International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

ARTICLE TITLE	ANDROGENETIC ALOPECIA: A REVIEW OF CURRENT THERAPEUTIC OPTIONS
DOI	https://doi.org/10.31435/ijitss.4(48).2025.4291
RECEIVED	08 November 2025
ACCEPTED	25 December 2025
PUBLISHED	30 December 2025
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

ANDROGENETIC ALOPECIA: A REVIEW OF CURRENT THERAPEUTIC OPTIONS

Wiktoria Auguścik *(Corresponding Author, Email: wiktoria_auguscik@wp.pl)*
District Health Center, Otwock, Poland
ORCID ID: 0009-0009-6670-1604

Katarzyna Bielawska
Grochowski Hospital, Warsaw, Poland
ORCID ID: 0009-0001-7381-8415

Aleksandra Tlak
Grochowski Hospital, Warsaw, Poland
ORCID ID: 0009-0008-2506-5309

ABSTRACT

Introduction: Androgenetic alopecia (AGA) is the most common form of hair loss, caused by a genetically determined hypersensitivity of hair follicles to dihydrotestosterone (DHT). This condition affects both sexes and significantly impacts quality of life.
Aim: The aim of this review is to present current and new therapeutic options for the treatment of androgenetic alopecia.
Methods: A literature review was conducted in PubMed, Scopus and Google Scholar databases from 2015 to 2025, covering 19 publications on pharmacotherapy, supportive and surgical methods.
Results: Minoxidil (topical and oral) and 5α-reductase inhibitors are the most effective methods. Adjunctive therapies such as platelet-rich plasma, microneedling, LLLT, and spironolactone enhance treatment efficacy. In advanced cases, hair transplantation techniques are the solution.
Conclusions: The treatment of AGA requires individualisation, combination therapy and long-term monitoring. The development of regenerative methods creates new therapeutic perspectives.

KEYWORDS

Androgenetic Alopecia, Minoxidil, Finasteride, Platelet-Rich Plasma, Hair Transplantation

CITATION

Wiktoria Auguścik, Katarzyna Bielawska, Aleksandra Tlak. (2025) Androgenetic Alopecia: A Review of Current Therapeutic Options. *International Journal of Innovative Technologies in Social Science*. 4(48). doi: 10.31435/ijitss.4(48).2025.4291

1. Introduction

Androgenetic alopecia (AGA) is the most common cause of chronic hair loss in both men and women. It is characterised by the progressive miniaturisation of hair follicles in specific areas of the scalp (Kaiser et al. 2023). The condition becomes more prevalent with age, affecting up to 50% of men over the age of 50 and up to 40% of postmenopausal women (Ntshingila et al. 2023).

The pathophysiology of AGA involves a complex interaction of genetic and hormonal factors, with dihydrotestosterone (DHT), an active metabolite of testosterone, playing a dominant role. DHT binds to androgen receptors in the hair follicles, which leads to the anagen (growth) phase being shortened and terminal hair gradually transforming into thinner vellus hair (Kaiser et al. 2023).

In women, androgenetic alopecia (female pattern hair loss, FPHL) usually progresses differently than in men. It rarely results in total hair loss, instead causing diffuse thinning in the parietal region while leaving the frontal hairline intact (Ntshingila et al. 2023).

Androgenetic alopecia is more than just an aesthetic issue. Numerous studies have demonstrated that it significantly reduces self-esteem and quality of life (Kaiser et al. 2023; Ntshingila et al. 2023).

Although AGA is not life-threatening, the condition's psychosocial significance and the difficulty in achieving a lasting therapeutic effect make finding effective treatments a continuing challenge in aesthetic dermatology and trichology. This paper reviews current and new therapeutic options for androgenetic alopecia, including topical and systemic therapies, surgical techniques, and combined strategies (Kaiser et al. 2023; Ntshingila et al. 2023).

2. Methods

A literature review was conducted in the PubMed, Scopus and Google Scholar databases, covering English-language publications from 2015 to 2025. The analysis included original clinical studies, randomised controlled trials (RCTs), meta-analyses and systematic reviews on the treatment of androgenetic alopecia in men and women.

Keywords included: androgenetic alopecia, minoxidil, finasteride, platelet-rich plasma, hair transplantation.

3. Established Therapies

3.1. Topical Minoxidil

Minoxidil is the primary drug used to treat androgenetic alopecia in both men and women (Suchonwanit et al., 2019). It works by opening potassium channels, which causes blood vessels to dilate and increases the supply of oxygen and nutrients to the hair follicles. Minoxidil sulphate is its active metabolite, which increases the production of vascular endothelial growth factor (VEGF) in dermal papilla cells, stimulating angiogenesis and prolonging the anagen phase of the hair growth cycle (Suchonwanit et al., 2019; Kaiser et al., 2023). Preparations in concentrations of 2% and 5% are available for topical use. These are alcohol-based solutions or foams. The 5% preparation is more effective, as it increases hair density by approximately 15-20% after 24 weeks of continuous use. However, it causes more severe local irritation and itching (Koralewicz et al., 2024). Foam preparations are better tolerated because they do not contain propylene glycol and cause fewer contact dermatitis reactions. This encourages patients to comply with the recommendations (Koralewicz et al., 2024). The preferred concentration for male patients is 5% minoxidil, applied once or twice a day. However, for women, 2% minoxidil is often recommended to minimise the risk of excessive hair growth. Clinical improvement is observed in 60-70% of users, with noticeable hair regrowth occurring after three to six months of treatment. Unfortunately, the preparation must be used continuously for a long time, as discontinuation of treatment leads to hair loss within a few months (Suchonwanit et al., 2019; Kaiser et al., 2023; Koralewicz et al., 2024).

3.2. Oral Minoxidil (Low-Dose Oral Minoxidil, LDOM)

Low-dose oral minoxidil (LDOM) is an effective treatment option for patients who do not respond to or cannot tolerate topical preparations (Gupta et al., 2023; Kaiser et al., 2023). Oral minoxidil has the same biological effect as topical minoxidil. It opens ATP-sensitive potassium channels, leading to improved blood flow around the hair follicles and stimulation of dermal papilla cell activity. Systemic administration avoids variability in topical absorption and increases compliance with therapeutic recommendations (Gupta et al., 2023). Therapeutic doses typically range from 0.25 to 5 mg per day, depending on gender, tolerance, and response. Randomised and observational studies have demonstrated a significant improvement in hair density

and thickness after 24 weeks of treatment. These results are comparable to those obtained with 5% topical minoxidil (Penha et al., 2024). A randomised clinical trial conducted on men with androgenetic alopecia confirmed that an oral preparation at a dose of 5 mg per day is as effective as a 5% topical solution applied twice a day. Both types of treatment provide a similar level of patient satisfaction (Penha et al., 2024). The most common side effect, affecting 20–30% of patients (mainly women), is excessive hair growth. Other occasional side effects include peripheral oedema, orthostatic hypotension, and tachycardia. These usually resolve after a reduction in dosage or discontinuation of the drug (Gupta et al., 2023). Severe cardiovascular adverse effects are rarely observed at low doses; however, patients with existing heart disease require continuous monitoring. Combination therapy involving low-dose oral minoxidil (LDOM) or topical minoxidil in conjunction with 5α-reductase inhibitors enhances efficacy without substantially exacerbating adverse effects (Gupta et al., 2023; Penha et al., 2024; Kaiser et al., 2023). In summary, low-dose oral minoxidil appears to be a promising, well-tolerated option for treating androgenetic alopecia systemically (Gupta et al., 2023; Penha et al., 2024).

3.3 Finasteride and Dutasteride

Finasteride and dutasteride are oral inhibitors of 5α-reductase, an enzyme which converts testosterone into dihydrotestosterone (DHT). DHT is a key androgen involved in the miniaturisation of scalp hair follicles in androgenetic alopecia (Estill et al., 2023). Finasteride selectively inhibits type II 5α-reductase, which is predominant in hair follicles. In contrast, dutasteride blocks both type I and type II isoenzymes. This results in greater reductions in serum and scalp DHT levels (Shanshanwal et al., 2017; Sereepanpanich et al., 2025). Clinical studies have demonstrated that a daily dose of 1 mg of finasteride can stabilise hair loss in around 80–90% of men and promote visible hair regrowth in around 60% of patients after 6–12 months of treatment (Estill et al., 2023; Kaiser et al., 2023). When administered at a dose of 0.5 mg daily, dutasteride reduces serum DHT levels by over 90%, compared to around 70% for finasteride (Shanshanwal et al., 2017; Sereepanpanich et al., 2025). A recent randomised, blinded pilot study confirmed that intermittent dosing of dutasteride (two or three times per week) produces similar or better clinical outcomes than daily finasteride dosing. The safety profile was comparable (Sereepanpanich et al., 2025). Both drugs are well tolerated. However, mild and reversible sexual dysfunction (decreased libido and erectile dysfunction) has been reported in 2–4% of cases (Estill et al., 2023). Psychological side effects are rare, but they should be discussed with patients before therapy begins. 5α-reductase inhibitors are not recommended for women of childbearing age due to teratogenic risks. Nevertheless, they have been shown to be beneficial for postmenopausal women with androgenetic alopecia when used alongside topical minoxidil or antiandrogens such as spironolactone (Kaiser et al., 2023). Both finasteride and dutasteride are used to treat AGA. Dutasteride is slightly more effective and has a more flexible dosing schedule. However, adequate patient education and monitoring for potential adverse effects are required (Estill et al., 2023; Shanshanwal et al., 2017; Sereepanpanich et al., 2025; Kaiser et al., 2023).

Table 1. Established therapies for androgenetic alopecia

Therapy	Mechanism of action	Clinical efficacy	Common adverse effects	References
Topical minoxidil	Potassium channel activation, improved scalp microcirculation, prolongation of anagen phase	Increased hair density after 3–6 months of regular use	Scalp irritation, itching, scaling	(Suchonwanit et al. 2019; Koralewicz et al. 2024)
Oral minoxidil (LDOM)	Vasodilation, stimulation of follicular growth	Comparable efficacy to topical formulation	Hypertrichosis, edema, tachycardia	(Gupta et al. 2023; Penha et al. 2024)
Finasteride	Type II 5α-reductase inhibition → reduced DHT levels	Stabilization of hair loss in most patients, regrowth in ~60%	Decreased libido, erectile dysfunction	(Estill et al. 2023; Shanshanwal et al. 2017)
Dutasteride	Type I and II 5α-reductase inhibition → stronger DHT suppression	Higher efficacy than finasteride, even with twice- or thrice-weekly dosing	Sexual dysfunction (less frequent than finasteride)	(Shanshanwal et al. 2017, Sereepanpanich et al. 2025)

Source: author's own elaboration based on literature (Suchonwanit et al. 2019; Koralewicz et al. 2024; Gupta et al. 2023; Penha et al. 2024; Estill et al. 2023; Shanshanwal et al. 2017; Sereepanpanich et al. 2025)

4. New and supportive therapies

4.1. Platelet-rich plasma (PRP)

Platelet-rich plasma (PRP) therapy is becoming an increasingly popular regenerative treatment for androgenetic alopecia. PRP is an autologous platelet concentrate suspended in a small volume of plasma that is rich in bioactive growth factors. These growth factors include platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), transforming growth factor beta (TGF-β) and insulin-like growth factor 1 (IGF-1). These factors play a pivotal role in promoting hair follicle proliferation and neovascularisation (Müller Ramos et al., 2023; Kaiser et al., 2023). They stimulate dermal papilla cells, prolong the anagen phase, and counteract hair follicle miniaturisation. Numerous clinical studies and meta-analyses have demonstrated the efficacy of PRP therapy in significantly increasing hair density, thickness, and shaft diameter in individuals with androgenetic alopecia (AGA), including both men and women (Müller Ramos et al., 2023). Standard treatment protocols typically involve three to four sessions performed at monthly intervals, followed by maintenance treatments every 4–6 months. Objective trichoscopic measurements have shown an increase in hair density of 10–25% and an improvement in follicular diameter after three to four treatment cycles (Müller Ramos et al., 2023; Pillai et al., 2021). PRP therapy is most effective when combined with minoxidil or 5α-reductase inhibitors (Kaiser et al., 2023). The procedure is minimally invasive and well tolerated. The most commonly reported transient reactions are pain, erythema, and mild swelling. However, the lack of standardised protocols regarding platelet concentration, activation methods, and injection frequency remains a limitation. Therefore, future studies should focus on optimising these parameters to ensure reproducibility and long-term efficacy in different patient populations (Müller Ramos et al., 2023; Kaiser et al., 2023).

4.2. Low-level laser therapy (LLLT)

Low-level laser therapy (LLLT) is a non-invasive method of stimulating hair follicle growth. It involves the use of monochromatic red or near-infrared light, typically with wavelengths of 630–680 nm or 810–850 nm. This process is based on photobiomodulation, whereby photons are absorbed by cytochrome c oxidase within the mitochondrial respiratory chain. This increases adenosine triphosphate (ATP) production and the level of reactive oxygen species to subcytotoxic levels, thereby activating transcription factors that promote dermal papilla cell proliferation and survival (Pillai et al., 2021; Kaiser et al., 2023). LLLT has been shown to prolong the anagen phase of the hair cycle, improve blood flow around the hair follicles and boost growth factors, such as vascular endothelial growth factor (VEGF) and hepatocyte growth factor (HGF), that contribute to hair follicle regeneration. Clinical studies confirm its effectiveness in treating male and female pattern hair loss. LLLT is effective both as a stand-alone therapy and in combination with topical or oral treatments (Sonda et al., 2023; Martínez-Pizarro et al., 2021). Randomised controlled trials have demonstrated an increase in hair density of 10–20% and improved hair shaft thickness after 16–24 weeks of regular use (Pillai et al., 2021; Sonda et al., 2023). Devices include laser combs, helmets and caps, which are usually used three times a week for 15–20 minutes per session. Combined protocols combining LLLT with the topical application of minoxidil or PRP have demonstrated accelerated visible hair regrowth and a synergistic effect compared to monotherapy (Kaiser et al., 2023). Side effects are rare and mild. They are usually limited to transient erythema or itching of the scalp. Due to its safety, ease of use at home, and lack of systemic side effects, low-level laser therapy (LLLT) is considered a valuable adjunctive treatment for androgenetic alopecia, as well as a potential maintenance therapy following pharmacological or surgical interventions (Pillai et al., 2021; Martínez-Pizarro et al., 2021; Sondağ et al., 2023).

4.3. Microneedling

Microneedling is a minimally invasive technique involving the pricking of the skin with thin needles at depths of between 0.5 and 2.5 mm. This triggers the release of various growth factors, including platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF) and fibroblast growth factor (FGF). These factors then stimulate the activation of stem cells around the hair follicles, thereby promoting hair follicle regeneration (Dhurat et al., 2013; Kumar et al., 2018; Kaiser et al., 2023). The mechanical microtrauma caused by microneedling also increases the permeability of the stratum corneum, significantly improving the transdermal absorption of topical medications such as minoxidil. Numerous clinical studies have demonstrated that combination therapy achieves significantly better outcomes than minoxidil monotherapy alone (Dhurat et al., 2013; Kumar et al., 2018). For instance, a randomised, blind study by Dhurat et al. (2013) found that patients undergoing weekly microneedling and applying 5% topical minoxidil experienced a fourfold increase

in average hair count after 12 weeks, compared to those using minoxidil alone. Similarly, Kumar et al. (2018) confirmed that the combined treatment protocol resulted in greater improvement in hair density and patient satisfaction, with visible results typically observed within three months. Microneedling is generally well tolerated. The most common side effects are transient erythema, mild discomfort, and occasional pinpoint bleeding, all of which resolve within 24–48 hours. Proper technique and aseptic conditions are essential to minimise complications such as infection or post-inflammatory hyperpigmentation. Due to its simplicity, low cost, and potential for synergistic effects with pharmacological therapies, microneedling has become an increasingly popular adjunctive treatment for androgenetic alopecia. Ongoing research aims to standardise protocols concerning the depth, frequency and combination of needles to optimise therapeutic outcomes (Dhurat et al., 2013; Kumar et al., 2018; Kaiser et al., 2023).

4.4. Spironolactone

Spironolactone is a potassium-sparing diuretic that also has antiandrogenic properties. It has become an important systemic treatment option for women with androgenetic alopecia, also known as female pattern hair loss (FPHL). It primarily acts as an androgen receptor antagonist, competitively inhibiting the binding of dihydrotestosterone (DHT) and testosterone at receptor sites in target tissues, including hair follicles. Spironolactone also inhibits androgen production by the ovaries and adrenal glands while increasing testosterone metabolism. This results in a reduction in blood androgen levels (Aleissa et al., 2023; Kaiser et al., 2023). Typical therapeutic doses range from 25 to 200 mg per day, adjusted according to tolerance and response to treatment. Clinical studies have demonstrated the efficacy of oral spironolactone in reducing hair loss and increasing hair density in women, particularly those with hyperandrogenism symptoms or postmenopausal hair loss. A 2023 systematic review and meta-analysis reported significant improvements in overall photographic ratings and patient satisfaction after 6–12 months of continuous treatment (Aleissa et al., 2023). Recent randomised controlled trials have confirmed the drug's safety and efficacy profile. For example, in a 2025 double-blind, placebo-controlled study involving premenopausal women, a daily dose of 100 mg of spironolactone resulted in a notable decrease in hair loss and an increase in hair thickness compared to the placebo group, with few systemic side effects (Werachattawatchai et al., 2025). Spironolactone is generally well tolerated, with the most common side effects being breast tenderness, irregular menstruation, fatigue and mild hypotension. Due to its teratogenic potential, effective contraception is necessary for women of childbearing age. Individuals receiving long-term treatment should have their serum potassium and renal function monitored; however, hyperkalaemia is rare at standard dermatological doses (Aleissa et al., 2023). Spironolactone is an effective antiandrogen therapy for women with androgenetic alopecia, offering a combination of safety, affordability and efficacy, particularly when used alongside topical or low-dose oral minoxidil (Kaiser et al., 2023). Its good tolerability makes the drug suitable for long-term use and maintenance therapy.

Table 2. Emerging and adjunctive therapies for androgenetic alopecia

Therapy	Mechanism of action	Clinical effect	Common adverse effects	References
Platelet-rich plasma (PRP)	Growth factors (PDGF, VEGF, IGF-1) stimulating follicular proliferation	Improved hair density and thickness after 3–4 sessions	Pain, erythema, local swelling	(Müller Ramos et al. 2023)
Low-level laser therapy (LLLT)	Stimulation of mitochondrial activity, prolongation of the anagen phase	10–20% hair density increase after 16–24 weeks	No significant adverse events	(Pillai et al. 2021; Sondagr et al. 2023; Martinez-Pizarro et al. 2021)
Microneedling	Induction of growth factors, enhanced topical drug absorption	Improved outcomes when combined with minoxidil	Temporary erythema, mild discomfort	(Dhurat et al. 2013; Kumar et al. 2018)
Spironolactone (women)	Androgen receptor blockade, inhibition of DHT action	Reduced hair shedding and increased density after 6–12 months	Breast tenderness, menstrual irregularities	(Aleissa et al. 2023; Werachattawatchai et al. 2025).

Source: author's own elaboration based on literature (Müller Ramos et al. 2023; Pillai et al. 2021; Sondagr et al. 2023; Martinez-Pizarro et al. 2021; Dhurat et al. 2013; Kumar et al. 2018; Aleissa et al. 2023; Werachattawatchai et al. 2025).

5. Surgical and regenerative therapies

For advanced stages of androgenetic alopecia, hair transplantation is the most effective treatment. This involves transferring hair follicles from androgen-resistant areas of the scalp, typically the occipital and parietal regions, to areas affected by miniaturisation (Razmi et al., 2022; Wang et al., 2024).

There are currently two basic techniques: follicular unit transplantation (FUT) and follicular unit extraction (FUE). FUT, also known as the 'strip method', involves excising a narrow strip of scalp tissue from the donor area. This tissue is then dissected under magnification into individual follicular units and implanted into the recipient sites. This technique enables a large number of grafts to be transplanted in a single session; however, it can unfortunately cause a linear scar and a slightly longer recovery period (Razmi et al., 2022).

In contrast, FUE involves harvesting follicular units individually using small punches (0.7–1.0 mm in diameter), leaving no visible linear scar. It is currently considered the gold standard in hair restoration surgery, offering shorter healing times, less postoperative discomfort, and better aesthetic results (Wang et al., 2024). Studies indicate that graft survival exceeds 90% with experienced surgeons. Minor complications are common and include temporary swelling, folliculitis and hypopigmentation of the donor area. These usually resolve spontaneously (Razmi et al., 2022; Wang et al., 2024).

Recent advances in regenerative medicine have opened up new possibilities for the surgical treatment of AGA. Stem cell-based therapies, platelet-rich fibrin matrices and in vitro hair follicle organoid cultures are being investigated to increase graft survival, stimulate natural hair follicle regeneration and potentially replace traditional transplantation techniques (Razmi et al., 2022; Kaiser et al., 2023). Preliminary results suggest that dermal papilla cell transplantation and adipose-derived stem cell (ADSC) injections could stimulate dormant hair follicles, thereby increasing hair density and thickness. However, these methods are still in the experimental phase and require validation in clinical trials (Wang et al., 2024).

Overall, surgical hair restoration, particularly the follicular unit extraction (FUE) method, remains the most effective option for patients with extensive androgenetic alopecia who do not respond sufficiently to pharmacological treatment. Incorporating regenerative agents, such as stem cells, platelet concentrates, or bioengineered follicular units, into AGA therapy could bridge the gap between traditional surgery and biological regeneration (Razmi et al., 2022; Wang et al., 2024; Kaiser et al., 2023).

6. Discussion

Despite advances in research, the treatment of androgenetic alopecia remains a therapeutic challenge. The most effective treatments are minoxidil (topical and oral) and 5α-reductase inhibitors, which form the basis of therapy. While oral minoxidil may facilitate compliance with recommendations, it requires constant monitoring due to the risk of systemic effects. Dutasteride is more effective than finasteride in men, while spironolactone or low doses of oral minoxidil are better options for women. Supportive methods such as platelet-rich plasma therapy, microneedling and low-energy laser therapy can increase the effectiveness of pharmacological treatment, but the protocols require standardisation. Hair transplantation, especially the FUE technique, remains an effective option for advanced cases. Meanwhile, research into cell and regenerative therapies is opening up new prospects for the future. Effective treatment of AGA requires a personalised approach, combining various methods, and long-term cooperation between patient and doctor.

7. Conclusions

Androgenetic alopecia is the most common form of hair loss and has significant aesthetic and psychosocial implications. The most effective treatments are pharmacological therapies, such as topical and oral minoxidil and 5α-reductase inhibitors, which form the basis of treatment for both men and women. Supportive methods such as platelet-rich plasma therapy, low-level light therapy, microneedling and spironolactone expand therapeutic possibilities and improve outcomes. In advanced cases, hair transplantation is still an effective option, and regenerative techniques under development could transform the treatment of androgenetic alopecia in the future. An effective approach to AGA therapy requires a personalised combination of methods and ongoing cooperation between patient and doctor.

Disclosure

Author Contributions

Conceptualization: Wiktoria Auguścik
Methodology: Aleksandra Tlak
Formal analysis: Katarzyna Bielawska
Validation: Aleksandra Tlak
Investigation: Katarzyna Bielawska
Resources: Wiktoria Auguścik
Writing -rough preparation: Wiktoria Auguścik
Writing -review and editing: Katarzyna Bielawska
Visualization: Aleksandra Tlak
Supervision: Katarzyna Bielawska
Project administration: Wiktoria Auguścik

All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding
Institutional Review Board Statement: Not applicable.
Informed Consent Statement: Not applicable.
Data Availability Statement: Data sharing is not applicable to this article.
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Aleissa M. The Efficacy and Safety of Oral Spironolactone in the Treatment of Female Pattern Hair Loss: A Systematic Review and Meta-Analysis. Cureus 2023;15:e43559. https://doi.org/10.7759/cureus.43559
2. Dhurat R, Sukesh M, Avhad G, Dandale A, Pal A, Pund P. A randomized evaluator blinded study of effect of microneedling in androgenetic alopecia: a pilot study. Int J Trichology 2013;5:6–11. https://doi.org/10.4103/0974-7753.114700
3. Estill MC, Ford A, Omeira R, Rodman M. Finasteride and dutasteride for the treatment of male androgenetic alopecia: A review of efficacy and reproductive adverse effects. Georgetown Medical Review 2023;7. https://doi.org/10.52504/001c.88531
4. Gupta AK, Talukder M, Shemer A, Piraccini BM, Tosti A. Low-Dose Oral Minoxidil for Alopecia: A Comprehensive Review. Skin Appendage Disord 2023;9:423–37. https://doi.org/10.1159/000531890
5. Kaiser M, Abdin R, Gaumond SI, Issa NT, Jimenez JJ. Treatment of androgenetic alopecia: current guidance and unmet needs. Clin Cosmet Investig Dermatol 2023;16:1387–406. https://doi.org/10.2147/CCID.S385861
6. Ntshingila S, Oputu O, Arowolo AT, Khumalo NP. Androgenetic alopecia: An update. JAAD International 2023;13:150–8. https://doi.org/10.1016/j.jdin.2023.07.005
7. Suchonwanit P, Thammarucha S, Leerunyakul K. Minoxidil and its use in hair disorders: a review. Drug Des Devel Ther 2019;13:2777–86. https://doi.org/10.2147/DDDT.S214907
8. Koralewicz MM, Szatkowska OA. Topical solutions for androgenetic alopecia: evaluating efficacy and safety. Forum Dermatologicum 2024;10:71–8. https://doi.org/10.5603/fd.101208
9. Kumar MK, Inamadar AC, Palit A. A Randomized Controlled, Single-Observer Blinded Study to Determine the Efficacy of Topical Minoxidil plus Microneedling versus Topical Minoxidil Alone in the Treatment of Androgenetic Alopecia. J Cutan Aesthet Surg 2018;11:211–6. https://doi.org/10.4103/JCAS.JCAS_130_17
10. Martínez-Pizarro S. Low-level laser therapy for androgenetic alopecia. Actas Dermo-Sifiliográficas (English Edition) 2021;112:99–102. https://doi.org/10.1016/j.adengl.2020.03.017
11. Müller Ramos P, Melo DF, Radwanski H, de Almeida RFC, Miot HA. Female-pattern hair loss: therapeutic update. An Bras Dermatol 2023;98:506–19. https://doi.org/10.1016/j.abd.2022.09.006
12. Penha MA, Miot HA, Kasprzak M, Müller Ramos P. Oral minoxidil vs topical minoxidil for male androgenetic alopecia: A randomized clinical trial. JAMA Dermatol 2024;160:600–5. https://doi.org/10.1001/jamadermatol.2024.0284
13. Pillai JK, Mysore V. Role of Low-Level Light Therapy (LLLT) in Androgenetic Alopecia. J Cutan Aesthet Surg 2021;14:385–91. https://doi.org/10.4103/JCAS.JCAS_218_20
14. Razmi Tm, Subburaj K. Hair transplantation: A brief review. Clin Dermatol Rev 2022;6:80. https://doi.org/10.4103/cdr.cdr_76_21

15. Sereepanpanich V, Khunkhet S, Rojhirunsakool S, Udompataikul M. Efficacy and safety of twice- or thrice-weekly dutasteride versus daily finasteride in men with androgenetic alopecia: A randomized, investigator-blinded, active-controlled, parallel-group pilot study. JAAD International 2025;23:69–76. https://doi.org/10.1016/j.jdin.2025.08.009
16. Shanshanwal SJS, Dhurat RS. Superiority of dutasteride over finasteride in hair regrowth and reversal of miniaturization in men with androgenetic alopecia: A randomized controlled open-label, evaluator-blinded study. Indian J Dermatol Venereol Leprol 2017;83:47–54. https://doi.org/10.4103/0378-6323.188652
17. Sondagar DM, Mehta HH, Agharia RS, Jhavar MK. Efficacy of Low-Level Laser Therapy in Androgenetic Alopecia - A Randomized Controlled Trial. Int J Trichology 2023;15:25–32. https://doi.org/10.4103/ijt.ijt_5_22
18. Wang F, Chen Y, Yang C, Li C, Zhang H, He J, et al. Using the follicular unit extraction technique in treatment of male androgenetic alopecia. BMC Surg 2024;24:358. https://doi.org/10.1186/s12893-024-02655-1
19. Werachattawatchai P, Khunkhet S, Harnchoowong S, Lertphanichkul C. Efficacy and safety of oral spironolactone for female pattern hair loss in premenopausal women: a randomized, double-blind, placebo-controlled, parallel-group pilot study. Int J Womens Dermatol 2025;11:e227. https://doi.org/10.1097/JW9.0000000000000227