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### A review on comprehensive management of Androgenic Alopecia Aditya Nandi\*, Bilash Nath, Dayal Krishna Hazarika, Chayanika Gogoi, Hemanta Kr. Gogoi, Priyanka Boruah, Dr. Rajesh Jesudasan

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#### Abstract:

Androgenetic alopecia (AGA) is a common problem where people experience gradual hair loss, especially on the scalp. Men and women both experience it, but the most severe hair loss happens in the middle of the scalp. It often starts during puberty and can really affect how someone feels about themselves and their life. However, there are not many approved treatments available for it. Some products claim to help with hair loss, but not all of them have been proven to work. Right now, minoxidil and finasteride are approved by the Food and Drug Administration (FDA) for treating androgenetic alopecia. Additionally, the HairMax LaserComb, which has FDA clearance, is recognized by the FDA as a treatment option for this condition.

**Keywords:** Androgenetic alopecia, minoxidil, finasteride, herbal treatments

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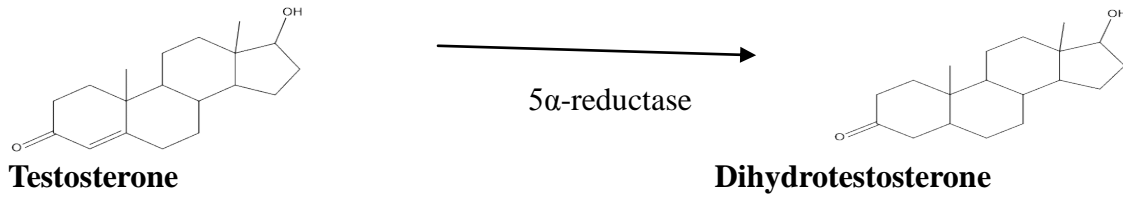
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## 1 Introduction:

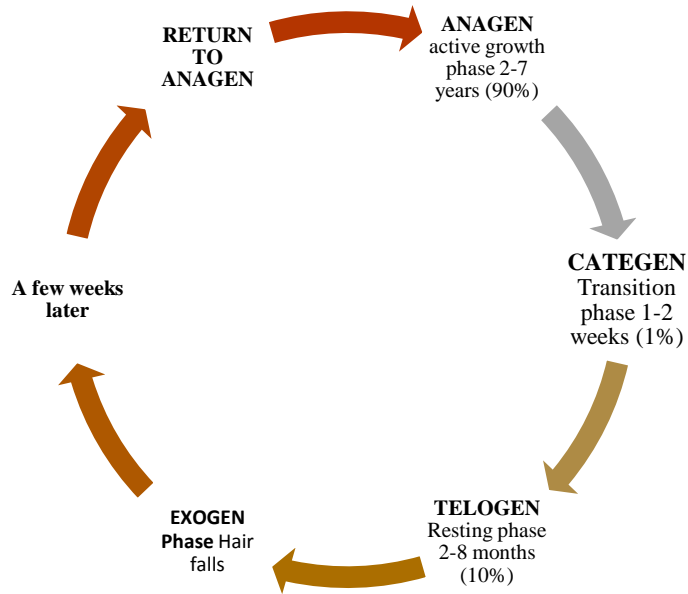
Male and female pattern baldness, or androgenetic alopecia (AGA), is defined by the hair follicles' gradual shrinkage without scarring, adhering to a distinctive distribution pattern in susceptible individuals of all genders. It stands out as a top reason prompting consultations regarding hair concerns.(Kelly et al., 2016)In 1960, Norman Orentreich coined the term AGA.Between the ages of 30 and 65 is when the prevalence peaks., with the initial signs of AGA typically appearing post-puberty.(Dhariwala& Ravikumar, 2019) Comparable prevalence rates are noted across diverse populations, although there are slight variations.Androgenetic alopecia affects roughly 57% of women and 73% of men over the age of 80, with 58% of men above 50 years old being impacted by the condition.(Dhariwala& Ravikumar, 2019) We usually don't expect to see AGA in kids before puberty unless they have high levels of androgen hormones.(Alves, 2017) Research has been carried out on these treatments; however, as far as we are aware, there hasn't been a meta-analysis compiling the efficiency of these procedures in treating androgenetic alopecia. (Adil & Godwin, 2017)The FDA has approved finasteride and minoxidil for the treatment of hair lossand the only product that the FDA has given the go-ahead for treating AGA is the Lasermax Haircomb.(Kaiser et al., 2023)Finasteride is a type II inhibitor of 5-alpha-reductase that decreases the conversion of testosterone to dihydrotestosterone (DHT), which is a more bioactive metabolite. As a dual type I and type II 5-alpha-reductase inhibitor, dutasteride has outperformed finasteride in Phase II trials; nevertheless, there is a dearth of information from Phase III trials. These medications work well to stop hair loss, but they can only partially regenerate hair. The treatment of early androgenetic alopecia is where they are most helpful.(Rebora, 2004)

### 1.1 Androgenic Alopecia

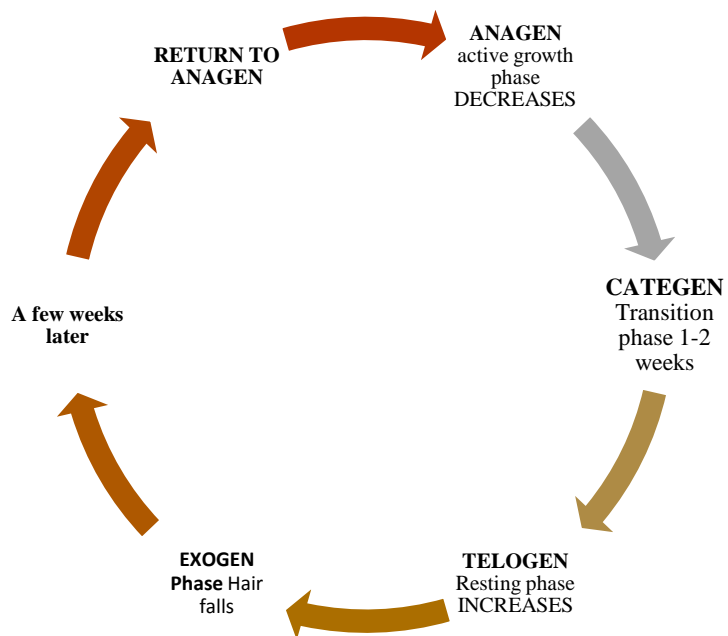
Male-pattern baldness, also known as androgenetic alopecia, is a condition in which dihydrotestosterone (DHT) causes hair loss, a powerful derivative of testosterone. DHT triggers the shrinking of hair follicles, resulting in the finer vellus hair being transformed from thick terminal hair.(Adil & Godwin, 2017)



**A. Normal hair physiology**



**B. Pathogenesis of hair loss**



**Figure(1) Both normal and**

**affected hair physiology A. Normal**

**hair physiology B. Pathogenesis**(Buffoli et al., 2013; Kaliyadan et al., 2013; Kučerová R et al., 2006; Thomas J, 2005)

**1.2 Table (1) Types of Alopecia and their characteristics:**

Sl No	Types	Characteristics
1	Alopecia Areata	The most prevalent type is alopecia areata, or patchy baldness. Usually, it begins on the scalp and spreads to the entire body or scalp, resulting in total hair loss. (Pratt et al., 2017)
2	Cicatricial alopecia	A variety of conditions are combined to form cicatricial alopecia, which is characterized by inflammation and consequent damage to hair follicles, leading to permanent hair loss. (Harries & Paus, 2010)
3	Alopecia universalis	Hair loss from all body parts is a characteristic of Alopecia Universalis (AU), a kind of hair loss. AU is frequently observed in patients with vitiligo and thyroid problems. The patient with this type of alopecia only experiences burning and itching as symptoms. Other illnesses, like atopic dermatitis and nail alterations, are present in addition to it. (Cole & Hfrzunger, 1984)
4	Syphilitic alopecia	The disease syphilis was caused by <i>Treponema pallidum</i> . Individuals suffering from sudden and partial hair loss were diagnosed with syphilitic alopecia. (Yu-Yun Lee, 1991)
5	Telogen effluvium	Damage to telogen hair brought on by atypical hair cycle is known as telogen effluvium. It is common to observe the

		<p>progressive, consistent loss of 100–200 telogen hairs.</p> <p>(Harrison &amp; Sinclair, 2002)</p>
<b>6</b>	Chronic cutaneous lupus erythematosus	<p>Skin inflammation and ongoing hair loss are hallmarks of the autoimmune condition known as cutaneous lupus erythematosus. Hereditary factors, exposure to sunshine, pollution from sources like cigarette smoke, and hormones are among the predisposing factors for chronic cutaneous lupus erythematosus.</p> <p>(BJIRNBERG&amp; Hel, 1963)</p>
<b>7</b>	Stress induced alopecia (SIA)	<p>Emotionally and behaviorally charged environments may be regarded as risk factors or triggers for hair loss. Therefore, maintaining a good diet, exercising frequently, and reducing stress are the most effective ways to manage SIA.</p> <p>(Padgett &amp; Glaser, 2003)</p>
<b>8</b>	Alopecia triggered by a chemotherapy	<p>Chemotherapy disrupts the matrix keratinocyte development in the anagen bulb, which is responsible for the formation of the hair shaft during proliferation. One of the most important, draining, and psychological side effects of chemotherapy is being bald. Finally, hairs grow back when the course of treatment with chemotherapy drugs is stopped.</p> <p>(Carelle et al., 2002)</p>

## 2 Pathogenesis:

### 2.1 What is AGA all about?

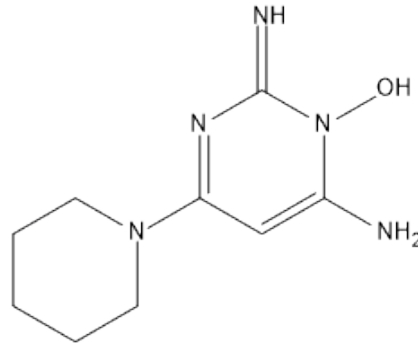
The characteristic feature of androgenetic alopecia (AGA) is the progressive miniaturisation of the hair follicle, it causes the terminal hair follicle to undergo vellus transformation as a result of a shift in the dynamics of the hair cycle. There is an active growth phase (anagen) in the regular hair cycle that can last anywhere from two to seven years. After this, there is a one- to two-week-long catagen stage of regression and a five- to six-week-long telogen resting phase, which lasts for around 100 days. During the involutionary process known as the catagen phase, the majority of follicular keratinocytes undergo a burst of apoptosis, which is accompanied by the completion of the pigment manufacturing process and the condensation of dermal papillae. This causes the dermal papillae to move higher. In the telogen stage, the hair shaft transforms into a vellushair. Eventually, combing and washing cause the hair to shed, resuming the anagen phase.(Piérard-FranchimontPiérard et al., 2001)In AGA, the anagen phase ultimately shortens while the telogen phase lasts longer.Because the anagen phase lasts longer than the previous one, the maximum length of each new anagen hair is shorter than the previous one, which eventually leads to miniaturization.(Fernandes, 2005)

### 2.2 What causes baldness in the AGA?

Numerous studies show that androgens are essential for the miniaturization of hair follicles, as does the connection between the dermal papillae and the hair follicle. In the balding scalp, there is an increase in DHT concentration in addition to higher levels of androgen receptors and 5  $\alpha$  reductase. The other enzymes involved in the transformation of weak androgens into potent androgens are seventeen hydroxysteroid dehydrogenase (17-HSD) and three hydroxysteroid dehydrogenase (3-HSD) both enzymes exhibit enhanced activity in AGA. The effect on gene expression that regulates follicular cycle, increases with the levels of androgen and androgen receptor.(Schweikert & Wilson, 1974)

### 3 Treatment of Androgenic alopecia

#### 3.1 Minoxidil



**FIGURE (2)** Structure of Minoxidil

Topical minoxidil therapy is a single among the three FDA-approved treatments for hair loss in both male and female patterns. In 1988, it was approved only for use in males with mild-to-moderate AGA as a primary treatment. The oral formulation was first used as a vasodilator to treat hypertension in the 1960s. Minoxidil is widely accessible in liquid solutions with different efficacies and as 2% and 5% foam. It is commonly known that minoxidil increases hair density and diameter in the vertex and frontal parts of the scalp, which stimulates hair renewal and slows the rate of hair loss by prolonging the anagen phase. It is suggested that the active metabolite minoxidil sulphate binds to potassium channels responsive to ATP and relaxes the smooth muscles. (Nestor et al., 2021)

The treatment results in a greater rise in hair weight but a less obvious increase in the quantity of hairs, suggesting that a rise in the diameter of preexisting hairs is the primary source of the therapeutic effect. (Lolli et al., 2017)

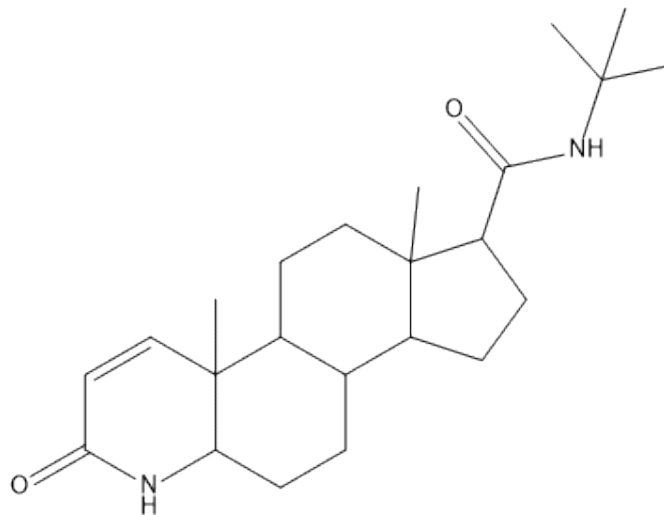
Applying the 5% topical solution twice a day has been shown to be more effective for men than the 2% solution. Research indicates that in females, in comparison to the 2% solution, the 5% solution is either better or equal. By the 6 or 8 weeks, minoxidil seems to affect hair growth, reaches its peak by 12–16 weeks, and does not significantly improve with further time. Up to 60% of male patients may not benefit from topical minoxidil therapy due to lower base concentrations of the enzyme sulfotransferase, which needs to convert minoxidil to its active metabolite. Furthermore, it was demonstrated that the level of sulfotransferase in retrieved hair follicles was a strong predictor of how well females would react to topical minoxidil treatment. (Kaiser et al., 2023)

One can use minoxidil for vertex or frontal scalp thinning. Rather than a de novo renewal, the majority of the increase in density is due to miniaturised hairs that become terminal hairs. Typically, the significant rise appears during the first four months of treatment. Following the

early phase of regrowth, the hair loss stabilises. (Bolduc & Shapiro, 2000)

### 3.2 5 $\alpha$ -reductase inhibitors:

#### 3.2.1 Finasteride:



**Figure(3) Structure of Finasteride**

Finasteride reduces scalp DHT levels to function as a type II inhibitor of 5- $\alpha$ -reductase. A 60–75% reduction in scalp DHT is seen in scalp biopsies obtained both before and after finasteride treatment. One milligram of finasteride per day is the ideal dosage for treating androgenetic alopecia. Studies with a placebo control group have demonstrated that finasteride dramatically increases hair count after one to two years of treatment, and the effect lasts for five years. An open, randomised, comparative trial using Finasteride 1 mg orally once a day and 5% topical minoxidil demonstrated considerably greater hair growth in the finasteride group. (Rathnayake & Sinclair, 2010)

AGA patients may benefit from topical finasteride, which has less adverse effects than oral finasteride. Finasteride at concentrations of 100 and 200  $\mu$ l can be applied once a day to suppress scalp DHT and potentially reduce unwanted sexual side effects associated with systemic DHT decrease. (Alves, 2017)

It has been demonstrated that finasteride, a particular inhibitor of human type II 5 $\alpha$ -reductase, lowers the levels of dihydrotestosterone in the serum and scalp skin of balding guys. Recent research has also shown that males with vertex thinning have an increase in scalp hair when using finasteride 1 mg/day. This study evaluated the effectiveness and safety of finasteride in



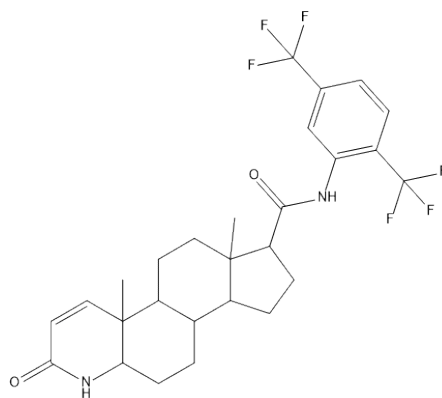
males with frontal (anterior/mid) scalp thinning because hair loss in this area is quite noticeable and hence significant to patients. (Leyden, 1999)

Treatment for female pattern hair loss is difficult, and the precise etiopathogenesis is yet unknown. Finasteride's clinical effectiveness is debatable, despite the fact that it has been shown to be advantageous for patients with female pattern hair loss. There is not much information out there on the topic, which is covered below.

Finasteride's exact mode of action in female pattern hair loss is unknown. For those who do not respond to minoxidil therapy or are unable to take it, a daily regimen of 1 mg oral medication may be suggested, as stated in male pattern hair loss. Hair loss must stabilise over a year-long therapeutic trial; hair restoration may take up to two years or more. (Mysore V, 2016)

Male pattern hair loss in males is largely caused by dihydrotestosterone (DHT), testosterone's 5 $\alpha$ -reduced metabolite. The enzyme 5 $\alpha$ -reductase type 2 is specifically inhibited by finasteride, which lowers scalp and blood DHT levels. 1 mg Finasteride day<sup>-1</sup> has been proved in clinical trials to both enhance the growth of hair and delay the development of hair loss in males experiencing male pattern hair loss. Moreover, patients showed progressive clinical improvement over the course of two years of treatment, and their hair density stayed stable. According to these findings, finasteride may have improved hair quality by lengthening and increasing the quantity of anagen hairs. (Neste, 2000)

### 3.2.2 Dutasteride:



**Figure(4) Structure of Dutasteride**

Dutasteride is more effective in lowering scalp DHT than finasteride, although having a lot of similarities. It inhibits 5-alpha-reductase enzymes of type I and type II. The FDA has approved the drug dutasteride for the management of BPH, or benign prostatic hyperplasia. A dose-dependent rise in the growth of hair was shown in phase II tests for 2.5 mg/day of finasteride was more successful than finasteride 5 mg/day in treating androgenetic alopecia.

(Rathnayake & Sinclair, 2010)

A recent meta-analysis and comprehensive review comparing the safety and effectiveness of dutasteride to finasteride suggests that the both medications seem to have comparable rates of adverse responses, particularly in sexual dysfunction. (Herz-Ruelas et al., 2020)

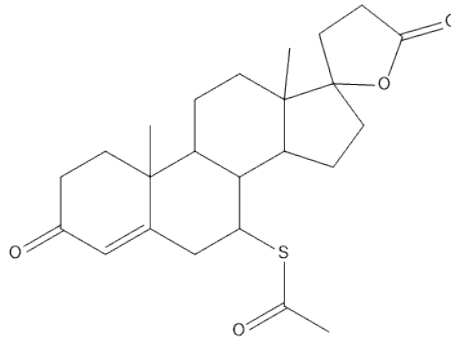
The recommended daily dosage of dutasteride for the purpose of BPH treatment is 0.5 mg. There are controlled trials that compare finasteride and dutasteride's effectiveness in treating AGA. Phase II trials have demonstrated that taking It is more effective to take 2.5 mg of dutasteride daily rather than 5 mg of finasteride.

One female patient who responded inadequately to oral finasteride and topical minoxidil was able to improve with 0.5 mg of dutasteride every day for six months, according to a case report. Without contraception, women of reproductive age shouldn't use dutasteride, same as finasteride, while using this medicine, liver function must be regularly checked. (Varothai & Bergfeld, 2014)

### **3.3 Antagonists of androgen receptors:**

Androgen receptor antagonists have not received FDA approval, despite that they are widely used off-label to treat FAGA. Spironolactone, cyproterone acetate, and flutamide are examples of androgen receptor antagonists that have been the subject of little research, none of which provides high-quality evidence, especially when it comes to individuals who do not exhibit hyperandrogenism. The majority of research has assessed these medications' effectiveness alone or in combination with acne and hirsutism in women with hyperandrogenism. It is crucial to emphasise that these drugs are prescribed off-label for the treatment of each of these illnesses, and because of their teratogenicity, they need to be used with safe contraception. (Yip & Sinclair, 2006)

### 3.3.1 Spironolactone:

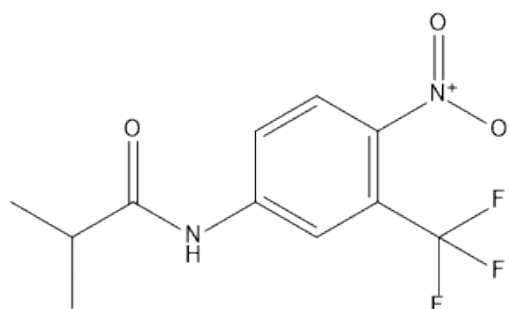


**Figure(5) Structure of Spironolactone**

Spironolactone is a diuretic that spares potassium while lowering testosterone levels and blocking androgen receptors in target organs, making it an antiandrogen. (Shaw, 1996) It has been used for more than 20 years should administer 50–200 mg of medication every day to treat FAGA, and it has an excellent long-term safety record. (Burke BM, 1985). For the treatment of FAGA, it is the most frequently recommended off-label anti-androgen daily treatment for a minimum six treatment of 50–200 mg has been used to treat FAGA. (Varothai&Bergfeld, 2014) For a minimum of 12 months the results of cyproterone acetate with spironolactone were assessed in eighty female FAGA patients. Of them, 40 women received 200 mg of spironolactone forty women were given 50 mg of cyproterone acetate daily or 100 mg for ten days per month if they were premenopausal. There was no difference between the two pairs. Oral antiandrogens were found to promote hair regeneration in 44% of individuals, had no effect in 44% of patients and 10% of individuals continuing to experience hair loss. (Sinclair et al., 2005)

In terms of safety, spironolactone's effects of diuretics (hyperkalaemia, hypotension, exhaustion, reduction in weight and heightened frequency of urine) as well as its antiandrogenic actions (breast tenderness, irregular menstruation) can result in dose-dependent side effects. (Kelly et al., 2016)

### 3.3.2 Flutamide:

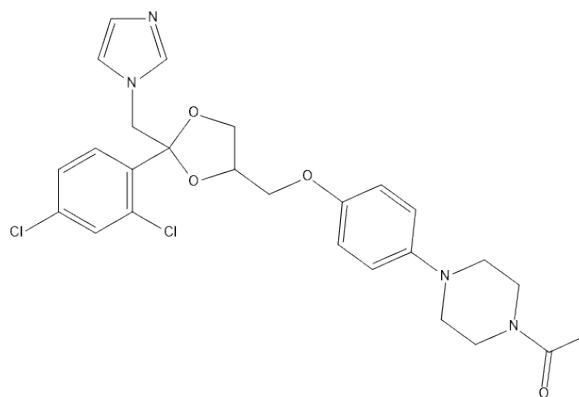


**Figure(6) Structure of Flutamide**

Potent anti-androgen flutamide inhibits the androgen receptor in a competitive manner. After just six months of treatment, flutamide can increase hair growth and provides long-term List of terms in FAGA. A randomised trial found that after a year, finasteride and cyproterone acetate were not thought to be beneficial, but flutamide, 250 mg once a day, showed a slight enhancement of FAGA. (Varothai&Bergfeld, 2014)

According to a case study, flutamide increased hair growth in an FAGA patient who was not responsive to oral spironolactone or minoxidil applied topically. The dose-dependent risk of severe liver damage associated with flutamide limits its use. According to a report, a daily dose of 62.5 mg is both efficient and well-absorbed. (Yazdabadi& Sinclair, 2011)

### 3.4 Ketoconazole:



**Fig (7) Structure of Ketoconazole**

Topical ketoconazole used consistently has demonstrated effectiveness in managing androgenetic alopecia. Ketoconazole has antiandrogenic qualities with DHT suppression additionally to its antifungal and anti-inflammatory qualities in *Malassezia* for the treatment of seborrheic dermatitis. For the treatment of AGA, shampoos with a 2% ketoconazole concentration can be utilised as a promising supplement therapy. (Nestor et al., 2021) Ketoconazole is a synthetic form of imidazole with strong antifungus that prevents the formation of ergosterol (Borgers et al., 1983)

Moreover, ketoconazole inhibits the production of testosterone, which reduces DHT and lends additional support to its effectiveness in the management of AGA. Also has very less side effects. (Pont et al., 1982)

### **3.4 Surgical Treatment:**

When conventional therapies fail to produce desired results for AGA patients, surgical procedures become increasingly important. These include reduction of the scalp and hair transplantation, or the two combined. Hair transplantation is the most common procedure among these since it requires less surgical intervention, whereas scalp reduction with FAST requires a highly trained surgeon to execute well. In terms of articles, AGA hair replacement surgery is thought to lack significant data in both genders due to variations in study findings brought about by various techniques, subject characteristics, and surgical and team competence. (Rose, 2011)

#### **3.4.1 Low level light therapy:**

To perform LLLT, tissues are exposed to light energy (<1,000 mW), usually in the near-infrared (700–1,000 nm) or red (600–700 nm) range. LLLT, minoxidil, and finasteride are the only FDA-approved treatments for AGA. A 45-paper meta-analysis concerning these three treatments revealed that the only AGA treatment method approved by the FDA is LLLT. and that it stimulates greater hair growth when used as a monotherapy than minoxidil. When it comes to hair regrowth, LLLT and medications can work in combination. Tissue regeneration (a post-treatment measure for acne, burns, ulcers, and scarring processes), skin conditions connected to microbes and dandruff, pain alleviation, and inflammation reduction are a few applications of laser light therapy (LLLT). However, promoting hair growth in people with alopecia is among the most widely used uses of LLLT in the commercial world. (Katzner et al., 2019)

It has been found that LLLT and minoxidil are associated in an effective way and sufficient for AGA. A four-month study including 45 women who presented with FPHL showed satisfactory and comparable outcomes for the safety and efficacy of topical minoxidil (twice daily) and LLLT (three times a week, 25 minutes with the iGrow® helmet) as separate therapies.. The combo group (minoxidil + LLLT) produced the greatest outcomes in terms of patient satisfaction and Ludwig classification. (Esmat et al., 2017)

#### **3.4.2 Hair Transplantation:**

An additional therapy option for people with stabilised hair loss who are above 25 years of age is hair transplantation (HT). The donor dominance principle, it asserts that even when

transplanted onto androgen-dependent scalps, hair follicles from androgen-insensitive locations keep their features., underpins the mechanism of action of HT. HT is a very popular treatment for AGA, yet there isn't enough good evidence to support its effectiveness because investigations' outcomes vary depending on the surgeon's skill level, the technique used, and the patient's unique characteristics.(Rose, 2011)The main procedure used in hair restoration surgery for AGA is several types of hair transplantation. Currently, the utilisation of scalp reduction procedures as a therapeutic strategy for AGA is not common. The foundation of hair transplantation's effectiveness is donor dominance, which states that qualities of androgen-insensitive hair follicles remain intact when transplanted into androgenetic alopecia-affected scalp regions. The follicles on the scalp that are not impacted by miniaturisation reposition themselves. A hair transplant is a viable choice for individuals who have enough donor hair, regardless of gender. For optimal results, it is advised to combine oral finasteride with hair transplantation.

### **3.4.3 Side effects of hair transplantation:**

The comparatively minor side effects of hair transplant surgery include swelling that may spread to the eyes, mild pain in the operated areas, and the creation of scabs over the grafts, which usually go away in two weeks. It is uncommon to have severe bleeding, scarring, or infection issues. (Kaliyadan et al., 2013)

## **3.5 Emerging therapies:**

### **3.5.1 Scalp Microneedling:**

A minimally invasive technique named microneedling makes use of several tiny needles to penetrate the skin in tiny holes. These two to four cell-wide puncture holes promote the expression of Wnt proteins, release growth factors, and initiate neovascularization.(Fertig et al., 2018) When using microneedling therapy, the patient is repeatedly rolled over a barrel-shaped roller instrument that is adorned with tiny needles, which range in length from 0.5 to 2.5 mm. (Fernandes, 2005)

"Collagen induction" is the basis of the procedure after these recurrent microtraumas.Microneedling has been proposed as a way to encourage hair growth; specifically, the needle's injury increases the production of growth factors by neutrophils and platelets, such as TGF-beta, TGF-alpha, and platelet-derived growth factor.Afterwards, fibroblasts aid in the papillary dermis's production of collagen and elastin. Treatment for hair

loss with this process has been effective, especially when paired with other therapies. (Ocampo-Garza et al., 2020)

### **3.6 Combinational Therapies:**

#### **3.6.1 Combination of Topical Minoxidil with oral finasteride:**

One of the most popular combos for treating AGA is oral finasteride combined with topical minoxidil. A conducted meta-analysis that included 809 participants from 8 studies, and the results showed that topical minoxidil was more effective than oral finasteride. (Zhou et al., 2020). Also a study found that 84.44% of participants were able to maintain healthy hair density with a topically applied minoxidil and finasteride combination to 12 months after stopping oral finasteride. (Chandrashekar et al., 2015)

#### **3.6.2 Combination of Microneedling with minoxidil:**

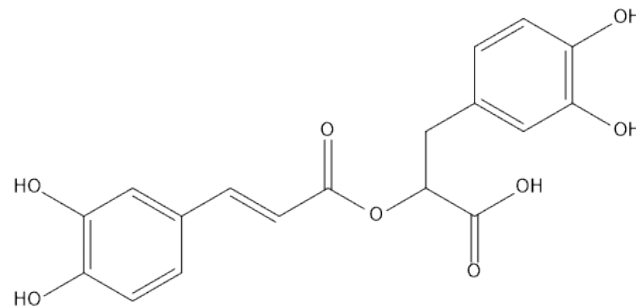
One way by which microneedling increases hair growth is by making first-line drugs, such as minoxidil, is easier to penetrate. From a study, found that it is easy, and affordable therapy option showing effectiveness. Patients in this trial who received topical 5% minoxidil alone did not exhibit the same level of improvements following microneedling with 5% minoxidil; this difference was shown to be statistically substantial. The percentage of satisfied patients was high also it shows improved patient's compliance and quicker hair growth. (Malhotra & Herakal, 2020)

#### **3.6.3 Combination of Microneedling, Finasteride, 10% Minoxidil:**

The idea behind this combined approach, that included microneedling, finasteride, 10% minoxidil, was to facilitate early, faster, and better hair growth during the first phase of therapy by working synergistically to enhance treatment compliance and increase confidence in patients. In six months of therapy, the results of this pilot trial using a combined treatment method demonstrated a moderate to an excellent response using a physician evaluation scale. Additionally, it was noted that young patients had more favourable responses than older individuals with any side effects. (Choudhary et al., 2017)

## 4 Herbal Treatments for androgenic alopecia:

### 4.1 Rosemary:



**Figure(7) Structure of Rosmarinic acid**

*Rosemarinus officinalis* family is the biological name of rosemary. Grown extensively throughout along the sub-Himalayan regions, Labiatae has been cultivated from ancient times in the northern and southern borders of the Mediterranean Sea, Venezuela, the Philippines, America, Germany, France, Denmark, and England. (Dhariwala & Ravikumar, 2019) 1-2% volatile oil, rosemary primarily consists of monoterpene hydrocarbons, 1, 8-cineole, borneol, camphor, and bornyl acetate. Additionally, it has 8–20% alcohols and 0.8–6% esters. (Kaushik et al., 2011) Rosemary works by increasing vascularity and blood circulation, which aids in follicle renewal. (Dhariwala & Ravikumar, 2019) Further uses for rosemary include antidepressant, antitumorigenic, choleric, hepatoprotective, antimycotic, alopecia areata, dermatological, anti-inflammatory, and spasmolytic properties that promote relaxation in smooth muscles. It is also an antioxidant. (Panahi Y, 2015)

### 4.2 Ginkgo:

The biological name of Ginkgo is *Ginkgo biloba*. Chemical components: 6% lactones 24% of the following are flavonols, isorhamnetin, sitosterol, lactones, anthocyanins, ginkgolides A, B, C, and bilobalide-A. (Kaushik et al., 2011) It is well known that the medication enhances cerebral microcirculation, which raises oxygen delivery. (Zhang J, 2000)



### **4.3 Onion (*Allium cepa* L.):**

Ingredients: diallyl sulfide, allyl propyl disulfide, alliin, and allicin, protein (albumin). Additionally, it has trace amounts of chromium as well as minerals such as magnesium, calcium, zinc, and potassium. Patchy baldness has also been proven to benefit from onions. Apply onion juice morning and evening to the affected region until it becomes red. It then needs to be massaged with honey. (Kaushik et al., 2011) Zinc helps prevent dandruff, this promotes the secretion of essential oil from the scalp and can cause hair loss. Iron is necessary for your body's red blood cells to oxygenate. It is necessary for both sustaining healthy hair and proper hair development. (Khalifa E. Sharquie, 2002)

### **4.4 Pumpkin Seed (*Cucurbita pepo*):**

The chemical compositions differ between species, it was discovered that the three primary components of pumpkin seeds were tocopherols, sterols (also known as phytoestrogens), and fatty acids. (Dhariwala & Ravikumar, 2019) About 80% of *Cucurbita pepo*'s composition is made up of polyunsaturated fatty acids, like oleic, linoleic, stearic, myristic, and palmitic acids; vitamin E is found in the form of  $\alpha$ - and  $\gamma$ -tocopherols, carotenoid, and phytosterols, as well as trace elements. (Montesano et al., 2018) It has been documented that a 24-week course of 400 mg/d inhibits the activity of 5  $\alpha$ -reductase reductase when combined with pumpkin seed oil and extract. Phytosterols are thought to be responsible for this action, and the addition of lipids may have a synergistic impact when treating AGA. (Cho et al., 2014) Pumpkin seeds can also be used for treating heterophyiasis, immune-regulatory potential, anti-peroxidative qualities, hypertension, hypercholesterolemia, anti-oxidant and anti-inflammatory, antiviral, antibacterial, insecticidal, or fungal infections. (Lestari B, 2018)

## 5Conclusion:

In this review, the pathogenesis of androgenetic alopecia is discussed. We conclude that patients need to follow a lifetime therapy regimen because stopping treatment will not halt AGA from progressing. The FDA has approved minoxidil, finasteride, and low-level laser therapy available for this illness at the moment, and they could all be successful in treating specific AGA individuals. While selecting a patient's course of care, there are numerous things to take into consideration, including the patient's age, lifestyle, preferences, level of hair loss, compliance, and budgetary constraints. For treatment of androgenetic alopecia, the combination therapies of Minoxidil, Finasteride, and Microneedling shows better outcomes than utilizing the monotherapy of only minoxidil or finasteride, because they maximize efficacy in addition to treating hair loss from numerous aspects. Also, in this review we have discussed about the herbal treatments available for the treatment and when applied topically to the scalp, herbal medications have the potential to be more advanced than conventional ones. Further study on the usage of these herbal medications in combinations of two or more may provide fresh insights into the safe, practical, and effective field of cosmetics.

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