bulge zone, interfollicular epidermis, and surrounding skin tissue.[8]Activated autologous PRP stimulates hair growth by increasing FGF-7, β-catenin, and activating ERK and Akt pathways, promoting dermal papilla cell growth. VEGF secretion by keratinocytes and fibroblasts also drives anagen-associated angiogenesis, forming new blood vessels essential for hair development.[4]

Although there have been some promising practical applications, there is still a lack of comprehensive studies evaluating the clinical effects and mechanisms of platelet-rich plasma (PRP) treatment in patients with androgenetic alopecia (AGA). This limits the availability of strong evidence supporting the effectiveness of this treatment strategy. Hence, the present study was undertaken to determine the role of platelet rich plasma in patients with androgenetic alopecia.

MATERIALS AND METHOD

The present prospective comparative cross-sectional study was carried among clinically diagnosed patients of androgenetic alopeciaattending the out-patient department of Dermatology, Venereology and Leprosy of Chhatrapati Shivaji Subharti Hospital, Meerut, for 1.5 years after approval by the university. Ethical clearance was obtained from the institutional ethical committee.

This study employed convenience sampling to collect samples. The inclusion criteria consisted of male patients clinically diagnosed with androgenetic alopecia, willing to participate, and above 18 years old were eligible. Patients with Norwood Hamilton grades I to VI were included.The exclusion criteria were patients with active scalp infections, those who had received treatment for androgenetic alopecia within three months, NSAID users, and individuals unwilling to participate or harboring unrealistic expectations were excluded.The modified Norwood-Hamilton Scale was employed to assess the severity of androgenetic alopecia. A Dino-Lite handheld video-dermoscope, operated through Dinocapture 2.0 on Windows O.S. and DinoXcope on Mac O.S., was used for dermatoscopic evaluations.

After the purpose and the contents of the study have been fully explained, written informed consent was obtained from all patients fulfilling the inclusion criteria. On the basis of simple randomization, two groups of 50 each were made. **Group A** received PRP therapy along with topical minoxidil 5% twice daily with oral dutasteride 0.5mg once daily.**Group B**receivedreceived topical minoxidil 5% twice daily with oral dutasteride 0.5mg once daily.

PRP injections were given at intervals of 4 weeks. During each visit macrophotographs were taken and records maintained. Patients were given PRP at above mentioned interval for a total of 3 months.

After the study period, repeat images were taken from the same scalp area and assessed for improvement in hair parameters. Macrophotographs were evaluated using the Modified Norwood Scale. Patient satisfaction was measured on a 0-4 scale (0=Poor, 1=Fair, 2=Good, 3=Very Good, 4=Excellent) after 3 months.

Dermoscopic examination was performed using a Dino-Lite handheld Video-dermoscope. Data was analyzed using Student's t-test for continuous data. Results were presented as mean ± SD for continuous measurements and number/percentage for categorical measurements.

Statistical analysis was conducted using Microsoft Excel and SPSS software 22.0, with Microsoft Word used for generating graphs and tables.

RESULTS

Table 1: Comparison of DHT level To Grade of Presentation in Both Groups

	Grade I- III		**Grade** IV- VI		
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**	**p value**
DHT Level	7.27	3.22	22.47	16.05	0.287

Table 1 shows comparison of DHT level To Grade of Presentation in Both Groups results revealed that mean DHT level was found 7.27 in grade 1-3 patients & 22.47 in Grade IV- VI it was found statistically insignificant (P-0.287).

Table 2: MDA Level distribution among study subjects in different group

MDA level	**Group A**		**Group B**	
	Frequency	**Percent**	**Frequency**	**Percent**
Elevated	17	34.0	14	28.0
Low	33	66.0	36	72.0

Table 2 shows MDA Level distribution among study subjects' results found that MDA level was elevated in 17 subjects of group A and 14 subjects of group B and low in 33 subjects of group A and 36 subjects of group B.

Table 3: Distribution of various dermoscopy findings among 2 group study subjects

Dermoscopy Findings	**Group A**		**Group B**	
	Frequency	**Percent**	**Frequency**	**Percent**
Yellow spots	45	90	40	80
Miniaturization	45	90	40	80

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Vellus hair	18	36	15	30
Perifollicular pigmentation	18	36	12	24

Table 3 shows distribution of various dermoscopy findings among 2 study groups results revealed that yellow spots were observed in 45 subjects of group A and 40 subjects of group B, miniaturization was found in 45 subjects of group A and 40 subjects of group B, vellus hair were observed in 18 subjects of group A and 15 subjects of group B and Perifollicular pigmentation was found in 18 subjects of group A and 12 subjects of group B.

Table 4: Distribution of study subjects in two groups according to PSS at end of follow-up (patient satisfaction score)

PSS	Group A		Group B	
	Frequency	**Percent**	**Frequency**	**Percent**
0	7	14.0	15	30.0
1	30	60.0	32	64.0
2	12	24.0	3	6.0
3	1	2.0	0	0.0
Chi square value-9.37; p value – 0.02*				

Table 4 shows distribution of study subjects in two groups according to PSS at end of follow-up (patient satisfaction score) results revealed that PSS score 0 was observed in 7 subjects of group A and 15 subjects of group B, score 1 was observed in 30 subjects of group A and 32 subjects of group B, score 2 was observed in 12 subjects of group A and 3 subjects of group B and score 3 was observed in one subject of group A it was found statistically significant (P=0.02).

Table 5: Distribution of study subjects in PRP group according to side effects

Side Effect	Group A	
	Frequency	**Percent**
None	11	22.0
Pain	30	60.0
Redness	2	4.0
Swelling	7	14.0

Table 5 shows distribution of study subjects in PRP group according to side effects. results revealed that pain was observed in 30 subjects of group A, redness in 2 subjects and swelling in 7 subjects of group A.

Table 6: Comparison of grades of presentation at baseline and after 3 months

Grade	BASELINE				After 3 months			
	Group A		Group B		Group A		Group B	
	Freq.	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
I	0	0	1	2	4	8	9	18
II	4	8	11	22	28	56	20	40
III	18	36	17	34	12	24	10	20
IV	20	40	8	16	4	8	8	16
V	6	12	8	16	2	4	3	6
VI	2	4	5	10	0	0	0	0

Table 6 shows comparison of grades of presentation at baseline and after 3 month results revealed that grade I found in one subject of group B at baseline and 4 subjects of group A and 9 subjects of group B after 3 month, grade II was found in 4 subjects of group A and 11 subjects of group B at base line and 28 subjects of group A and 20 subjects of group B after 3 months, grade III was found in 18 subjects of group A and 17 subjects of group B at base line and 12 subjects of group A and 10 subjects of group B after 3 months, grade IV was found in 20 subjects of group A and 8 subjects of group B at base line and 4 subjects of group A and 8 subjects of group B after 3 months, grade V was found in 6 subjects of group A and 8 subjects of group B at base line and 2 subjects of group A and 3 subjects of group B after 3 months and grade V was found in 2 subjects of group A and 5 subjects of group B at base line and none of the participant of group B after 3 months.

Table 7: Mean of grade before, after treatment with number of grades improved at the end of follow up In Group A

	Before Rx	After 3 sittings	No of grades improved at the end of Follow up
Grades	3.05	2.03	1.03

Table 7 mean of grade before, after treatment with number of grades improved at the end of follow up with the mean grade before treatment was 3.06. The mean grade after treatment was 2.03. The mean number of grades

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improved at end of treatment was 1.03.

Table 8: Mean of grade before, after treatment with number of grades improved at the end of follow up In Group B

	Before Rx	After 3 sittings	No of grades improved at the end of Follow up
Grades	3.00	2.15	0.85

Table 8 shows mean of grade before, after treatment with number of grades improved at the end of follow up with. The mean grade before treatment was 3.00. The mean grade after treatment was 2.15. The mean number of grades improved at end of treatment was 0.85.

DISCUSSION

Androgenetic alopecia, affecting 50% of males and females, is a hereditary condition exacerbated by androgens.[9]It leads to significant psychological distress and decreased quality of life. Existing treatments include minoxidil, finasteride, spironolactone, nutritional supplements, low-level light therapy, and hair transplantation.[10] Platelet-rich plasma (PRP) therapy is a debated treatment for androgenetic alopecia (AGA). [11]

This study investigates PRP's effectiveness in AGA treatment, particularly when combined with standard therapies. 100 male patients (≥18 years) were randomly divided into two groups of 50. Group 1 received topical minoxidil 5% + oral dutasteride 0.5mg + PRP therapy. Group 2 received topical minoxidil 5% + oral dutasteride 0.5mg.

Our study found mean DHT levels of 7.95 nmol/ml (Grade I-III) and 22.47 nmol/ml (Grade IV-VI). This aligns with Urysiak-Czubatka et al.'s findings[12]of elevated DHT in androgenetic alopecia patients. However, they reported no significant correlation between DHT levels and alopecia progression.DHT shrinks hair follicles and decreases IGF-1 synthesis. PRP, rich in IGF-1, counteracts DHT's suppressive effects.[13]

We used trichoscopy and macrophotography to objectively evaluate therapy efficacy, avoiding subjective measures. Our study revealed elevated MDA levels in 31 subjects, consistent with Prie et al.'s findings of increased oxidative stress markers, including Malondialdehyde, in androgenetic alopecia patients.[14]

In current study yellow spots on the dermoscopy result revealed that yellow spots were observed in 90% cases of minoxidil group and 80% cases of PRP + minoxidil group. In study by Jha et al in post-PRP-treated patients of AGA, reductions in yellow dots were appreciated after 3 sessions.[63] The combination of PRP with topical minoxidil produced significantly better outcomes compared to using minoxidil alone, as determined by clincotrichoscopic evaluation in a comprehensive study conducted by Ray R et al.[15]Reduced yellow spot was seen in our study which is similar to those reported by [16] According to study by Alves et al, when used together with the usual treatment methods of minoxidil or finasteride, PRP shows a stronger therapeutic benefit, as proven by trichoscopy, compared to using only one of these treatments which is similar as observed in present study. [17]

According to Butt et al, the miniaturization on the dermoscopy results revealed that miniaturization was observed in 90% cases of group A and 80% in group B. In our study according to vellus hair on the dermoscopy results revealed that vellus hair was observed in 36% subjects of group A and 30% of group B. After PRP therapy, the terminal to vellus hair ratio showed an increase in 60% of the patients.[18]Jha et al in their study using video microscopic inspection revealed that the QR678 group had considerably superior hair density, terminal hair density, vellus hair density, and shaft diameter compared to the PRP group ($P < .005$).[19]Another study by Pakhomova et al found an increase in density, average diameter, and proportion of telogen hair was found in 28% of patients, as indicated by the proportion of vellus hair in 24% of patients in combination of PRP and minoxidil.[11]Olsen et al found that the maximum regrowth of hair occurred about 1 year after treatment initiation. Furthermore, the study observed that the non-vellus hair, which was not present at the beginning of the study, was still maintained 4.5-5 years later. [20]

Perifollicular pigmentation on the dermoscopy was seen in 36% patients in group A and 24 % patients in group B. Inui et al had concluded that AGA is distinguished by an elevated hair density difference when examined with trichoscopy, as well as the presence of peripilar sign/perifollicular pigmentation and yellow spots.[21] Wei W et al had reported that PRP could stimulate follicular and perifollicular angiogenesis.[22] Ray et al proposed that the group receiving combined treatment demonstrated statistical superiority over the group receiving monotherapy in terms of photographic evaluation and hair diameter increase. [15]

In present study grades of presentation after 3 months of treatment in group A revealed that grade II was seen in maximum cases (56%) followed by grade III (24% cases), grade I and IV (8% each), whereas in group B revealed that grade II was seen in maximum cases i.e., 40% followed by grade III (20% cases), grade I (18%), IV (16%) and grade V in 6%.

In the present study PSS score 1 was observed in 60% patients of group A followed by score 2 in 12%, score 0 in 14% and 3 in 2% cases, whereas in group B, PSS was 1 in 64%, 0 in 30%, 2 in 6% cases. Results obtained were found to be statistically significant (P=0.02). In another study by Wei A et al, patient

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satisfaction, minoxidil was superior to PRP, and no serious adverse reactions occurred.[22]Our study is in accordance to those reported by **Wei W.** A prospective study conducted by Kaiser et al have shown that patients who received a combination treatment of 5% minoxidil, platelet-rich plasma, and microneedling had the highest levels of satisfaction, as assessed by both the patients themselves and their physicians, as compared to those who received only minoxidil therapy.[23]Physician satisfaction was not studied in our study. However, **Pachar S et al r**eported that postprocedural satisfaction score was better in the PRP + minoxidil 5% side than that in the minoxidil 5% side.[24]A comparative study by Verma K et al, examining the therapeutic effectiveness of PRP therapy and minoxidil therapy revealed that patients who had PRP treatment exhibited a notably higher satisfaction score compared to patients who received minoxidil treatment.[25]

In our study we found that pain was most common side effect in PRP group i.e., Pain in 60%, followed by swelling in 14% cases, redness in 4%cases and no side effect was seen in 22% cases, whereas in combination group no side effect was seen. In a study conducted by Pakhomova et al, only four individuals, accounting for 8.5% of the total, reported experiencing pain at the injection sites.[11]Verma K et al concluded that the side effects associated with PRP therapy were minor, leading to improved outcomes and potentially enhancing patient compliance.[25]Girijala R et al reported that common adverse effects of the PRP injection may include mild scalp pain, headache, and a burning feeling. However, these effects often diminish within 10-15 minutes after the injection and may not require the use of topical anesthetic or pain medications.[26]No such findings were observed in our study. Neerja P suggested that typical adverse effects of microneedling include discomfort, discoloration, and inflammation of hair follicles.[27] Nestor MS et al had observed adverse reactions of minoxidil encompass irritating and allergic contact dermatitis, scalp irritation, and face hypertrichosis.[28] Caserini et al had also mentioned the potential adverse effects of the minoxidil which include skin redness and inflammation, allergic skin reaction upon contact, elevated liver enzymes, bedwetting at night, testicular discomfort, headaches, feeling lightheaded before fainting, and soreness in the throat and mouth.[13]

In our study Mean grade improvement in PRP group was 1.03 and Non PRP group was 0.85. Picard F et al[29] reported that PRP seems effective with respect to promoting lost hair regret, decreasing hair loss and increasing hair thickness. Our results were in accord to those reported by Zhang X et al and Jha AK et al as they found that PRP treatment resulted in an increase in both hair count and hair diameter when compared to the initial measurements. However, there was no statistically significant change when compared to the placebo treatment ($P > .05$).[30,31]

CONCLUSION

This study assessed the efficacy of platelet-rich plasma (PRP) therapy in treating androgenetic alopecia and majority of the patients showed hair re-growth with decrease in hair fall post treatment and few patients showed decrease in hair fall despite having no improvement in grade of hair loss. Pain was the most common side effect in PRP group. The PRP group had higher patient satisfaction scores and a greater average reduction in grading after three sessions. The significant outcome by treating patients of AGA with PRP therapy and along with the Minoxidil and Dutasteride will improve the social and emotional aspect of patient' life.

The study concludes that combination therapy with PRP, minoxidil, and dutasteride is a safe and effective treatment for androgenetic alopecia, promoting hair regrowth, reducing hair loss, and enhancing hair thickness. These findings align with previous research on PRP's molecular and biological impacts on hair follicles.

REFERENCES

1. Alfonso M, Richter-Appelt H, Tosti A, Viera MS, García M. The psychosocial impact of hair loss among men: a multinational European study. Curr Med Res Opin. 2005 Nov;21(11):1829-36.
2. Al Aboud AM, Zito PM. Alopecia. In: StatPearls. StatPearls Publishing, Treasure Island (FL); 2023. PMID: 30844205.
3. Gentile P, Cole JP, Cole MA, Garcovich S, Bielli A, Scioli MG, Orlandi A, Insalaco C, Cervelli V. Evaluation of not-activated and activated PRP in hair loss treatment: role of growth factor and cytokine concentrations obtained by different collection systems. International journal of molecular sciences. 2017 Feb 14;18(2):408.
4. Cervelli V, Garcovich S, Bielli A, Cervelli G, Curcio BC, Scioli MG, Orlandi A, Gentile P. The effect of autologous activated platelet rich plasma (AA-PRP) injection on pattern hair loss: clinical and histomorphometric evaluation. BioMed research international. 2014 May 6;2014.
5. Kwack MH, Kim MK, Kim JC, Sung YK. Dickkopf 1 promotes regression of hair follicles. Journal of Investigative Dermatology. 2012 Jun 1;132(6):1554-60.
6. Li ZJ, Choi HI, Choi DK, Sohn KC, Im M, Seo YJ, Lee YH, Lee JH, Lee Y. Autologous platelet-rich plasma: a potential therapeutic tool for promoting hair growth. Dermatologic Surgery. 2012 Jul 1;38(7 pt1):1040-6.
7. Sohn KC, Shi G, Jang S, Choi DK, Lee Y, Yoon TJ, Park H, Hwang C, Kim HJ, Seo YJ, Lee JH. Pitx2, a β-catenin-regulated transcription factor, regulates the differentiation of outer root sheath cells cultured in vitro. Journal of dermatological science. 2009 Apr 1;54(1):6-11.
8. Sidney LE, Branch MJ, Dunphy SE, Dua HS, Hopkinson A. Concise review: evidence for CD34 as a common marker for diverse progenitors. Stem cells. 2014 Jun 1;32(6):1380-9.
9. Plasma: A Review and Author's Perspective. J Cutan Aesthet Surg. 2014 Oct-Dec; 7(4): 189–197.

DOI: 10.69605/ijlbpr_13.12.2024.81

10. Lolli F, Pallotti F, Rossi A, Fortuna MC, Caro G, Lenzi A, Sansone A, Lombardo F. Androgenetic alopecia: a review. Endocrine. 2017 Jul;57(1):9-17.
11. Pakhomova EE, Smirnova IO. Comparative Evaluation of the Clinical Efficacy of PRP-Therapy, Minoxidil, and Their Combination with Immunohistochemical Study of the Dynamics of Cell Proliferation in the Treatment of Men with Androgenetic Alopecia. Int J Mol Sci. 2020 Sep 6;21(18):6516.
12. Rakowska A. Trichoscopy (hair and scalp videodermoscopy) in the healthy female. Method standardization and norms for measurable parameters. J Dermatol Case Rep. 2009 Apr 5; 3(1): 14–19.
13. Urysiak-Czubatka I, Kmieć ML, Broniarczyk-Dyła G. Assessment of the usefulness of dihydrotestosterone in the diagnostics of patients with androgenetic alopecia. Advances in Dermatology and Allergology/Postępy Dermatologii i Alergologii. 2014 Aug 1;31(4):207-15.
14. Caserini M, Radicioni M, Leuratti C, Terragni E, Iorizzo M, Palmieri R. Effects of a novel finasteride 0.25% topical solution on scalp and serum dihydrotestosterone in healthy men with androgenetic alopecia. *Int J Clin Pharmacol Ther*. 2016;54(1):19-27.
15. Prie BE, Voiculescu VM, Ionescu-Bozdog OB, Petrutescu B, Iosif L, Gaman LE, Clatici VG, Stoian I, Giurcaneanu C. Oxidative stress and alopecia areata. Journal of medicine and life. 2015;8(Spec Issue):43.
16. Jain N, Doshi B, Khopkar U. Trichoscopy in Alopecia : Diagnosis simplified. Int J Trichology. 2013 Oct-Dec; 5(4): 170–178.
17. Stevens J, Khetarpal S. Platelet-rich plasma for androgenetic alopecia: a review of the literature and proposed treatment protocol. International journal of women's dermatology. 2019 Feb 1;5(1):46-51.
18. Butt G, Hussain I, Ahmed FJ, Choudhery MS. Efficacy of platelet-rich plasma in androgenetic alopecia patients. J Cosmet Dermatol. 2019 Aug;18(4):996-1001.
19. Jha AK, Vinay K, Zeeshan M, Roy PK, Chaudhary Rgenti, Priya A. Platelet-rich plasma and microneedling improves hair growth in patients ofandrogenetic alopecia when used as an adjuvant to minoxidil. J Cosmet Dermatol. 2019 Oct;18(5):1330-1335
20. Olsen EA, Dunlap FE, Funicella T, Koperski JA, Swinehart JM, Tschen EH, Trancik RJ. A randomized clinical trial of 5% topical minoxidil versus 2% topical minoxidil and placebo in the treatment of androgenetic alopecia in men. Journal of the American Academy of Dermatology. 2002 Sep 1;47(3):377-85.
21. Ray R, Sharma A. Comparison of 5% minoxidil lotion monotherapy versus its combination with autologous platelet rich plasma in androgenetic alopecia in hundred males. *Med J Armed Forces Ind.* 2021;77:355–62.
22. Wei W, Zhang Y, Long B, Zhang Y, Zhang C, Zhang S. Injections of platelet-rich plasma prepared by automatic blood cell separator combined with topical 5% minoxidil in the treatment of male androgenetic alopecia. Skin Res Technol. 2023 Jul;29(7):e13315.
23. Kaiser MA, Ferrari LM, Gaumond SI, Issa N, Jimenez JJ, Issa NT. Platelet Rich Plasma Combination Therapies for Treatment of Androgenetic Alopecia: A Systematic Review. J Cutan Aesthet Surg. 2023 Jul-Sep;16(3):169-177.
24. Inui S. Trichoscopy for common hair loss diseases: algorithmic method for diagnosis. *J Dermatol*. 2011;38(1):71-75. [P
25. Verma K, Tegta GR, Verma G, Gupta M, Negi A, Sharma R. A Study to Compare the Efficacy of Platelet-rich Plasma and Minoxidil Therapy for the Treatment of Androgenetic Alopecia. Int J Trichology. 2019 Mar-Apr;11(2):68-79.
26. Pachar S, Chouhan C, Rao P, Kachhawa D, Singh H, Yadav C. A Comparative Study of Efficacy of 5% Minoxidil and 5% Minoxidil Plus Platelet-Rich Plasma in Same Patient for Treatment of Androgenetic Alopecia. J Cutan Aesthet Surg. 2022 Jan-Mar;15(1):71-76
27. Girijala RL, Riahi RR, Cohen PR. Platelet-rich plasma for androgenic alopecia treatment: a comprehensive review. *Dermatol Online J*. 2018;24(7):13030/qt8s43026c.
28. Neerja P. A study on the efficacy of microneedling with minoxidil solution versus microneedling with hair multivitamin solution for the treatment of androgenetic alopecia. *Int J Dermatol Clin Res*. 2020;6(1):10-12.
29. Picard F, Hersant B, Niddam J, Meningaud JP. Injections of platelet-rich plasma for androgenic alopecia: A systematic review. J Stomatol Oral Maxillofac Surg. 2017 Oct;118(5):291-297.
30. Zhang X, Ji Y, Zhou M, Zhou X, Xie Y, Zeng X, Shao F, Zhang C. Platelet-Rich Plasma for Androgenetic Alopecia: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. J Cutan Med Surg. 2023 Sep-Oct;27(5):504-508.
31. Kapoor R., Shome D., Vadera S., Ram M.S. QR 678 & QR678 Neo Vs PRP-A randomised, comparative, prospective study. *J. Cosmet. Dermatol.* 2020;19:2877–2885.