Fall 10-18-2020

Efficacy of Platelet Rich Plasma Injections vs. Topical Minoxidil in Androgenic Alopecia

Scott Sproul

Efficacy of Platelet Rich Plasma Injections vs. Topical Minoxidil in Androgenic Alopecia

Student Author: Scott Sproul, PA-S

Faculty Advisors: Jacob Adkison, DNP and Charity Keplinger, DHSc, MPAS, PA-C

Dominican University of California
PAL 5680 SCPE Elective
October 16, 2020

Abstract

Background: Topical Minoxidil is the most common FDA approved treatment for Androgenic Alopecia (AA), but does not work for everyone. Platelet rich plasma (PRP) therapy is a new treatment for AA that has been shown to be effective at treating AA. However, there is no consensus on which treatment is more effective.

Purpose: The purpose of this systematic review is to compare the studies available that directly evaluate whether PRP therapy or topical Minoxidil is more effective at treating AA.

Methods: The google scholar database was searched for studies written in English that directly compared platelet rich plasma injections and topical minoxidil in treatment of AA. Ultimately 4 studies were included in this review.

Results: Patel et al (2016) showed the PRP group having better outcomes. In Verma et al (2019) the PRP group had higher patient satisfaction and perceived better outcomes. In Novarro et al (2016) the PRP group had a higher increase in anagen hair and higher decrease in telogen hair. In Farid et al (2016) the Minoxidil group had a higher rate of normalization of hair shedding than PRP group.

Discussion: All 4 studies found both treatments effective at treating androgenic alopecia. The studies showed increases in hair density and amount of anagen hair present with both treatments and no serious side effects. In the future, more studies are needed to fully evaluate if PRP therapy is more effective than topical Minoxidil at treating AA.

Conclusion: This study shows that there is no clear evidence that PRP or Minoxidil is more effective than the other at treating AA.

Key Words: Androgenetic Alopecia, Minoxidil, Platelet Rich Plasma.

Introduction

Androgenic Alopecia (AA) is the most common form of hair loss and affects 50 million men and 30 million women in the United States alone[1]. Americans, it is estimated, spend more than $3.5 billion on various hair regrowth treatments a year to treat hair loss[2]. People affected with AA can suffer from psychological and emotional distress and have a decreased quality of life[3-6]. It is estimated that 50% of men by age 50, and 40% of women by age 70 – 79 will suffer from some form of hair loss[7,8]. AA has the highest incidence in Caucasians, followed by Asians and then Africans[9]. It is believed to be genetically determined with family history being a big risk factor[10]. Up to 15 loci have been associated with contributing to AA with the androgen receptor on the X chromosome showing the strongest association[11,12]. For both men and women AA is thought to be caused by a process called follicular miniaturization[7]. In men, a metabolite of testosterone, dihydrotestosterone (DHT), binds to androgen receptors in the hair follicle. This leads to a gradual transformation of the follicle from producing a thick terminal hair with a long lifespan to a thinner vellus hair with a shorter lifespan[13]. The process starts out as bitemporal regression and thinning at the vertex which can progress to full hair loss throughout the top of the scalp and can be measured by the Hamilton-Norwood scale[13,14]. In women the mechanism of action for follicular miniaturization and the role of androgens is not yet fully understood[15]. Female patterned hair loss is characterized by an evenly distributed thinning of the hair with no discernable pattern and can be measured by the Ludwig classification[16,17].

Currently there are only two FDA approved treatments for AA. Oral Finasteride is approved in men and topical Minoxidil is approved for both men and women[18]. Both medications need to be used daily and are not covered by insurance due to the fact that androgenic alopecia treatment is considered cosmetic, and therefore the patient must pay out of

pocket[19]. Of the two, topical Minoxidil is more common because it is relatively cheap, well tolerated, and can be purchased over the counter[20, 21]. It is a liquid or foam that is applied directly to the scalp and thought to work by causing vasodilation[21]. Having more blood brings more nutrients to the hair follicle and stimulates dermal papilla cells by promoting stem cells to release growth factors[22,23]. Both processes help keep the hair follicle healthy. Studies have shown that Minoxidil is an effective treatment for AA with most people showing an increase in hair density with daily use[22-24]. However, it has been documented that Minoxidil does not work for everyone[24].

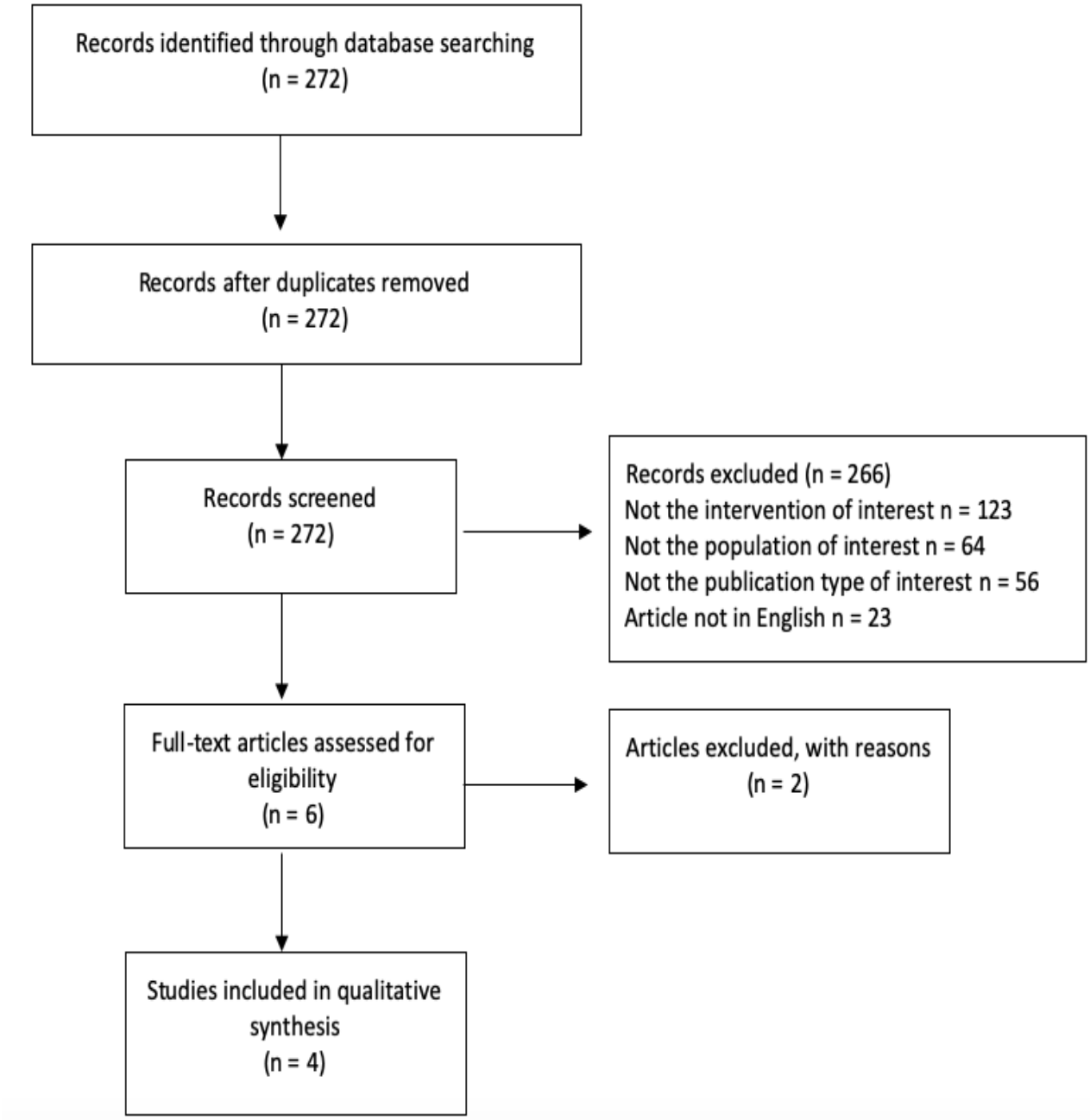
A relatively new non FDA approved treatment for AA, which provides a potential attractive alternative to topical minoxidil, is platelet rich plasma (PRP) therapy. PRP therapy is a minimally invasive procedure with limited side effects that does not require daily use. For this treatment a small amount of a patient's blood is taken, spun down in a centrifuge, and layers separated until the PRP is isolated. Then the PRP is injected into the scalp intradermally. The mechanism for how this helps hair growth is not fully understood. It is thought that platelets contain many growth factors, cytokines, and chemokines that help promote hair growth and hair maturation[25]. Patients have been shown to have an increase in hair density after treatment when compared to a placebo[25-27].

Before recommending a new treatment like PRP it is important to establish whether that treatment is just as effective or more effective than the current treatment options. The current evidence available shows that both topical minoxidil and PRP therapy are effective at treating AA. However, there is no consensus on which treatment is more effective. The purpose of this analysis is to compare the studies available that directly compare whether PRP therapy or topical Minoxidil is more effective at treating AA.

Methods

I carried out my search of the google scholar database using the PRISMA guidelines. My search terms used were Androgenetic Alopecia, platelet, Minoxidil, and versus with the time period set at 2015 – 2019, excluding patents and citations. The search returned a total of 272 results. I was searching for studies written in English that directly compared platelet rich plasma injections and topical minoxidil in treatment of AA. I excluded studies that looked at any other form of alopecia other than AA, used only 1 intervention of interest, combined treatment modalities, not looking at adult men and women, and not written in English. I found a total of 6 studies that met my inclusion criteria. Of those 6, 4 were ultimately included in this systematic review. Of the 2 excluded, 1 study is a very recent study where only an abstract is available and the other was found in the Letters to the Editor section of the journal.

PRISMA Flow Diagram: (Figure 1)



Studies included in this Systematic Review: (figure 2)

Author	Study Type	Sample Size	Population	Measurement
Patel (2016)	Randomized Control Trial	220 110 PRP 110 5% Minoxidil	20 - 50 year old males. Grade II - VII Norwood Hamilton Scale	Type of Hair: Terminal or Vellus, Density, Calibre (course, fine, color). Degree and pattern of hair loss
Verma (2019)	Randomized Control Trial	40 20 PRP 20 5% Minoxidil	20 - 49 year old males. Grade I - V Norwood Hamilton Scale	Global photography, Hair pull test, Patient standardized hair growth questionnaire, patient satisfaction score
Navarro (2016)	Randomized Control Trial	379 282 PRP (213 Women 69 Male) 97 5% Minoxidil (65 Male 32 Female)	29 - 75 year old male or female Grade I - V Norwood Hamilton Scale Grade I - II Ludwig Scale	Standardized Trichograms: Anagen to Telogen ratio, overall improvement
Farid (2016)	Randomized Control Trial	40 20 PRP with microneedling (16 female 4 male) 20 5% Minoxidil (15 female 5 male)	40 patients who met criteria of having PHL. Any grade of the Norwood Hamilton Scale or Savin	Upgrade of level on severity scale. Patient satisfaction score. Count of hair density in 1cm2 area. Rate of hair shedding.

Results:

Patel et al (2016) included 220 males aged 20 – 50 years old who had been diagnosed with androgenic alopecia grade II – VII on the Norwood – Hamilton scale. These 220 males were randomized using the simple sampling method into two groups of 110 individuals. One group received daily topical minoxidil treatment for 6 months and the other group received 6 PRP injections every 15 days for a period of 3 months. Photographs were taken and analyzed for hair distribution pattern and hair density and diameter were measured before treatment began and once treatment was discontinued. Comparing the before and after for both groups the researchers rated the improvement of each patient as good, fair, and poor. They found that overall PRP therapy had a more positive effect on hair regrowth than Minoxidil. Using a Chi square test between the PRP group and Minoxidil group, they calculated a P-value of 0.000647. The greatest effect was seen in those aged 20 – 30 with the lesser duration of hair loss[28].

Verma et al (2019) included 40 males aged 20 – 49 years old who had been diagnosed with AA grade I -V on the Hamilton – Norwood scale and had not used any hair regrowth

treatment over the past 6 months. The 40 males were randomly divided into two groups of 20. Group A received monthly intradermal PRP injections for 4 months while group B used 1mL topical 5% Minoxidil twice daily for 6 months. Group A was followed up every month for 6 months while group B was followed up every 3 months for 6 months. At each follow up, assessment was done using global photography, hair pull test, patient standardized hair growth questionnaire, and patient satisfaction score. For all quantitative variables mean and standard deviations were calculated using Epi-info version 7 and an unpaired T test was applied. This study found that group A had more subjects with positive outcomes in the hair pull test, hair growth questionnaire, and patient satisfaction score. Only a few measurements were statistically significant. More patients (8 of 16) in group A felt they had moderate hair regrowth compared to group B (1 of 14), P-value 0.014. When asked how they feel about the appearance on the crown of their head more patients in group A were satisfied (14 of 16 to 5 of 14, P-value 0.004) and less patients were neutral (2 of 16 to 7 of 14, P-value 0.03) when compared to group B. Lastly, the subject's patient satisfaction score was higher in group A (6.56 ± 1.09) than group B (4.85 ± 1.46), P-value 0.001. In group A four patients dropped out of the study due to pain with PRP injections. Six patients dropped out of the study from group B due to no observed positive effects from Minoxidil treatment[29].

Navarro et al (2016) included 379 patients (245 women and 134 men) diagnosed with AA who had previously underwent topical minoxidil or platelet rich plasma injections between 2012 – 2014 at the Dermatology and Aesthetic center in Valencia Spain. Women must be grade I – II on the Ludwig scale and males must be grade I – V on the Hamilton – Norwood scale. 282 participants (213 women and 69 men) received a PRP injection once a month for 2 months and 97 participants (65 men 32 women) were treated with 1 mL 3% Minoxidil solution 6 nights a

week for 4 months. Photographs and diagnostic trichograms were taken before and 4 months after beginning treatment. The distribution of qualitative variables was analyzed using the Shapiro-Wilk test and the anagen-telogen ratio between pre and post treatment was analyzed using the Wilcoxon non parametric test. They found that patients in the PRP therapy group showed a higher increase in anagen hair, 6.9% ± 0.4% to 4.6%± 0.5% p value < 0.05, and a higher decrease in telogen hair, 5.7% ± 0.3% to 2.6% ± 0.5% p value < 0.05 when compared to the minoxidil therapy group. In addition, global photography showed a bigger improvement in volume of hair in the PRP group[30].

Farid et al (2016) included 40 patients (31 female, 9 male) who had been diagnosed with AA between April 2012 – December 2014 at the Alexandria Main University Hospital in Egypt. The patients were then randomly divided into two groups of 20. Group 1 received PRP injections once a month for 6 months, while group 2 received 1mL topical 5% Minoxidil applied twice daily for 6 months. Photographs were taken to determine hair distribution patterns and non vellous hair counting in a 1cm^2 area of the scalp before and after treatment while also measuring patient satisfaction and rate of hair shedding once treatment was finished. To compare the two groups Chi-square, fisher's exact, and Mann-Whitney tests were used. They found both treatment modalities were comparable in their effectiveness at improving hair density and alopecia grade. The study found slightly more positive outcomes in topical minoxidil, with only 1 measurement being statistically significant. When comparing hair shedding 19 of 20 patients in the Minoxidil group compared to 13 of 20 patients in the PRP group had a normalization of hair shedding after treatment, p-value 0.04[31].

Discussion:

In the four studies analyzed, three of the four found a more positive outcome in patients treated with PRP therapy[28-30]. While only one study found topical Minoxidil was associated with more positive outcomes, the difference between the two treatments was not statistically significant[31]. All 4 studies found both treatments effective at treating androgenic alopecia. The studies showed increases in hair density and amount of anagen hair present with both treatments and no serious side effects. Looking at the current studies available there is no clear evidence that PRP therapy or topical Minoxidil is more effective over the other at treating AA. Although recent studies have shown that using a combination therapy approach to treating AA is superior to monotherapy. Two studies found that finasteride combined with minoxidil had superior outcomes to minoxidil alone[32,33]. In addition, a recent study by Shah et al (2017) showed PRP therapy combined with minoxidil had superior outcomes to minoxidil alone[34].

Limitations of this systematic review include limited number of studies to analyze, no uniform scale to evaluate improvement of hair loss, and no standard protocol for PRP therapy to treat androgenic alopecia. Three of the four studies mainly relied on subjective data with patient questionnaires and investigator grading of photographs. With the small sample sizes the variability in which subjects view their treatment could impact which treatment is viewed as superior. In addition, PRP injections are a relatively new therapy for treating AA and there is not a consensus on which protocol to use. There are many protocol variations, differences include anticoagulant used, starting amount of blood, centrifugation technique, concentration of platelets, and whether an activator is used or not. While there is no consensus of which protocol is superior, each study used a different protocol which could affect the outcome of the treatment[35,36]. In Farid et al (2016) the study also used micro needling in conjunction with PRP therapy which added a variable that the others studies did not include[31].

Conclusion:

In the future, more studies are needed to fully evaluate if PRP therapy is more effective than topical Minoxidil at treating AA. These future studies should involve more subjects in similar stages of hair loss, longer duration of treatment, and a standard protocol for PRP therapy to fully evaluate the two treatments. This study shows that both topical minoxidil and PRP therapy can be effective at treating AA, but there is no evidence to suggest that PRP therapy should be recommended to patients over topical Minoxidil. As therapies improve more studies will be needed to evaluate which therapy should be recommended as first line for treating AA.

References

1. “Androgenetic Alopecia - Genetics Home Reference - NIH.” *U.S. National Library of Medicine*, National Institutes of Health, 10 Sept. 2019, https://ghr.nlm.nih.gov/condition/androgenetic-alopecia#sourcesforpage.

2. American Hair Loss Association. *American Hair Loss Association - Hair Loss Treatment*, https://www.americanhairloss.org/hair_loss_treatment/.

3. Han SH, Byun JW, Lee WS et al. “Quality of life assessment in male patients with androgenetic alopecia: result of a prospective, multicenter study.” Ann Dermatol 2012; 24: 311-318.

4. Titeca, Geraldine et al. "“The Psychosocial Burden Of Alopecia Areata And Androgenetica”: A Cross-Sectional Multicenter Study Among Dermatological Out-Patients In 13 European Countries". *Journal Of The European Academy Of Dermatology And Venereology*, 2019. *Wiley*, doi:10.1111/jdv.15927.

5. Cash, Thomas F. "The Psychological Effects Of Androgenetic Alopecia In Men". *Journal Of The American Academy Of Dermatology*, vol 26, no. 6, 1992, pp. 926-931. *Elsevier BV*, doi:10.1016/0190-9622(92)70134-2.

6. Cash, Thomas F. et al. "Psychological Effects Of Androgenetic Alopecia On Women: Comparisons With Balding Men And With Female Control Subjects". *Journal Of The American Academy Of Dermatology*, vol 29, no. 4, 1993, pp. 568-575. *Elsevier BV*, doi:10.1016/0190-9622(93)70223-g.

7. Heilmann-Heimbach, Stefanie, et al. “Hunting the Genes in Male-Pattern Alopecia: How Important Are They, How Close Are We and What Will They Tell Us?” *Experimental Dermatology*, vol. 25, no. 4, 2016, pp. 251–257., doi:10.1111/exd.12965.

8. Birch, M.p., et al. “Hair Density, Hair Diameter and the Prevalence of Female Pattern Hair Loss.” *British Journal of Dermatology*, vol. 144, no. 2, 2001, pp. 297–304., doi:10.1046/j.1365-2133.2001.04018.x.

9. Blume-Peytavi, U., et al. “S1 Guideline for Diagnostic Evaluation in Androgenetic Alopecia in Men, Women and Adolescents.” *British Journal of Dermatology*, vol. 164, no. 1, 2011, pp. 5–15., doi:10.1111/j.1365-2133.2010.10011.x.

10. Chumlea, W. Cameron, et al. “Family History and Risk of Hair Loss.” *Dermatology*, vol. 209, no. 1, 2004, pp. 33–39., doi:10.1159/000078584.

11. Li, Rui, et al. “Six Novel Susceptibility Loci for Early-Onset Androgenetic Alopecia and Their Unexpected Association with Common Diseases.” *PLoS Genetics*, vol. 8, no. 5, 2012, doi:10.1371/journal.pgen.1002746.

12. Ellis, Justine A., et al. “Androgenetic Alopecia: Pathogenesis and Potential for Therapy.” *Expert Reviews in Molecular Medicine*, vol. 4, no. 22, 19 Nov. 2002, pp. 1–11., doi:10.1017/s1462399402005112.

13. Hamilton, James B. “Patterned Loss Of Hair In Man: Types And Incidence.” *Annals of the New York Academy of Sciences*, vol. 53, no. 3, Mar. 1951, pp. 708–728., doi:10.1111/j.1749-6632.1951.tb31971.x.

14. Gupta, Mrinal, and Venkataram Mysore. "Classifications Of Patterned Hair Loss: A Review". *Journal Of Cutaneous And Aesthetic Surgery*, vol 9, no. 1, 2016, p. 3. *Medknow*, doi:10.4103/0974-2077.178536.

15. Ramos, Paulo Müller, and Hélio Amante Miot. “Female Pattern Hair Loss: a Clinical and Pathophysiological Review.” *Anais Brasileiros De Dermatologia*, vol. 90, no. 4, 2015, pp. 529–543., doi:10.1590/abd1806-4841.20153370.

16. Price, Vera H. “Androgenetic Alopecia in Women.” *Journal of Investigative Dermatology Symposium Proceedings*, vol. 8, no. 1, June 2003, pp. 24–27., doi:10.1046/j.1523-1747.2003.12168.x.

17. Ludwig, Erich. “Classification of the Types of Androgenetic Alopecia (Common Baldness) Occurring in the Female Sex.” *British Journal of Dermatology*, vol. 97, no. 3, Sept. 1977, pp. 247–254., doi:10.1111/j.1365-2133.1977.tb15179.x.

18. Lee SW, Juhasz M, Mobasher P, Ekelem C, Mesinkovska NA. “A Systematic Review of Topical Finasteride in the Treatment of Androgenetic Alopecia in Men and Women.” *J Drugs Dermatol*. 2018;17(4):457-463.

19. Hair Loss: Should I Take Medicine to Regrow Hair? https://healthy.kaiserpermanente.org/health-wellness/health-encyclopedia/he.hair-loss-should-i-take-medicine-to-regrow-hair.tr2559. Published July 2, 2020. Accessed September 11, 2020.

20. Goren, Andy, and Ty Naccarato. "Minoxidil In The Treatment Of Androgenetic Alopecia". *Dermatologic Therapy*, vol 31, no. 5, 2018, p. e12686. *Wiley*, doi:10.1111/dth.12686.

21. Suchonwanit P, Thammarucha S, Leerunyakul K. “Minoxidil and its use in hair disorders: a review” [published correction appears in Drug Des Devel Ther. 2020 Feb 10;14:575]. *Drug Des Devel Ther*. 2019;13:2777-2786. Published 2019 Aug 9. doi:10.2147/DDDT.S214907

22. Headington, J.t. “Hair Follicle Biology and Topical Minoxidil: Possible Mechanisms of Action.” *Dermatology*, vol. 175, no. 2, 1987, pp. 19–22., doi:10.1159/000248894.

23. Otomo, Susumu. “Hair Growth Effect of Minoxidil.” *Folia Pharmacologica Japonica*, vol. 119, no. 3, Mar. 2002, pp. 167–174., doi:10.1254/fpj.119.167.

24. Goren, Andy et al. "Clinical Utility And Validity Of Minoxidil Response Testing In Androgenetic Alopecia". *Dermatologic Therapy*, vol 28, no. 1, 2014, pp. 13-16. *Wiley*, doi:10.1111/dth.12164.

25. Alves, Rubina, and Ramon Grimalt. "A Review Of Platelet-Rich Plasma: History, Biology, Mechanism Of Action, And Classification". *Skin Appendage Disorders*, vol 4, no. 1, 2017, pp. 18-24. *S. Karger AG*, doi:10.1159/000477353.

26. Dervishi, Gezim, et al. “Autologous Platelet-Rich Plasma Therapy for Pattern Hair Loss: A Systematic Review.” *Journal of Cosmetic Dermatology*, 26 Aug. 2019, doi:10.1111/jocd.13113.

27. Picard, F., et al. “Injections of Platelet-Rich Plasma for Androgenic Alopecia: A Systematic Review.” *Journal of Stomatology, Oral and Maxillofacial Surgery*, vol. 118, no. 5, Oct. 2017, pp. 291–297., doi:10.1016/j.jormas.2017.06.011.

28. Patel, Pawan Kumar, et al. "Comparative study of efficacy of platelet rich plasma versus minoxidil (5%-10%) in the treatment of androgenetic alopecia in males." *Journal of Evolution of Medical and Dental Sciences*, vol. 5, no. 2, 2016, p. 131+. *Gale OneFile: Health and Medicine*,.

29. Verma, Kuldeep, et al. "A Study to Compare the Efficacy of Platelet-Rich Plasma and Minoxidil Therapy for the Treatment of Androgenetic Alopecia." International Journal of Trichology, vol. 11, no. 2, Apr. 2019, pp. 68-79. EBSCOhost, doi:10.4103/ijt.ijt_64_18.

30. Navarro, M. R., et al. “Management of Androgenetic Alopecia: a Comparative Clinical Study between Plasma Rich in Growth Factors and Topical Minoxidil.” *European Journal of Plastic Surgery*, vol. 39, no. 3, 6 Jan. 2016, pp. 173–180., doi:10.1007/s00238-015-1175-1.

31. Farid CI, and Abdelmaksoud RA. "Platelet-Rich Plasma Microneedling versus 5% Topical Minoxidil in the Treatment of Patterned Hair Loss." Journal of the Egyptian Women's Dermatologic Society, vol. 13, no. 1, Jan. 2016, pp. 29-36. EBSCOhost, doi:10.1097/01.EWX.0000472824.29209.a8.

32. Suchonwanit P, Srisuwanwattana P, Chalermroj N, Khunkhet S. “A randomized, double-blind controlled study of the efficacy and safety of topical solution of 0.25% finasteride admixed with 3% minoxidil vs. 3% minoxidil solution in the treatment of male androgenetic alopecia.” *J Eur Acad Dermatol Venereol*. 2018 Dec;32(12):2257-2263. doi: 10.1111/jdv.15171. Epub 2018 Jul 20. PMID: 29972712.

33. Hu R, Xu F, Sheng Y, Qi S, Han Y, Miao Y, Rui W, Yang Q. “Combined treatment with

oral finasteride and topical minoxidil in male androgenetic alopecia: a randomized and comparative study in Chinese patients." *Dermatol Ther*. 2015 Sep-Oct;28(5):303-8. doi: 10.1111/dth.12246. Epub 2015 Jun 2. PMID: 26031764.

34. Shah KB, Shah AN, Solanki RB, Raval RC. "A Comparative Study of Microneedling with Platelet-rich Plasma Plus Topical Minoxidil (5%) and Topical Minoxidil (5%) Alone in Androgenetic Alopecia." *Int J Trichology*. 2017 Jan-Mar;9(1):14-18. doi: 10.4103/ijt.ijt_75_16. PMID: 28761259; PMCID: PMC5514790.

35. Gentile P, Garcovich S. "Systematic Review of Platelet-Rich Plasma Use in Androgenetic Alopecia Compared with Minoxidil®, Finasteride®, and Adult Stem Cell-Based Therapy." *International Journal of Molecular Sciences*. 2020;21(8):2702. doi:10.3390/ijms21082702

36. Dhurat R, Sukesh M. "Principles and Methods of Preparation of Platelet-Rich Plasma: A Review and Author's Perspective." *J Cutan Aesthet Surg*. 2014;7(4):189-197. doi:10.4103/0974-2077.150734