Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/x9zh7e62

"COMPARISON OF THERAPEUTIC EFFICACY OF MICRONEEDLING WITH PLATELET-RICH PLASMA PLUS 5% MINOXIDIL AND 5% MINOXIDIL ALONE IN ANDROGENETIC ALOPECIA"

Dr. Harmeet Singh[1*], Dr. Krishna Talukdar[2], Dr. Minakshi Narah[3], Dr. Balu Haridas[4], Dr. Porimollika Boruah[5], Dr. Aparajita Roy[6], Dr. Pallabi Hatikakoty[7]

[1*]Junior Resident , Department of Dermatology, Venereology and Leprosy, Jorhat Medical College and Hospital , Jorhat Assam
[2]Professorand HOD,Department of Dermatology, Venereology and LeprosyJorhat Medical College and Hospital, Jorhat, Assam
[3]Assistant professor, Department of Dermatology, Venereology and LeprosyJorhat Medical College and Hospital, Jorhat, Assam
[4]Junior Resident , Department of Dermatology, Venereology and Leprosy, Jorhat Medical College and Hospital , Jorhat Assam
[5]Senior resident, Department of Dermatology, Venereology and Leprosy Tinsukia Medical College and Hospital, Jorhat, Assam
[6]Senior resident Department of Dermatology, Venereology and Leprosy Lakhimpur Medical College and Hospital, Jorhat, Assam
[7]Junior Resident, Department of Dermatology, Venereology and Leprosy, Jorhat Medical College and Hospital, Jorhat Assam

***Corresponding Author:** Dr Harmeet Singh
*Junior Resident , Department of Dermatology, Venereology and Leprosy, Jorhat Medical College and Hospital , Jorhat Assam, Email id- harmeets.life@gmail.com

ABSTRACT

Background: Alopecia, a complex dermatological condition, manifests through progressive follicular miniaturization and hair loss, adversely impacting psychological well-being and quality of life. Among its subtypes, androgenetic alopecia (AGA) is the most common form of nonscarring alopecia, largely influenced by genetic predisposition and androgen sensitivity. Despite therapeutic advancements, minoxidil and finasteride remain the only FDA-approved treatments, often limited by variable efficacy, prolonged use, and adverse effects. Platelet-rich plasma (PRP), an autologous biologic enriched with growth factors, has shown promise in hair restoration, although its protocols and long-term efficacy remain under investigation.

Aim and Objective: To compare the therapeutic efficacy of 5% topical minoxidil monotherapy versus a multimodal regimen combining minoxidil, microneedling, and autologous PRP in the management of AGA.

Methods: Fifty patients (aged 18–50 years) with AGA attending the Dermatology OPD at JMCH were enrolled and divided into Group A (minoxidil alone) and Group B (minoxidil + microneedling + PRP). PRP was administered monthly for six months. Microneedling was performed using a 1.5 mm dermaroller, followed by PRP injections and topical application. Efficacy was assessed via

patient self-evaluation, standardized photographs, and Hamilton–Norwood grading at baseline, 3, and 6 months. Informed consent was obtained from all participants.
Results: Mean ages were 30.04 years (Group A) and 31.12 years (Group B). Grade III alopecia (52%) was most prevalent. AGA had familial association in 54% of patients. Group B demonstrated significantly superior outcomes at 6 months ($P < 0.05$). Mild adverse effects included pruritus (16%), seborrheic dermatitis (14%), and headache (12%).
Conclusion: The combination of minoxidil, microneedling, and PRP provides superior efficacy over monotherapy. PRP is a safe and effective adjunct, but standardized protocols and larger multicentric studies are warranted.

Introduction

Alopecia refers to the loss of hair follicles, individual strands, or both, and may occur either as an isolated condition or in association with systemic or dermatological disorders. The term originates from the Greek word *alopex*, likening hair loss to the patchy fur shedding seen in foxes with mange.[1-4]Hair loss can affect individuals of all ages and may arise due to disruptions in the normal hair growth cycle. Accurate evaluation requires a comprehensive understanding of hair physiology, structure, genetics, nutrition, and environmental influences.[2] Alopecia is broadly classified into nonscarring (non-cicatricial) and scarring (cicatricial) forms. Nonscarring alopecias are more common and include androgenetic alopecia (AGA), telogen effluvium, alopecia areata, and trichotillomania. Scarring alopecias are associated with irreversible follicular destruction, as seen in conditions such as lichen planopilaris, discoid lupus erythematosus, folliculitis decalvans, and acne keloidalis.[2]
AGA is the most prevalent form of nonscarring alopecia, influenced by genetic predisposition and androgen-mediated follicular miniaturization.[3] While it does not pose a direct health risk, AGA significantly affects self-esteem and psychological well-being, particularly in females and young males.[4] Current FDA-approved treatments include oral finasteride and topical minoxidil; however, both require prolonged use and have limitations in efficacy and tolerability.[5]
Minoxidil, enzymatically activated in the outer root sheath, acts as a vasodilator, enhancing follicular perfusion.[5] Although widely used, its dependency on long-term adherence often leads to suboptimal outcomes, necessitating alternative or adjunctive therapies.[6-8]
Among emerging options, platelet-rich plasma (PRP)—a minimally invasive, autologous treatment enriched with growth factors—has shown promise.[9-11] Microneedling, which induces controlled skin injury to stimulate dermal regeneration, has also demonstrated synergy with PRP.[12] However, standardized treatment protocols for PRP preparation, administration, and combination strategies remain lacking, warranting further clinical investigation.[13-16]

Need for the Study:

Current treatments for androgenetic alopecia (AGA), including minoxidil and finasteride, require prolonged use and often yield inconsistent results, leading to poor adherence.[5,6] Surgical options, though effective, are expensive and technique-sensitive. Platelet-rich plasma (PRP), rich in autologous growth factors, promotes follicular proliferation and has shown promise, especially in combination with existing therapies.[18-22]. Microneedling enhances transdermal delivery and growth factor release by inducing controlled dermal injury.[22] Combined use of PRP, microneedling, and minoxidil may offer synergistic effects, improved efficacy, and better patient satisfaction.[23] This study aims to evaluate this multimodal approach as a practical alternative in AGA management.[24-30]

Materials and methods

This hospital-based, cross-sectional observational study was conducted in the Outpatient Department of Dermatology, Venereology, and Leprosy at Jorhat Medical College and Hospital (JMCH), Assam, over a one-year period from 24th December 2023 to 24th December 2024. Ethical approval was obtained from the Institutional Ethics Committee prior to initiation.

Fifty patients were enrolled through purposive sampling and divided into two groups of 25 each. Inclusion criteria included patients aged 18–50 years with androgenetic alopecia (AGA) Stage III–V (Hamilton–Norwood classification), no treatment in the preceding six months, and willingness to provide informed consent. Patients with other types of alopecia, bleeding disorders, chronic illnesses, active infections, or unrealistic expectations were excluded.

Group A received topical 5% minoxidil (1 ml twice daily).

Group B received topical minoxidil along with monthly microneedling using a 1.5 mm dermaroller followed by platelet-rich plasma (PRP) injections (0.05 ml/cm²) and topical PRP application, administered over six sessions.

Outcomes were assessed through: (1) **Patient self-assessment** using a validated 7-point improvement scale; (2) **Physician assessment** based on standardized photographs taken at baseline, 3 months, and 6 months under fixed lighting, position, and distance using a 50-megapixel camera; (3) **Grading of hair loss** using the Hamilton–Norwood scale before and after treatment. Patients were advised not to change their hairstyle or use hair dyes during the study period to minimize external influences on results.

RESULTS

Baseline demographic and clinical characteristics

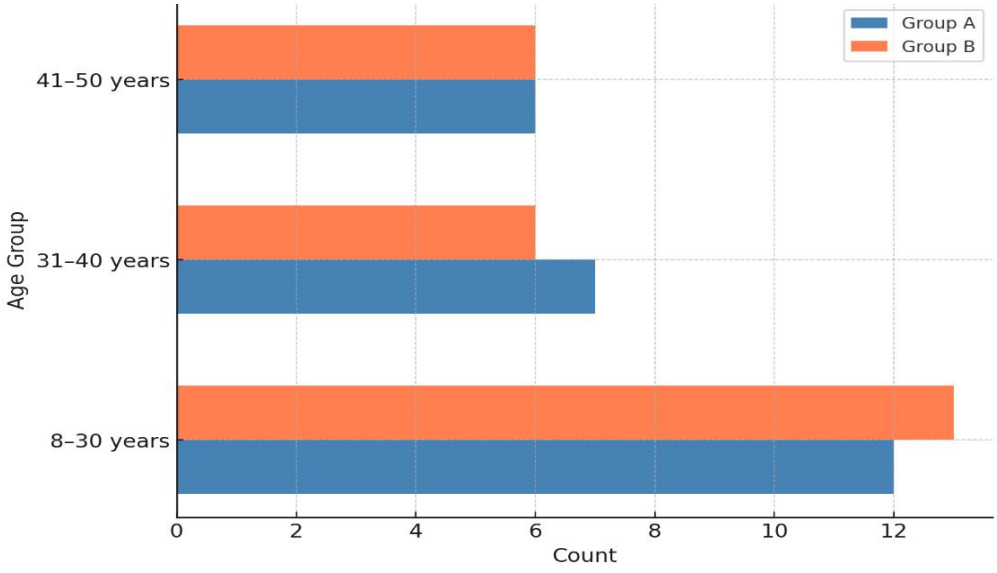
Fifty consecutive patients with androgenetic alopecia (AGA) were enrolled (Table 1). **Men predominated (88 %, n = 44)**, with women comprising 12 % (n = 6). The overall mean ± SD age was **30.04 ± 7.5 years in Group A** and **31.12 ± 8.1 years in Group B**, with no inter-group difference (χ^2, $P > 0.05$). Nearly half the cohort (50 %, n = 25) belonged to the 18–30-year bracket, followed by 31–40 years (26 %, n = 13) and 41–50 years (24 %, n = 12) (Figure 1). A positive family history of AGA was obtained in **54 % (n = 27)** of participants (Table 6, Figure 9).

The mean duration of hair loss was 12–60 months in 62 % (n = 31) of subjects, with a maximum of 15 years; duration did not differ significantly between treatment arms.

Table 1 Distribution Of Male And Female In Androgentic Alopecia

Gender	Number of Cases	Percentage (%)
Men	44	88%
Women	6	12%
Total	**50**	**100%**

Figure 1 Age distribution in Androgenetic Alopecia



Baseline severity

Among women, Ludwig grades 2, 3 and 4 were observed in three, two and one case(s), respectively In men, Norwood grades 3 (54.5 %) and 4 (34.5 %) predominated (Table 8, Figure 11). When both sexes were combined, **grade III AGA was most frequent (52 %, n = 26)**, followed by grade IV (32 %, n = 16) .

Treatment-Related Outcomes

Patient Self-Assessment at 6 Months

At 6-month follow-up, **patients' subjective assessment of improvement** demonstrated a **statistically significant superiority in Group B** compared to Group A.

The 6-month treatment outcomes demonstrated a clear and statistically significant advantage of combination therapy (Group B: topical minoxidil with platelet-rich plasma [PRP] and microneedling) over monotherapy with topical minoxidil alone (Group A). In terms of **patient self-assessment**, only **8%** of patients in Group A rated their improvement as excellent, while **40%** reported moderate improvement. Notably, **44%** of Group A participants experienced only mild improvement, and **8%** reported no change at all. In contrast, **Group B patients showed a markedly better response**, with **28%** reporting excellent improvement and **64%** reporting moderate improvement. Only **8%** noted mild improvement, and none reported no change. The statistical comparison using the Chi-square test yielded a value of $\chi^2 = 12.39$, with a **P-value of 0.006**, indicating a **highly significant difference** between the two treatment groups ($P < 0.05$).

These findings were further supported by the **investigator's global clinical assessment** at the 6-month mark. Dermatologist evaluations showed that patients in Group B exhibited greater hair density, improved scalp coverage, and better overall cosmetic outcomes compared to those in Group A. The proportion of patients achieving moderate to excellent improvement was significantly higher in Group B, reinforcing the results of the self-assessment scale. This alignment between patient-reported outcomes and clinical evaluation strengthens the evidence for the superior efficacy of the combination approach

This difference was analyzed using the Chi-square test (Table 13 & 14), and the calculated value was $\chi^2 = 12.39$, with **P = 0.006**, indicating **statistical significance (P < 0.05)**.

Investigator Global Assessment

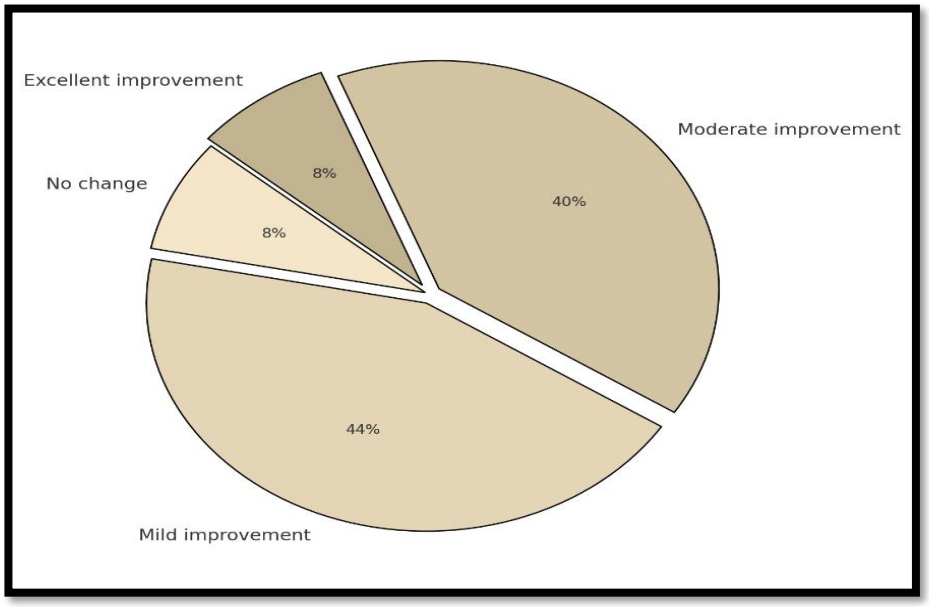
The treating dermatologist's evaluation at 6 months also revealed that **Group B showed markedly superior improvement**, aligning with patient self-assessment. A higher proportion of **moderate to excellent responses** were recorded in Group B than in Group A, affirming the efficacy of adjunct PRP and microneedling therapy.

Investigator assessment

Investigator global evaluation paralleled patient perception: Group B demonstrated a higher frequency of moderate-to-marked regrowth compared with Group A ($P < 0.05$).

Distribution of patient assessment scale after 6 months (Group A)

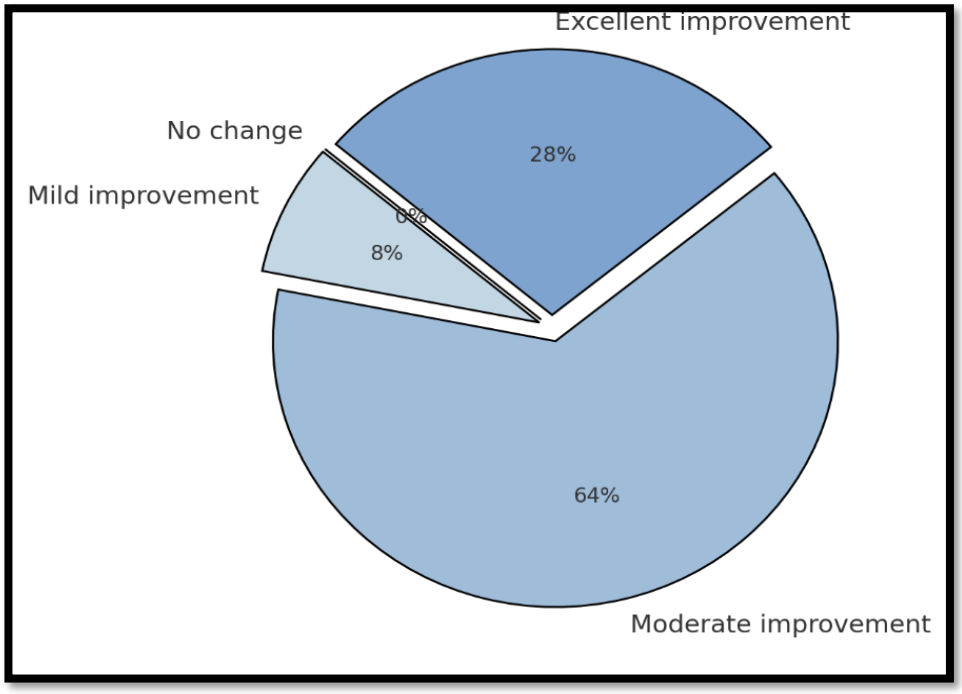
Improvement Outcome	Group A (n=25), n (%)
No change	2 (8%)
Mild	11 (44%)
Moderate	10 (40%)
Excellent	2 (8%)



OUTCOME DISTRIBUTION IN GROUP A

Distribution of patient assessment scale after 6 months (Group B)

Improvement Outcome	Group B (n=25), n (%)
No change	0 (0%)
Mild	2 (8%)
Moderate	16 (64%)
Excellent	7 (28%)



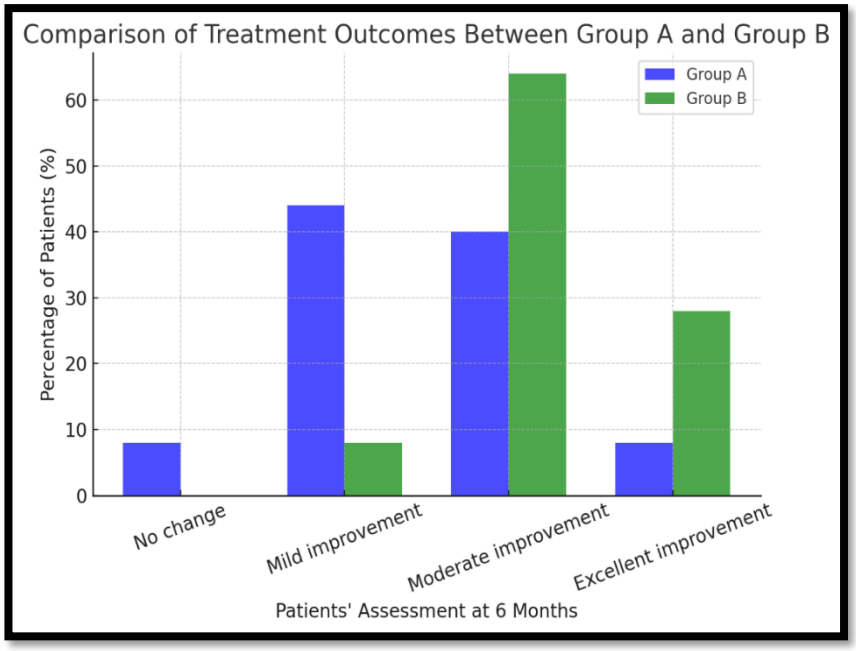
OUTCOME DISTRIBUTION IN GROUP IN GROUP B

Platelet enrichment

Mean platelet count in PRP (**618 405 ± 84 785 µL**) was approximately 2.6-fold higher than whole blood (**242 000 ± 36 236 µL**), a difference that was statistically significant ($P < 0.05$; Table 12).

Comparison of Platelet Counts in Whole Blood and Platelet-Rich Plasma in Group B

Platelet Count in Group B	Whole Blood	Platelet-Rich Plasma
Mean	242,000	618,405
Standard Deviation	36,235.9	84,785.4



Patient's Assessment done at 6 Months

Assessment Category	Group A (n=25), n (%)	Group B (n=25), n (%)	P-value
No change	2 (8%)	0 (0%)	0.006
Mild improvement	11 (44%)	2 (8%)	
Moderate improvement	10 (40%)	16 (64%)	
Excellent improvement	2 (8%)	7 (28%)	

All statistical analyses employed the Chi-square or paired-sample t test as appropriate, with significance set at $P < 0.05$.

Adverse events

Treatment-emergent events were mild and self-limiting. **Pruritus (16 %), seborrhoeic dermatitis (14 %) and headache (12 %)** were the commonest (Table 15, Figure 17). No serious adverse event or study withdrawal occurred. The incidence of side-effects did not differ significantly between groups.

Conclusion

Our findings reinforce the growing evidence supporting PRP therapy as a promising treatment for androgenetic alopecia, particularly when combined with microneedling and minoxidil. While the therapy demonstrated significant improvements in hair density and patient satisfaction, variations in outcomes across different studies highlight the need for standardized protocols. Factors such as platelet concentration, method of administration, and combination with adjunct therapies remain areas for further investigation. Additionally, although adverse effects such as pruritus, seborrheic dermatitis, and headache were reported, their frequency was relatively low and comparable to previous studies. Future large-scale, multicentre randomized controlled trials are essential to establish optimal treatment regimens and long-term efficacy, ensuring that PRP therapy becomes a well-defined and reliable option for androgenetic alopecia management**.**

References

1. Sperling LC, Sinclair RD, El Shabrawi-Caelen L. Alopecias. In: Bolognia JL, Schaffer JV, Cerroni L, editors. Dermatology. 4th ed. China: Elsevier; 2018. p. 1162-82.
2. Sacchidanand S, Savitha AS, Shilpa K, Shashi Kumar BM, Nagesh TS. IADVL Textbook of Dermatology. 5th ed. Mumbai: Bhalani Publishing House; 2022. p. 1633-1766.
3. Hu R, Xu F, Han Y, et al. Trichoscopic findings of androgenetic alopecia and their association with disease severity. J Dermatol. 2015;42(6):602-7. doi:10.1111/1346-8138.12857.
4. Ntshingila S, Oputu O, Arowolo AT, Khumalo NP. Androgenetic alopecia: An update. JAAD Int. 2023 Jul 22;13:150-8. doi:10.1016/j.jdin.2023.07.005. PMID: 37823040; PMCID: PMC10562178.
5. Goren A, Naccarato T. Minoxidil in the treatment of androgenetic alopecia. Dermatol Ther. 2018;31(5):e12686. doi:10.1111/dth.12686.
6. Ruthvik S, John RS, George M, Kumar SP, Krishnan M. Comparison of efficacy of platelet-rich plasma with and without topical minoxidil for hair growth in patients with androgenetic alopecia: A prospective study. Cureus. 2024 Feb 8;16(2):e53875. doi:10.7759/cureus.53875. PMID: 38465061; PMCID: PMC10924654.
7. De Villez RL. Topical minoxidil therapy in hereditary androgenetic alopecia. Arch Dermatol. 1985;121:197–202. doi: 10.1001/archderm.121.2.197.
8. Muhammad A, Iftikhar N, Mashhood A, et al. Comparison of efficacy of platelet-rich plasma (PRP) with PRP microneedling in androgenetic alopecia. Cureus. 2022 Oct 18;14(10):e30418. doi:10.7759/cureus.30418. PMID: 36407242; PMCID: PMC9670661.
9. Faghihi G, Nabavinejad S, Mokhtari F, Fatemi Naeini F, Iraji F. Microneedling in androgenetic alopecia; comparing two different depths of microneedles. J Cosmet Dermatol. 2021 Apr;20(4):1241-7. doi:10.1111/jocd.13714.
10. Ocampo-Garza SS, Fabbrocini G, Ocampo-Candiani J, et al. Microneedling: A novel therapeutic approach for androgenetic alopecia. Dermatol Ther. 2020;33(6):e14267. doi:10.1111/dth.14267.
11. Hamilton JB. Patterned loss of hair in man; types and incidence. Ann N Y Acad Sci. 1951;53(3):708-28. doi:10.1111/j.1749-6632.1951.tb31971.x.
12. Olsen E. Androgenetic alopecia. In: Disorders of Hair Growth: Diagnosis and Treatment. New York: McGraw-Hill; 1994. p. 257.
13. Williams DJ, Timothy GB, Dirk ME. Disorders of skin appendages. In: Andrew's Diseases of the Skin: Clinical Dermatology. Philadelphia: Elsevier Inc; 2011. p. 741-7.
14. Smith MA, Wells RS. Male-type alopecia, alopecia areata, and normal hair in women; family histories. Arch Dermatol. 1964;89:95-8. doi:10.1001/archderm.1964.01590250101017.
15. Oiwoh SO, Enitan AO, Adegbosin OT, et al. Androgenetic alopecia: A review. Niger Postgrad Med J. 2024;31(2):85-92. doi:10.4103/npmj.npmj_47_24.
16. Enitan AO, Olasode OA, Onayemi OE, et al. Androgenetic alopecia: What impact does it have on the quality of life? Niger J Med. 2022;31:455-61.
17. Wang TL, Zhou C, Shen YW, et al. Prevalence of androgenetic alopecia in China: A community-based study in six cities. Br J Dermatol. 2010;162:843-7.
18. Shankar DK, Chakravarthi M, Shilpakar R. Male androgenetic alopecia: Population-based study in 1,005 subjects. Int J Trichol. 2009;1:131-3.
19. Paik JH, Yoon JB, Sim WY, et al. The prevalence and types of androgenetic alopecia in Korean men and women. Br J Dermatol. 2001;145:95-9.
20. Norwood OT. Incidence of female androgenetic alopecia (female pattern alopecia). Dermatol Surg. 2001;27:53-4.
21. Gan DC, Sinclair RD. Prevalence of male and female pattern hair loss in Maryborough. J Invest Dermatol Symp Proc. 2005;10:184-9.
22. Paus R, Cotsarelis G. The biology of hair follicles. N Engl J Med. 1999;341:491-7.
23. Pierard-Franchimont C, Pierard GE. Teloptosis, a turning point in hair shedding biorhythms. Dermatology. 2001;203:115-7.

24. Randall VA. The biology of androgenetic alopecia. In: Camacho F, Randall VA, Price VH, editors. Hair and its Disorders: Biology, Pathology and Management. London: Martin Dunitz; 2000. p. 123-36.
25. Roh C, Tao Q, Lyle S. Dermal papilla-induced hair differentiation of adult epithelial stem cells from human skin. Physiol Genomics. 2004;19:207-17.
26. Blanpain C, Lowry WE, Geoghegan A, et al. Self-renewal, multipotency, and the existence of two cell populations within an epithelial stem cell niche. Cell. 2004;118:635-48.
27. Oshima H, Rochat A, Kedzia C, et al. Morphogenesis and renewal of hair follicles from adult multipotent stem cells. Cell. 2001;104:233-45.
28. Botchkarev VA, Kishimoto J. Molecular control of epithelial-mesenchymal interactions during hair follicle cycling. J Investig Dermatol Symp Proc. 2003;8:46-55.
29. Kishimoto J, Burgeson RE, Morgan BA. Wnt signaling maintains the hair-inducing activity of the dermal papilla. Genes Dev. 2000;14:1181-5
30. Kaufman KD. Androgen metabolism as it affects hair growth in androgenetic alopecia. Dermatol Clin. 1996;14:697-711.
31. Randall VA. Androgens and human hair growth. Clin Endocrinol (Oxf). 1994;40(4):439-57.
32. Thornton MJ, Hamada K, Messenger AG, Randall VA. Beard, but not scalp, dermal papilla cells secrete autocrine growth factors in response to testosterone in vitro. J Invest Dermatol. 1998;111(5):727-32.
33. Randall VA, Thornton MJ, Messenger AG. Cultured dermal papilla cells from androgen-dependent human hair follicles (e.g. beard) contain more androgen receptors than those from non-balding areas of the scalp. J Endocrinol. 1992;133(1):141-7.