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Management of Androgenetic Alopecia in Men in 2025: A Focused Review

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Androgenetic alopecia (AGA) affects a significant portion of the male population, with studies estimating that approximately 50% of men will experience some degree of AGA by the age of 50.[1] This condition can lead to significant psychological distress and a reduced quality of life.

Recent advancements in understanding the multifactorial etiology of AGA have led to the development of new treatment strategies. This review provides an overview of the currently available treatments for AGA in men.

Topical Formulations

Topical Minoxidil

Topical minoxidil remains a cornerstone in the management of androgenetic alopecia (AGA). To date, topical minoxidil is the only Food and Drug Administration (FDA)-approved treatment for hair loss in both men and women. Minoxidil achieves its therapeutic effect through its vasodilatory, anti-inflammatory, and anti androgen properties, as well as by inducing the Wnt/B-catenin pathway.

When comparing its efficacy by concentration, 5% topical minoxidil applied twice daily was found to be superior compared to the application of 1%, 2%, and 10% solutions twice daily. When comparing the vehicles employed for delivery of topical minoxidil, the gel was found to be equivalent to the solution, while the foam resulted in significantly lower rates of local intolerance, such as pruritus and dandruff. This is likely due to the absence of propylene glycol in the foam formulation.[2-7]

Topical Finasteride

A recent randomized controlled trial examined the efficacy and safety profile of topical finasteride compared to both the oral version and a placebo. The study's findings demonstrated significantly increased hair densities after 24 weeks of 0.25% topical finasteride compared to the placebo, with no significant differences compared to 1 mg of oral finasteride. Moreover, topical finasteride had fewer treatment-related sexual adverse events than the oral formulation.[8]

Compounded Formulations

Many studies have also looked at compounded formulations that combine minoxidil with other ingredients thought to improve hair growth. The addition of 0.01% tretinoin or 1% pyrithione zinc shampoo did not show increased efficacy when compared to minoxidil monotherapy.[9,10] However, the combination of topical finasteride (0.25%) with minoxidil (5%) provided superior efficacy in treating AGA compared to using either topical minoxidil or topical finasteride alone.[11]

Topical Ketoconazole

In addition to its anti-fungal effects, ketoconazole has anti-inflammatory and anti-androgenetic effects which may help in the treatment of AGA. A systematic review looking at topical ketoconazole for the treatment of AGA identified 2 animal studies and 5 human studies, for a total of 318 participants. The murine studies demonstrated a significant increase in hair regrowth in the ketoconazole treatment groups compared to controls, while the human studies reported an increase in hair shaft diameter following ketoconazole use.[12] One study of 100 male patients with AGA included 4 treatment groups: **1)** 1 mg oral finasteride daily, **2)** 1 mg oral finasteride daily with minoxidil 2% solution twice daily, **3)** 2% minoxidil twice daily, and **4)** 1 mg oral finasteride daily with 2% ketoconazole shampoo 3 times weekly. Ten patients were treated with ketoconazole. The patients were assessed every 3 months for 1 year. The highest mean score of hair growth was observed when finasteride was combined with either minoxidil or ketoconazole, with no significant difference between these 2 groups. No significant side effects were reported. Although further studies are needed, overall, ketoconazole seems to be a low-risk addition to the treatment regimen for any patient with AGA.[13]

Oral Formulations

Oral Minoxidil

A 2022 *New York Times* article on oral minoxidil sparked significant interest in this treatment option. In fact, a study published in The Journal of the American Medical Association (JAMA) Network Open observed a notable rise in prescriptions for oral minoxidil, with a significant increase recorded 8 weeks after the article's release.[14]

A 2024 study published in JAMA Dermatology compared the effects of 5 mg oral minoxidil with 5% topical minoxidil applied twice daily for 24 weeks in 90 male participants with AGA. The study confirmed that oral minoxidil was not inferior to the topical solution, with both treatments showing a similar safety profile and well-tolerated side effects. While oral minoxidil showed a trend toward greater improvement, with photographic analysis indicating that it was superior to topical minoxidil on the vertex but not on the frontal scalp, the difference was not statistically significant, and superiority could not be established. The most common side effects in the oral minoxidil group were hypertrichosis (49% of patients) and headaches (14% of patients).[15]

Although rare, pericardial effusion has been identified as a potential side effect of oral minoxidil, regularly causing many patients to reconsider taking the medication. This condition is believed to be caused by fluid retention and altered hemodynamics, with the risk being higher at doses between 10–40 mg, particularly in patients with pre-existing cardiovascular conditions. However, a recent study published in the Journal of Drugs in Dermatology (JDD) involving 100 participants, 51 of whom were using low-dose oral minoxidil, found no significant difference in the prevalence of small, asymptomatic pericardial effusions compared to the control group. This finding is reassuring

that low-dose oral minoxidil has a low side effect profile.[16]

Sublingual minoxidil (SM) has emerged as an alternative to oral minoxidil. This formulation bypasses first-pass metabolism, potentially reducing systemic side effects, as hepatic sulfation enhances this drug's cardiovascular effects. Furthermore, SM might achieve therapeutic effects at lower doses compared to oral minoxidil. A Phase 1B trial evaluated the efficacy of 0.45, 1.35, and 4.05 mg daily doses of SM in 40 participants (male and female) with AGA over 24 weeks. The results showed a significant increase in hair density and terminal hair count in both the frontal and vertex scalp regions compared to placebo, with mild side effects such as dizziness and postural hypotension.[17] A more recent double-blind, randomized, clinical trial compared 5 mg of SM per day versus 5 mg of oral minoxidil daily for 24 weeks in 110 males with AGA. The study found that 5 mg of SM per day did not demonstrate superiority over 5 mg of oral minoxidil per day in treating male AGA. Both treatments were well tolerated, with less frequent palpitations in the SM group.[18]

Oral Dutasteride and Finasteride

The conversion of testosterone to dihydrotestosterone (DHT) by the enzyme 5-alpha-reductase plays a critical role in the development of AGA. Both dutasteride and finasteride function as anti androgens by blocking 5-alpha-reductase, however, dutasteride inhibits both the type I and type II isoforms, while finasteride targets only the type II isoform.

In 1997, finasteride received approval to treat male pattern hair loss at a reduced dose of 1 mg and continues to be the only FDA approved oral treatment for this condition. However, clinicians have been increasingly using oral dutasteride off-label for hair loss. Recently, Japan and South Korea have approved oral dutasteride (0.5 mg/day) for male AGA. Given its broader inhibition of both 5-alpha-reductase isoforms, some have suggested that dutasteride may be more effective than finasteride for treating hair loss.[19]

A meta-analysis evaluating the efficacy and safety of dutasteride and finasteride in treating men with AGA over a 24-week treatment cycle concluded that dutasteride seems to provide a better efficacy compared with finasteride in treating AGA and that the 2 drugs appear to show similar rates of adverse reactions, especially regarding sexual dysfunction.[20]

There is a theoretical concern that using 5-alpha-reductase inhibitors may hinder the early detection of prostate cancer, as these medications reduce the levels of prostate cancer markers. Therefore, the author recommends a baseline prostate specific antigen (PSA) level in patients prior to starting this class of medications. Moreover, the long term effects of anti-androgens in men, beyond sexual side effects, are poorly understood. Although there is a lack of strong evidence, many studies caution regarding risk of metabolic and bone health risks with long term use.[21]

In-office Physical Modalities

Platelet-Rich Plasma (PRP) Therapy

PRP therapy has gained popularity as a regenerative treatment for AGA. **Figure 1** shows a PRP system. The procedure involves collecting a patient's own blood, processing it to concentrate platelets, and injecting this plasma into the scalp. The platelets release growth factors and cytokines that promote cell proliferation, differentiation, and angiogenesis, which are essential for hair follicle regeneration. Furthermore, PRP contains insulin-like growth factor 1 (IGF-1), which can reduce the inhibitory effects of DHT on hair growth.

A systematic review and meta-analysis of 9 randomized controlled trials with 238 participants investigated the effects of PRP on hair density and hair diameter in AGA. The analysis found that PRP significantly increased hair density at 3 and 6 months compared to placebo injections ($P < 0.05$). However, while PRP also improved hair diameter compared to baseline, there were no significant differences compared to the placebo ($P > 0.05$). No serious side effects were observed.[22]

However, PRP monotherapy is likely not the most effective approach for managing AGA. A randomized, double-blind, placebo-controlled trial involving 80 male patients with AGA found

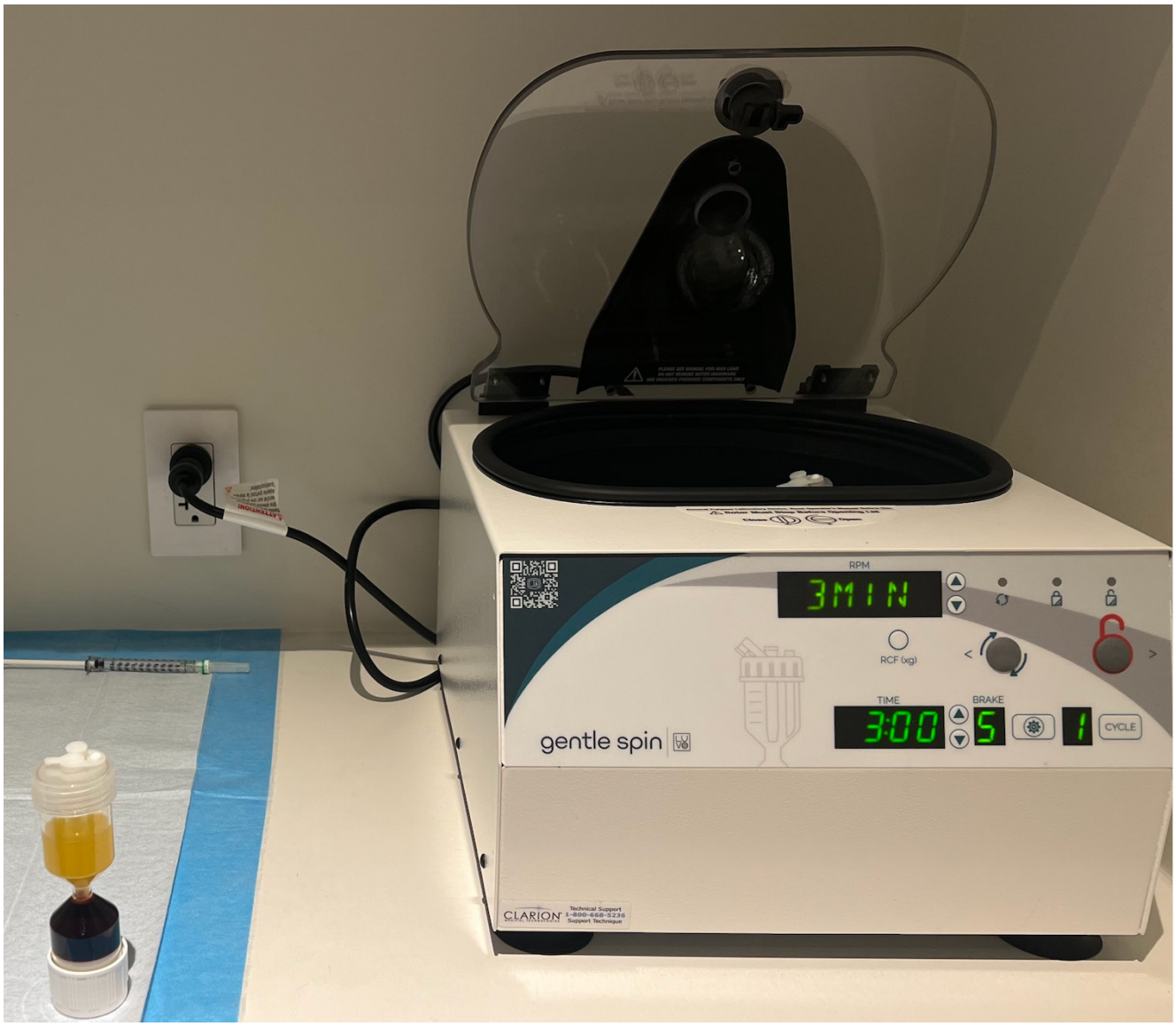

Figure 1. A platelet-rich plasma (PRP) therapy setup: Multiple systems are available. The author is currently using the WorldPRP© system by Clarion Medical Technologies, which yields approximately 6 mL of 3.5X concentrated PRP per 23 mL blood draw; *courtesy of Hanieh Zargham, MD, FRCPC.*

the greatest improvement in hair density when PRP was combined with twice-daily application of 5% topical minoxidil. This was followed by PRP alone, with minoxidil alone showing the least improvement.[23]

An issue regarding the use of PRP for AGA is the lack of a standard dose or protocol. Further studies and trials are needed to establish these parameters. Currently, PRP injections are typically administered once a month for 3–5 consecutive months, then every 4–6 months for ongoing maintenance to sustain results.

Dutasteride Mesotherapy

Dutasteride mesotherapy has also emerged as a potential treatment for AGA, offering an alternative to oral dutasteride or finasteride by delivering the drug directly into the scalp. This localized treatment approach enhances the efficacy of the drug while minimizing systemic side effects.

A multicenter retrospective study involving 541 patients with AGA assessed the safety and effectiveness of 0.01% dutasteride mesotherapy. Patients received intradermal injections of dutasteride every 3 months for a year. After 1 year, 38.4% of the 86 patients evaluated showed marked clinical improvement. The most common side effect was mild, transient pain at the injection site, with no serious or sexual side effects reported.[24]

A clinical trial involving 90 men with AGA compared the efficacy of 0.005% dutasteride alone, 0.05% dutasteride combined with dexpanthenol, biotin, and pyridoxine, and a control group that received physiological saline. The group treated with 0.05% dutasteride combined with the vitamin solution showed a significant increase in hair follicles in the anagen phase, although the contribution of the additional vitamins could not be excluded.[25]

Conclusion

Given the widespread prevalence of AGA and its significant impact on patients' quality of life, it is crucial for dermatologists to have access to a diverse range of effective, evidence-based treatment options. While this review provides an overview of various treatment modalities—ranging from topical and oral therapies to in-office physical procedures—it is not exhaustive. Although we currently have a variety of promising treatments, continued research is essential to refine existing therapies and expand our options for managing AGA.

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