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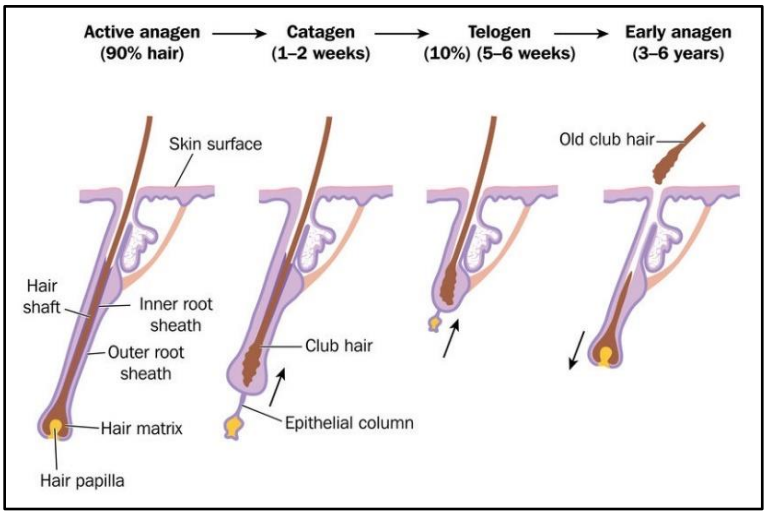
Hair Loss

Hair loss, medically referred to as “alopecia,” can be annoying for some people and devastating for others. It’s estimated that 50 million men and 30 million women are affected, with 50% of men experiencing hair loss by age 50 and 40% of women by age 70.[1] Hair loss can occur diffusely throughout the scalp, in patches, or on the entire body and can range from temporary shedding to permanent scarring of the scalp. If you’re losing hair, this ebook will help you identify the type of hair loss affecting you, possible causes and contributing factors, and available treatment options.

Normal hair growth

Hair is actually a highly specialized proliferative component of skin. Scalp hair grows approximately 0.3 to 0.4 mm per day or 6 inches per year, with average daily hair loss of 50 to 100 hairs. Each hair follicle goes through a 3-stage cycle—anagen (growth), catagen (regression), and telogen (rest). Dead hair falls out at the end of the telogen phase (sometimes referred to as “exogen.”) Hair cycle length varies on different parts of the body; for example, eyebrows have an average 4-month cycle versus scalp hair of 3 to 4 years.

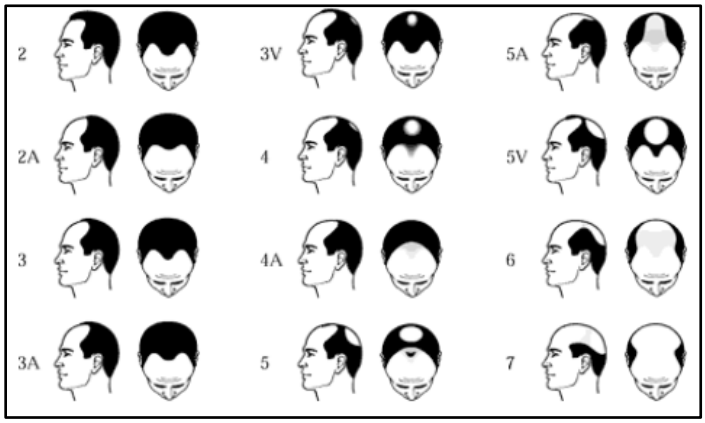
85-90% of scalp follicles are in the anagen phase which lasts from 2 to 6 years, with an average of 3 years. During anagen, follicles produce a hair shaft from root to tip—the length of anagen determines how long hair grows. Anagen depends on continued proliferation and differentiation of matrix cells at the base of the follicle. **Genetics, nutrition, age, hormones, and overall health influence the anagen phase.**



The transition from anagen to catagen involves growth factors and molecules, some of which have been identified, although how they work together to terminate anagen or promote catagen is not yet understood.[2] During catagen, which lasts 1 to 2 weeks, cells in the hair follicle regress and the hair shaft stops growing and becomes a rounded structure called a club. During the telogen phase, hair follicles rest for up to 3 months. The telogen-to-anagen transition occurs when quiescent stem cells

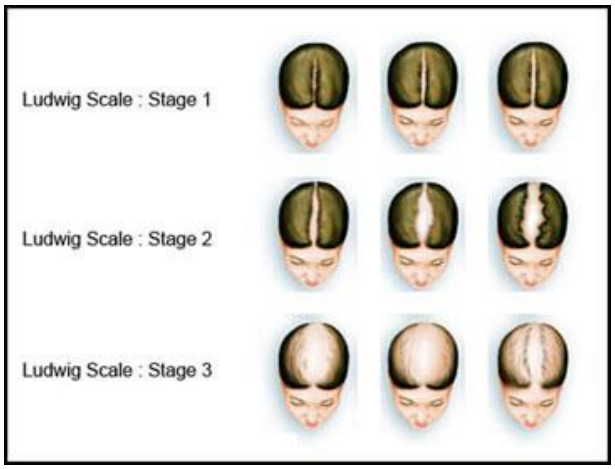
in the hair follicle are activated to produce a new hair shaft. The old hair falls out spontaneously or is removed during combing or washing.

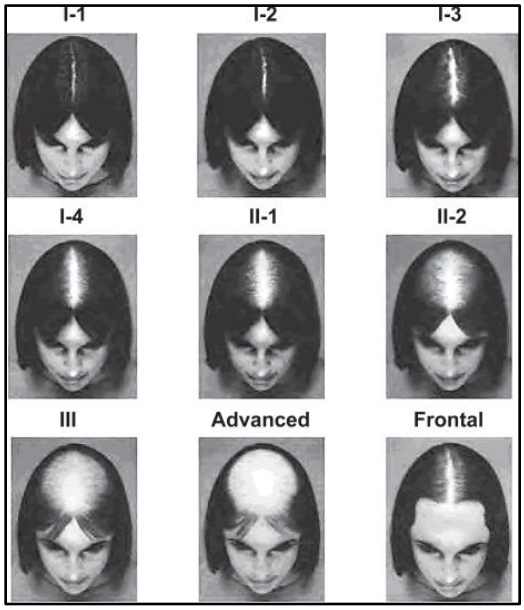
Types of hair loss



- **Gradual thinning** affects men and women. In men, hair can recede from the forehead in an "M" pattern. The Norwood Scale is used to determine how far hair loss has progressed in men.

  Women typically retain their hairline at the forehead but have a broadening of the part in their hair. The Ludwig or Savin Scales provide a determination of female pattern hair loss.





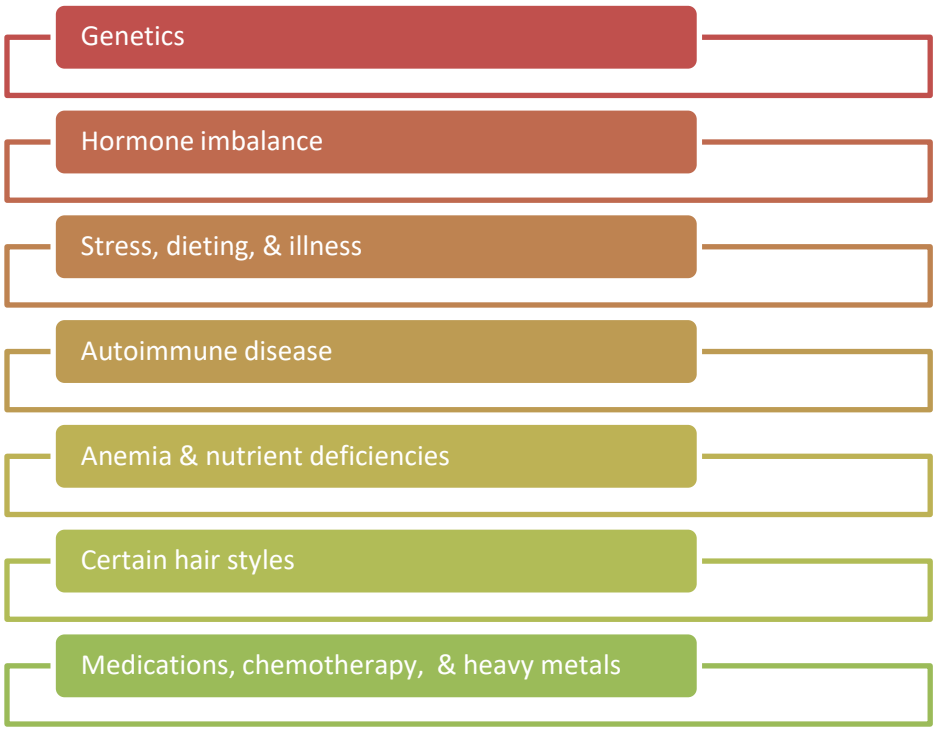
- **Circular patches or bald spots** usually affect the scalp, but they can also occur in the beard or eyebrows. This type of hair loss may be itchy or painful before hair falls out and scalp area may be smooth.

- **Sudden hair loss** can follow significant physical or emotional stress. Handfuls of hair may come out when combing or washing or even with gentle tugging. This type of hair loss usually causes overall hair thinning and not bald patches.

- **Full-body hair loss** may be due to certain medications (e.g., tamoxifen) or chemotherapy. Hair loss peaks at 1 to 2 months and usually grows back after treatment is discontinued.

- **Patches of scaling** that spread over the scalp may be associated with redness and swelling and broken hair. This is from ringworm, a fungal condition that can be treated with topical or systemic antifungal medications.

Causes of hair loss



Genetics

By far, the most common type of alopecia is due to genetics, called "**androgenetic alopecia.**" This type of hair loss starts between ages 12 to 40, and half of affected men with have hair loss by age 50. The cause is assumed to be dihydrotestosterone or "DHT" which is a metabolite of testosterone produced by the enzyme type II 5α-reductase. DHT shortens the hair follicles' anagen phase. In women, increased circulating testosterone, increased 5α-reductase activity, or increased androgen receptors can cause this type of hair loss.

With androgenetic alopecia, affected hair becomes shorter, finer, and less pigmented and the condition

progresses with each successive hair cycle. Men tend to have hair loss at the frontal hairline, temples, and crown. Women may have more diffuse thinning of the scalp, often worse at the crown, sparing the temples and frontal hairline. "**Female pattern hair loss**" or FPHL may not always be associated with increased blood levels of androgens, with multiple contributing factors possible.[3] In fact, it's estimated that 60-70% of FPHL cases are not associated with evidence of androgen access.[4]

Hormones

The anagen (growth) and catagen (regression) phases of the hair follicle are modulated by several hormones in circulation. In addition, the hair follicle and supporting structures (such as oil producing glands) express enzymes such as aromatase (that converts androgens to estrogens), 5α-reductase (that converts testosterone to DHT) and 17 β-HSD type I/II (that convert androstenedione to testosterone). Therefore, local conversion of hormones can affect hair growth and loss. Human hair follicles are also capable of synthesizing some hormones, such as cortisol[5] and melatonin.[6]

In women, estrogen appears to protect against hair loss. During pregnancy, hair growth increases as estrogen prolongs the anagen phase.[7] Although FPHL can occur at any time, most cases worsen with perimenopause or after menopause.[8] Menopausal status influences the rate of hair growth, percentage of hair in the anagen phase, and hair diameter especially in the frontal scalp area.[9] Women with lower levels of estrogen after treatment with antiestrogenic medications, such as aromatase inhibitors for breast cancer treatment, are more likely to develop female pattern hair loss.[10]

Studies explaining the mechanism by which estrogen influences the hair cycle in women are lacking. Some data suggests that estrogen prolongs anagen and decrease catagen.[11] Another possible benefit is that estradiol stimulates the hair follicle to produce vascular endothelial growth factor (VEGF);[12] VEGF promotes angiogenesis or growth of blood vessels to feed the hair follicle. Estradiol can inhibit 5α-reductase or increase conversion of testosterone to weaker androgens (androstenedione or androstenediol) thereby decreasing the amount of testosterone available to convert to DHT.[13] Since women's hair follicles contain more aromatase activity than men's, testosterone may also be converted to 17β-estradiol.

Thyroid hormone promotes the anagen phase of the hair cycle. Hypo and hyperthyroidism can cause diffuse hair loss affecting the entire scalp and sometimes eyebrows.[14] With adequate treatment of the underlying thyroid condition, hair regrowth is possible but may take several

months. Unfortunately, if the thyroid condition is autoimmune (for example, from Hashimoto's or Grave's disease), other autoimmune diseases are more common including alopecia areata.

Stress, Dieting, & Illness

Physical and emotional stressors can cause hair follicles in anagen and catagen to shift to the telogen phase. Approximately 1 to 3 months after the stressful event, significant hair shedding called "telogen effluvium" can occur. Common causes of telogen effluvium include severe stress, low-calorie dieting, high fevers, infections, illnesses, and major surgery. Besides a rapid drop in hormones after childbirth contributing to hair loss, some women experience telogen effluvium during the 2 to 4 months following childbirth. This can continue for up to 6 months, rarely up to 15 months.[15]

Although hair loss from telogen effluvium can be concerning since hair seems to come out in handfuls, hair should regrow if the underlying cause has been addressed.

Autoimmune Disease

Alopecia areata is relatively common, affecting 1-2% of the US population. It can cause 3 different types of hair loss—patches (called alopecia areata), loss of hair on the entire scalp (alopecia totalis), and loss of all body hair (alopecia universalis). This type of hair loss is caused by the immune system attacking hair follicles.

Alopecia areata is associated with an increased risk for other autoimmune diseases such as autoimmune thyroid diseases, inflammatory bowel disease, rheumatoid arthritis, psoriasis and psoriatic arthritis, type I diabetes, pernicious anemia, and vitiligo.[16-18] In addition, asthma, allergies, and eczema are more common in people with alopecia areata. Alopecia areata may be associated with micronutrient deficiencies especially vitamin D, zinc, and folate.[19]

Systemic lupus erythematosus or "SLE" and discoid lupus erythematosus, "DLE" can cause scaring alopecia, as well as hair loss that overlaps with alopecia areata, telogen effluvium, and anagen effluvium.[20]

Anemia & Nutrient Deficiencies

Micronutrients play a major role in the normal hair cycle, especially in the rapidly dividing matrix cells of the hair follicle. Deficiencies in vitamins A, B, C, D, E, iron, selenium, or zinc can all contribute to alopecia.[21]

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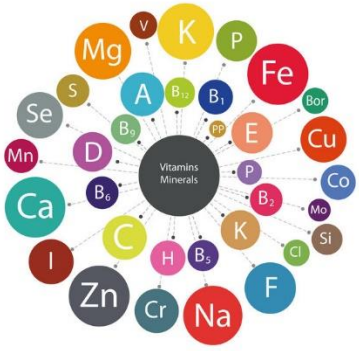
Iron deficiency can cause hair loss and studies have found a relationship between iron deficiency and alopecia areata, androgenetic alopecia, telogen effluvium, and diffuse hair loss.[22,23] Measuring serum ferritin, iron, and total iron binding capacity can help rule in or out this possible cause. Note that excess iron can promote oxidative stress and the genetic iron overload disease (hereditary hemochromatosis) is common; therefore, iron supplementation should be reserved for states of deficiency or insufficiency, and ferritin and iron studies should be performed to monitor iron supplementation.



Animals and humans with vitamin D receptor mutations can have alopecia. Vitamin D receptors are found in the area of the hair follicle where stem cells are located, suggesting that vitamin D plays a role in proliferation and differentiation of these cells during the hair cycle.[24] Currently, no studies have shown improved hair growth with vitamin D supplementation.

Zinc is an essential trace mineral that participates in the activation of hundreds of enzymes and is involved in more than 2000 zinc-dependent transcription factors needed for DNA and protein synthesis, cell division, and normal metabolism. Zinc is also a key immune modulator that helps fight infections and restrain inflammation. Low zinc levels have been found in people with alopecia areata, male pattern hair loss, female pattern hair loss, and telogen effluvium.[25-27] Zinc supplementation may benefit alopecia areata patients, especially those with a zinc deficiency.[28,29]

Biotin, a water-soluble vitamin known as B7, is a coenzyme necessary for fatty acid and glucose synthesis, and metabolism of amino acids and carbohydrates. Biotin deficiency has been found in 38% of women with hair loss[30] and is also seen in people with seborrheic dermatitis. Research linking biotin supplementation with improvement in alopecia is limited. Supplementing with biotin may help splitting or brittle nails or people with demonstrated biotin deficiency.[31,32]

Essential fatty acid deficiency (either omega-3 or omega-6 fatty acids) can also cause diffuse scalp and eyebrow hair loss, as well as lightening of hair. Some types of unsaturated fatty acids, especially gamma-linolenic acid or GLA, docosahexaenoic acid or DHA, and alpha-linolenic acid or ALA can inhibit 5α-reductase,[33] decreasing the conversion of testosterone to DHT.

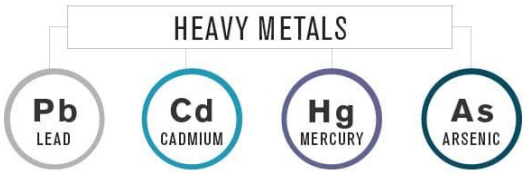
Hair Styles

Traction alopecia is caused by trauma to hair follicles from certain hairstyles. Braiding, cornrows, tight ponytails, and extensions can all cause traction alopecia. If the hairstyle is changed, most of the time the condition can reverse itself.

Medications & Toxins

Anagen effluvium occurs after any insult to the hair follicle that impairs its metabolism or ability to produce hair. This type of hair loss is common with chemotherapy and radiation treatments that targets rapidly dividing cells.

Many other medications can cause anagen or telogen effluvium.[34] Anagen effluvium tends to occur within days to weeks of starting a drug whereas telogen effluvium can occur 2 to 4 months after starting treatment. The American Hair Loss Association lists several drug categories that can contribute to hair loss including those for acne treatment, blood thinners, cholesterol-lowering drugs, anticonvulsants, antidepressants, amphetamines, antifungals, blood pressure lowering drugs, and anti-inflammatories. Natural supplements, especially excessive vitamin A and selenium, can cause hair loss.[35]



Toxic heavy metals, such as mercury, thallium, cadmium, lead, and arsenic can limit hair growth and cause chronic telogen or anagen effluvium.[36-39] Exposure to toxic heavy metals may occur acutely, or over years or decades leading to long-term storage in the body. Testing for heavy metals can be performed via blood, hair, and urine (via Quicksilver Scientific Lab) or by urine testing following a chelation challenge with EDTA & DMPS (through Doctor's Data).

Aging & Hair

The density of scalp hair decreases with age. Women experience a reduction in total hair follicle number of 0.22% per year from ages 13 to 84.[40] In addition, the anagen phase can shorten with prolongation of the telogen phase. The diameter of the hair shaft, except in the occipital area, can decrease with age, making hair appear thinner.

Graying of hair increases significantly after age 50 due to death of hair follicle melanocytes and DNA damage from increased oxidative stress (free radicals formed from normal cellular metabolism or other sources) and impaired repair enzymes (e.g., catalase, superoxide dismutase, glutathione peroxidase).[41,42] Gray hair tends to grow faster than pigmented hair.[43]

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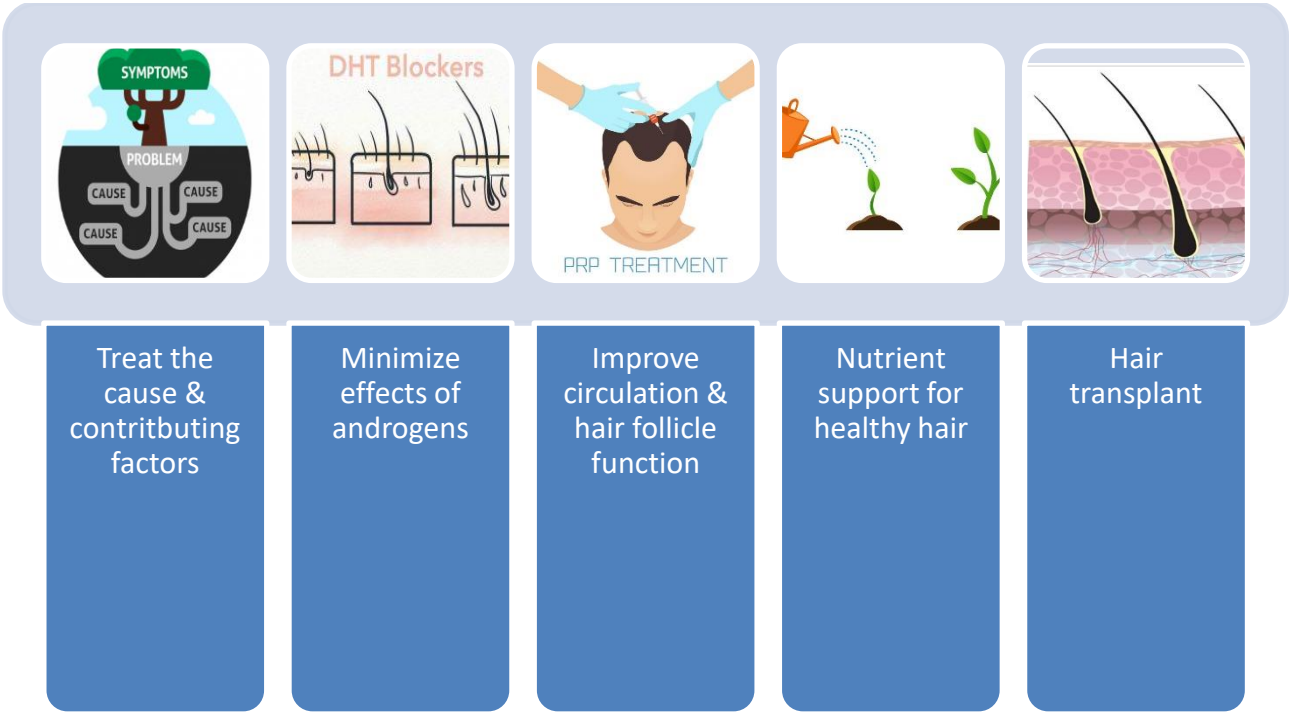
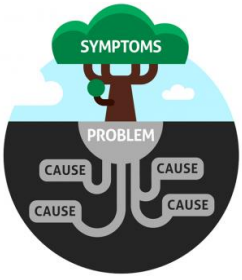
Oxidative stress and sustained inflammation accelerate aging of the skin and hair. Avoiding health issues (such as diabetes, metabolic syndrome, and obesity) and substances (such as cigarette smoke, UV radiation, excessive calorie consumption, or environmental toxins) that raise oxidative stress and inflammation is fundamental to delaying age-related changes in hair. Testing for oxidative stress and antioxidant enzymes can be performed by several labs.

Treatment



Treat the cause & contributing factors



If hair loss is due to reasons other than androgenetic alopecia, the cause and contributing factors must be addressed. As discussed above, this can be due to hormone imbalance, autoimmune conditions, nutrient deficiencies, certain hair styles, medications, or heavy metals. Keep in mind hair loss may be multi-factorial and hair restoration may be most effective with a comprehensive approach.

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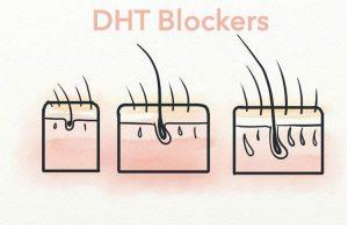
Minimize the effects of androgens



More than 95% of hair loss in men is due to androgenetic alopecia (AGA), likely caused by a number of genetic variants, 2 of which have been identified to be inherited from the mother.[44,45] Since dihydrotestosterone (DHT) causes this hair loss, blocking conversion of testosterone into DHT by inhibiting the enzyme 5α-reductase can be helpful. In addition, modulating androgen receptor signaling may improve androgenetic alopecia.

Finasteride (Proscar®, Propecia®)

Finasteride can be used orally or topically and is an effective 5α-reductase inhibitor that can decrease the progression of androgenetic alopecia and possibly stimulate regrowth. One long-term, uncontrolled study of men with androgenetic alopecia (AGA) using 1 mg finasteride daily for 10 years reported better results in men over age 30; in addition, the medication remained effective over time and, in some cases, improved beyond 5 years of use.[46] Another study performed in >3,000 Japanese men with AGA who used 1 mg finasteride per day reported hair growth in 87% of men.[47] The response rate improved with longer duration of treatment.

Finasteride cannot be used by pregnant women since it can be harmful to a developing male fetus. Studies are mixed regarding effectiveness of finasteride in women, with lower doses not showing benefit vs positive results with higher doses. For example, one randomized controlled trial evaluating women with AGA reported 1 mg of finasteride daily for 12 months was no more effective than placebo for slowing hair thinning or improving hair growth.[48] Another small 18-month study using 5 mg of finasteride daily in postmenopausal women with AGA but without elevated DHEA, testosterone, or DHT, found that this dosage was effective (subjectively and objectively) in 80-85% of women, with results seen at 6 months.[49] An Italian study using 2.5 mg finasteride per day along with oral contraceptives in women reported 62% of women experienced some improvement in hair loss.[50]

In addition to oral use, finasteride can be used as solution applied to the scalp. Topical 0.25% finasteride appears to be absorbed systemically since it's been shown to reduce blood levels of DHT roughly the same as 1 mg oral use.[51] Topical finasteride 1% gel has been shown to be equally as effective as 1 mg oral finasteride in men with AGA.[52] In women, a systematic review suggests topical finasteride slows hair loss and can improve hair growth.[53]

Sexual side effects including erectile dysfunction, ejaculation problems, and low libido are uncommon but have been seen in approximately 2 to 4% of men using oral finasteride; however, long-term use of 1 mg of finasteride has not been shown to cause sexual side effects.[54] In women with hair loss, 5 mg finasteride is associated with decreased libido, breast swelling and tenderness, headache, menstrual irregularities, dizziness, and increased body hair.

Most side effects decrease in intensity or disappear over time.[55] In both genders, finasteride must be continued indefinitely to maintain benefit.

Dutasteride

Dutasteride, another 5α-reductase inhibitor, is thought to be 3 times as potent as finasteride in inhibiting, the type II enzyme and 100 times as potent in inhibiting the type I enzyme. Recent analysis of 3 randomized controlled trials comparing dutasteride to finasteride in men with AGA suggests that dutasteride may be more effective.[56] Similar side effects are seen with both medications.

In women with AGA, one study comparing dutasteride 0.15 mg to 1.25 mg finasteride reported similar results with 80-83% of women noting increased hair thickness and images showing 65-69% improved hair density.[57] A review of 20 peer-reviewed articles found very few side effects related to sexual function in studies involving dutasteride or finasteride for hair loss in women.[58]

Dutasteride is currently not FDA-approved for hair loss. If used for this purpose, it would be considered “off-label.”

Spironolactone

Spironolactone has been used to treat female pattern hair loss although studies showing its effectiveness are minimal. Spironolactone acts as an androgen antagonist by competitively blocking androgen receptors and may inhibit ovarian production of androgens.

One small study of 80 women gave half of the women 200 mg of spironolactone daily while half received 50 or 100 mg cyproterone acetate, another androgen blocker. There were no significant differences in the results between spironolactone and cyproterone acetate—at one year, 44% had hair regrowth, 44% had significant regrowth, and 12% continued to lose hair.[59]

Spironolactone is currently not FDA-approved for hair loss. Side effects are mostly due to its additional action as an aldosterone antagonist and higher doses are more likely to cause side effects such as low blood pressure, electrolyte imbalance, and fatigue. Pregnant women should not use spironolactone and monitoring blood pressure and serum electrolytes while using spironolactone is imperative.

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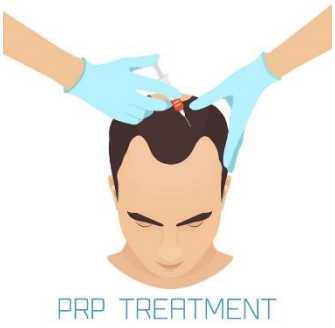
Improve circulation & hair follicle function



Minoxidil (Rogaine®)

Minoxidil was developed as an oral medication in the early 1970s for the treatment of severe or resistant high blood pressure.[60,61] The side effect of oral minoxidil was hair growth. Originally a 2% topical solution was FDA-approved for men in 1988 and women in 1991. The 5% solution and foam are now available for women and men.

Several studies have confirmed minoxidil improves hair growth,[62] presumably by prolongation of the anagen phase, shortening of the telogen phase, and increased blood supply to the hair.[63,64] Minoxidil may also promote stem cell differentiation and proliferation of dermal papilla cells in hair follicles and suppress androgen related function.[65,66] Interestingly, minoxidil has been shown to increase 17 β-HSD (the enzyme that converts androstenedione to testosterone) by nearly 40% in dermal papilla cells of balding men, while it also slightly increased 5α-reductase activity.[67]

The 5% concentration is superior to the 2%[68], and twice daily application works better than once-a day. Regrowth is more pronounced at the vertex than in the frontal areas and may not be seen for at least 4 months. If treatment is stopped, reversion to pre-treatment hair loss can be rapid. Adverse effects include dermatitis if allergic to any ingredients, facial hair growth, and possible increased shedding in the first few weeks.

Minoxidil plus finasteride

Combining medications to target different mechanisms involved in hair loss and regrowth may be more effective than using them individually. In a study of 50 men with androgenetic alopecia, 5% minoxidil combined with 0.1% finasteride maintained good hair density in 85% of the men.[69] These men had used 5% minoxidil and oral finasteride for 2 years prior to the topical combination. Higher dosages of topical finasteride may be more effective, with one trial reporting 0.25% finasteride/3% minoxidil solution versus 3% minoxidil alone reporting a 90% moderate to marked improvement in hair density and diameter at 6 months.[70]

In another 6-month study of 30 postmenopausal women with hair loss, a topical combination of 3% minoxidil plus 0.25% finasteride improved hair diameter better than minoxidil alone; both treatments improved hair density.[71] Serum DHT did decrease in the women on the combination solution (therefore, topical finasteride shouldn't be used by pregnant women) and no systemic side effects were reported.

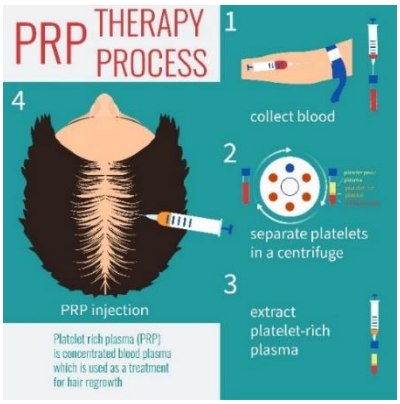
82F, 82M

No commercial combined minoxidil/finasteride product is available. Some compounded pharmacies and physicians have formulated combined products and made them available with a prescription.

82F is a compounded formula containing 5% minoxidil and 0.25% finasteride.

82M is a compounded formula containing 5% minoxidil, tretinoin (a vitamin A derivative), fluocinolone (a steroid that minimizes irritation and inflammation), and oleanolic acid (a 5α-reductase inhibitor.) 82M is propylene glycol-free and doesn't leave a residue on the hair.

Platelet Rich Plasma (PRP)



Platelet rich plasma (PRP) is a concentration of the body's own platelets found in the plasma. PRP has been used in orthopedic and sports medicine, wound healing, cosmetic procedures, oral surgery, and hair restoration. PRP contains more than 20 growth factors secreted from α-granules of platelets that contribute to hair regeneration.

Although the mechanisms by which PRP works in hair restoration are still being elucidated, studies have shown that many growth factors found in PRP are associated with hair follicle cycling and new blood vessel formation.[72] The following effects may explain PRP's benefits for hair loss: increased proliferation and differentiation of hair follicle cells, prevention of hair follicle cell death, induction of the anagen phase, promotion of the telogen to anagen transition, decreased inflammation, and new blood vessel formulation.[73,74]

PRP may offer hope for men with AGA who don't respond to other treatments. One small study of 11 men with AGA who hadn't responded to minoxidil or finasteride treated with 4 PRP injections every 2 weeks showed reduced hair loss, increased hair count, and overall high patient satisfaction.[75]

Randomized controlled trials using PRP and placebo injected into each half of a participant's scalp offer a unique opportunity to study PRP's effectiveness. In one study of 45 men with AGA, neither the physicians nor the participants knew which half of the scalp received PRP treatments (therefore, this study was "double-blinded").[76] Treatment was given once per month for 3 months. PRP increased hair regrowth and cell proliferation. Another randomized controlled trial of 20 men with AGA used PRP placebo on each half the participants scalps once per month for 3 months. Microscopic evaluation showed increased hair follicles and small blood vessels around follicles at 3 months, with results lasting up to 12 months.[77]

The most recent review of the literature assessing 9 studies using PRP for AGA treatment showed positive results in 7 of 9 studies in multiple outcomes including global photography, hair

pull test, hair count and density, anagen-to-telogen ratio, and patient satisfaction. Unfortunately, no standardized method for producing PRP exists; therefore, studies differ in terms of volume of blood drawn, centrifugation, and platelet concentration. Treatment protocols range from 1 to 6 sessions of 2 to 12 cc PRP injected every 2 to 12 weeks. Most improvement was reported after the third month of treatment.

PRP is not currently FDA-approved for hair loss. If used as part of a comprehensive hair restoration plan, PRP should be produced using FDA-cleared kits and should contain a high concentration of platelets in a small volume of plasma (usually 2 to 6 times the concentration of whole blood). The PRP solution should contain few red and white blood cells to minimize bruising and inflammation. Since PRP is autologous, the risk of infection and immune rejection is minimal. Recommended frequency of PRP is to receive treatments every month for the first 3 to 4 months, then every 3 to 6 months. Treatment may need to be ongoing since hair growth may reverse at 6 to 12 months after the last treatment.[78,79]

Low-level Light Therapy

Low-level light therapy (LLLT) was first discovered in the 1960s by NASA to accelerate wound healing in space. It has been used to treat skin problems such as nonmelanoma skin cancer, acne, and psoriasis. LLLT, also known as photobiomodulation, was cleared for safety by the FDA in 2007 and several randomized controlled trials suggest it is safe and effective for hair loss treatment in men and women.[80-83]

Lasers produce monochromatic, coherent light. Different wavelengths of light enter tissues at various depths. Laser light must be capable of penetrating the scalp 3 to 5 mm to reach hair follicles. The optimal wavelength is unknown; however, consensus is that a wavelength of approximately 650 to 900 nanometers is needed.[84] Cold laser light stimulates mitochondria to produce ATP (energy). Another hypothesis is that LLLT activates transcription factors that increase genes related to protein synthesis, cell migration and proliferation, anti-inflammatory

signaling, anti-apoptotic proteins, and antioxidant enzymes. Stem cells and progenitor cells appear particularly sensitive to LLLT.[85]

Although clinical trials for alopecia areata are lacking, case reports suggest that LLLT can promote hair regrowth in alopecia areata patches.[86,87] Studies using LLLT for androgenetic alopecia (AGA) are promising. One recent 6-month double-blind, sham device-controlled trial involving 20 women and 20 men with AGA showed greater hair density and diameter in treated subjects.[88] Another 6-month trial of 100 subjects with AGA used LLLT on one side of the head and sham treatment on the other side, 3 times per week for 30 minutes. Greater improvement in hair thickness, hair count, and hair coverage were seen in the treated side at 3 and 6 months.[89]

Several LLLT devices for home use are currently available, including Capillus®, Kiierr®, HairMax Lasercomb®, Lasercap®, and Theradome®. The HairMax Laser Comb was shown to improve hair density at 26 weeks in a company-sponsored study of 110 men with androgenetic alopecia.[90]

Theradome®, Capillus®, Lasercap®, and Kiierr® devices appear easiest to use since they're worn like a hat or helmet, unlike the HairMax LaserComb® that requires combing during treatment. Theradome® is worn for 20 minutes, twice per week, Capillus® is worn for 6 minutes daily, Lasercap® and Kiierr® are worn for 30 minutes every other day.

Nutrient support for healthy hair

Deficiencies in vitamins A, B, C, D, and E, as well as the minerals iron, selenium, and zinc can contribute to hair loss. Insufficient protein and essential fatty acids may also play a role. Nutrient deficiencies may be due to inadequate intake in the diet or digestive problems such as hypochlorhydria (low HCl), pancreatic enzyme insufficiency, or malabsorption. In addition to optimizing intake, ensuring adequate digestion and absorption of nutrients needed for healthy hair is essential.

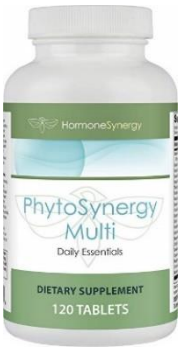
Besides supporting hair quality, some nutrients and compounds that act as antioxidants, improve the body's antioxidant defense system, or lower inflammation may benefit age-related changes in hair.

The following supplements may benefit hair loss or strengthen hair.

- **Synergy Collagen** is a blend of grass-fed beef, chicken, wild fish, and eggshell collagen peptides, providing type I, II, III, V, and X collagen proteins. Collagen is the most abundant protein in the body, making up approximately 70% of skin and 30% of bone to improve the strength, elasticity, and flexibility of these tissues. Collagen is also a major component of cartilage, ligaments, and tendons. Collagen is primarily made of the amino acids proline, hydroxyproline, and glycine. Proline is the main component of keratin, the protein used to make hair. Supplementation with collagen may support bone, joint, skin, and hair health.[91-95] Synergy Collagen contains 7,800 mg of collagen per scoop. Dose is 1 scoop, once or twice per day mixed into water, smoothie, or soup.

- **Hair, Skin, & Nails** contains biotin, silicon and choline-stabilized orthosilicic acid needed for collagen and glycosaminoglycan formation. Biotin supplementation may improve hair volume, scalp coverage, thickness, and moisture retention.[96] Choline-stabilized orthosilicic acid (ch-OSA®) is a patented, bioavailable form of silicon that promotes collagen production in cells. Clinical trials suggest that ch-OSA also increases keratin and elastin formation and improves skin and hair elasticity and strength.[97,98]

- **Zinc glycinate** is a chelated form of zinc that improves its absorption. Low zinc levels have been found in people with alopecia areata, male pattern hair loss, female pattern hair loss, and telogen effluvium.[99-101] Zinc supplementation can benefit hair loss caused by zinc deficiency.[102-104] Dosage is 1 capsule (20 mg) per day. Higher doses should be monitored by a physician since excessive zinc supplementation can cause copper deficiency.

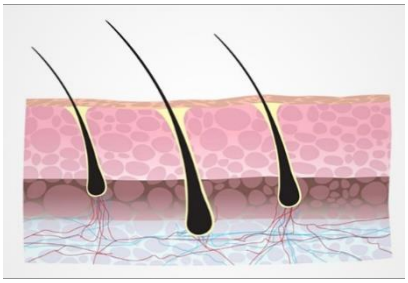


- **PhytoSynergy Multi** provides more than 20 essential vitamins and minerals as well as a full spectrum of phytonutrients, including lycopene, zeaxanthin, lutein, resveratrol and a complex array of polyphenol-rich nutrients such as pomegranate, blueberry, green tea, and green coffee bean extract. Unfortunately, only 10% of American adults meet recommended daily fruit or vegetable intake.[105] At least 40% of adults have inadequate intake of vitamins A, C, D, and E and magnesium.[106] This high-potency formula can replace missing essential nutrients and enhance the body's antioxidant defense system, protect DNA stability, and promote healthy aging. Dosage is 1 to 2 tablets per day.

- **OmegaSynergy 1000 EPA-DHA** contains a concentrated, purified source of omega-3 fatty acids in triglyceride form from sustainably source, cold-water fish. Each softgel is

stabilized with antioxidants to prevent oxidation, providing 710 mg EPA & 290 mg DHA per capsule. Omega-3 fatty acids reduce inflammation and may help with hair loss. Studies suggest improved hair growth and reduced hair loss in women with thinning hair.[107,108]

Hair transplant



A hair transplant involves transferring hair from an area unaffected by hair loss (the donor area) to an area of thinning hair or complete baldness. Hair transplantation has come a long way from the "punch" hair transplant pioneered by Dr. Norman Orentreich in the 1950s.[109]

Follicular unit transplantation (FUT) involves removing strips of hair units. Tiny cuts are made in the scalp where follicular unit grafts are placed. This type of hair transplant can leave scar tissue where the donor graft is taken. Follicular unit extraction (FUE) is often favored over FUT since individual hair follicles are extracted from the donor area and moved to transplant sites using a 1 mm punch. Grafting sessions in FUE can last up to 6 hours during which 2000-3000 follicular units may be transplanted. Complications of hair transplantation are rare and the procedures success rate is very high.

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