

ALOPECIA MANAGEMENT MINOXIDIL IMPROVING HAIR GROWTH: AN
OVERVIEWSuresh Ghritlahare^{1*}, Pushpendra Kurre¹, Govind Panagar¹ and Trilochan Satapathy²¹Shri Rawatpura Sarkar University, Raipur, (C.G.), India-492015.²Raipur Institute of Pharmacy, Raipur, (C.G.), India-492101.

Received on: 21/12/2019

Revised on: 11/01/2020

Accepted on: 31/01/2020

*Corresponding Author

Suresh Ghritlahare

Shri Rawatpura Sarkar
University, Raipur, (C.G.),
India-492015.

ABSTRACT

Hair is one of the important parts of our body. Hair failure is a familiar complaint, both men and women & use of prescription medications is well-known. Hair loss can be divided into three types: 1. Noncicatricial (potentially reversible), 2. Cicatricial 3. Due to hair shaft abnormalities. The scalp hair grows in cycles of anagen (growth), catagen (involution), telogen (resting), and exogen (release of dead hair) phases. Causes of hair loss: Hair loss is a dermatological disorder that has been recognised for more than 2000 years. Drugs that cause hair loss Drugs can cause telogen hair loss that starts about 12 weeks after starting the drug and continues while on the drug. 10 Dosing changes can also precipitate hair shedding. Any medication or over the counter product the patient is taking should be suspected in hair loss. Drugs known to cause telogen effluvium are oral contraceptive pills, androgens, retinoids, anticonvulsants, antidepressants, and the anticoagulants heparin and warfarin. Medicines used to treat arthritis (Penicillamine, Indomethacin, Naprosyn and Methotrexate), parkinson's disease (levodopa); any other medication which has an androgenic (male) hormone action, such as - anabolic steroids, often used by athletes and bodybuilders or danocrine used for treating endometriosis in women causes hair loss. Diagnosis of hair loss: Biopsy of central scalp, daily hair count, wash test, Hair pull test etc. Treatments of hair loss: a herbal drug used in treatment of alopecia i.e. Common names are Avocado Shikakai, Arnica, Onion, Birch, Mustard, Tea, Marigold, Pepper, Mandukparni etc. Synthetic drugs used for treatment of hair loss are Minoxidil, Finasteride, Zinc, Skinoren/Azelaic Acid, Ketoconazole, Cyproterone Acetate with Ethinyl oestradiol, Cimetidine, Cyproterone Acetate, Spironolactone, Prezate copper etc. minoxidil was transformed from an antihypertensive to hair-loss drug, Minoxidil affects hair follicles by inducing proliferation and differentiation of the dermal papilla cell at the bulb base. FDA approved 2% solutions for female patients. This stops the hair loss in patients with AGA and stimulates new hair growth.

KEYWORDS: *Androgenic alopecia, Alopecia areata, Telogen effluvium, Minoxidil.*

1. INTRODUCTION

Hair is one of the important parts of our body and it influences the overall appearance of the person and is derived from ectoderm of the skin, it is an ornament structure along with sebaceous gland.^[1] Hair failure is a familiar complaints, both men and women & use of prescription medications is well-known but, hair losses, in particular telogen effluvium, may occur in response to a number of triggers as well as, hemorrhage, fever, stress, severe illness, childbirth & a thorough exclusion of these potential confounders is necessary before the hair loss can attributed to the medication Alopecia is a dermatological disorder that has been recognized for more than 2000 years. It is common throughout the world.^[2]

Types of Hair Loss

Hair loss can be divided into three types:

- Noncicatricial (potentially reversible)
- Cicatricial
- Due to hair shaft abnormalities.

A. Noncicatricial Alopecia

Noncicatricial alopecia, in turn, has several subtypes

- Androgenetic alopecia (common bald- ness)
Alopecia areata (isolated or recurrent patchy hair loss)
- Telogen effluvium (shedding)
- Traction alopecia (caused by pulling hair), and trichotillomania (compulsive hair-pluck- ing).^[3]

Androgenetic alopecia: Androgenetic alopecia may affect genetically predisposed men and women at any time from puberty to senescence. The initiating incident

may be a telogen shed, but the primary symptom reported by the patient is thinning.

Causes: Androgens such as dehydrotestosterone and dehydroepiandrosterone sulfate influence hair loss.

Dehydrotestosterone, the most potent androgen, reduces the amount of scalp hair and increases the amount of body and genital hair. Androgenetic alopecia affects equal numbers of men and women.^[4,5]



"Fig. 1:"Androgenetic alopecia in both male and female hair loss pattern.

Alopecia areata: Presentation. Alopecia areata causes isolated or recurrent patchy hair loss, but multiple patches, complete scalp hair loss (alopecia totalis), and complete scalp and body hair loss (alopecia universalis) are other clinical presentations.

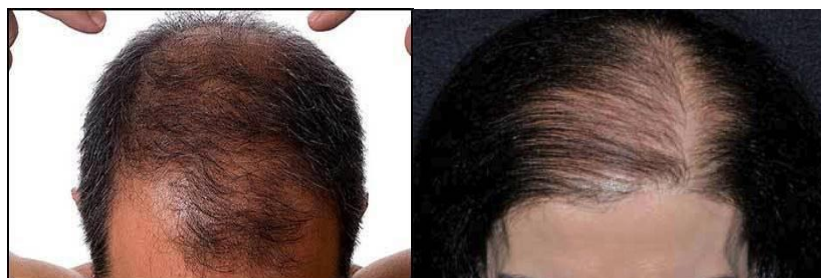
Causes: In alopecia areata, a deep inflammatory process around the follicle accelerates the shedding phase. The affected hair sheds, and no replacement is seen while the inflammation is present. The exact cause of alopecia areata has not been identified.^[6,7]



"Fig. 2:"Alopecia areta both male and female pattern.

Telogen effluvium: Telogen effluvium is the most general type of hair loss. In this state, hair follicles prematurely alter from the growth phase to the resting telogen phase.

Causes: Often, an event triggers the process 3 to 6 months before the shedding begins. Acute shedding was initially described after febrile diseases, childbirth, chronic systemic diseases, use of heparin, and emotional distress.^[8,9]



"Fig. 3:" Telogen effluvium both male and female pattern.

Traction alopecia: Traction alopecia is capable of physically damage the hair shaft and also alters the hair growth cycle, but traction is repetitive & chronic. Traction alopecia causes the hair to be sparse and break in the frontal area.

Causes: Rigid braids, elastic hair bands, ponytails, rollers and other devices that place extreme and repetitive stress on the scalp hair are responsible for nearly everyone cases.



Fig. Traction alopecia both male and female pattern.

Trichotillomania: It is the compulsive pulling out of one's individual hair in a bizarre pattern arrangement. Trichotillomania clinically presents as areas of partial

hair loss & undersized hair, most commonly on the scalp. Eyebrows, eyelashes & other hairy areas can also be affected.^[10]



"Fig. 4:" Trichotillomania both male and female pattern.

B. Cicatricial Alopecia: Cicatricial alopecia is irreversible hair loss associated with destruction of the stem cell reservoir located in the middle of the follicle.

planopilaris. Others include trauma, scarring bullous disorders (epidermol- ysis bullosa, bullous pemphigoid, porphyria cutanea), and neoplastic disease (skin tumors and cutaneous metastasis).

Causes: Common causes are fungal or bacterial folliculitis, discoid lupus erythemato- sus, and lichen



"Fig. 5:" Cicatricial alopecia both male and female pattern.

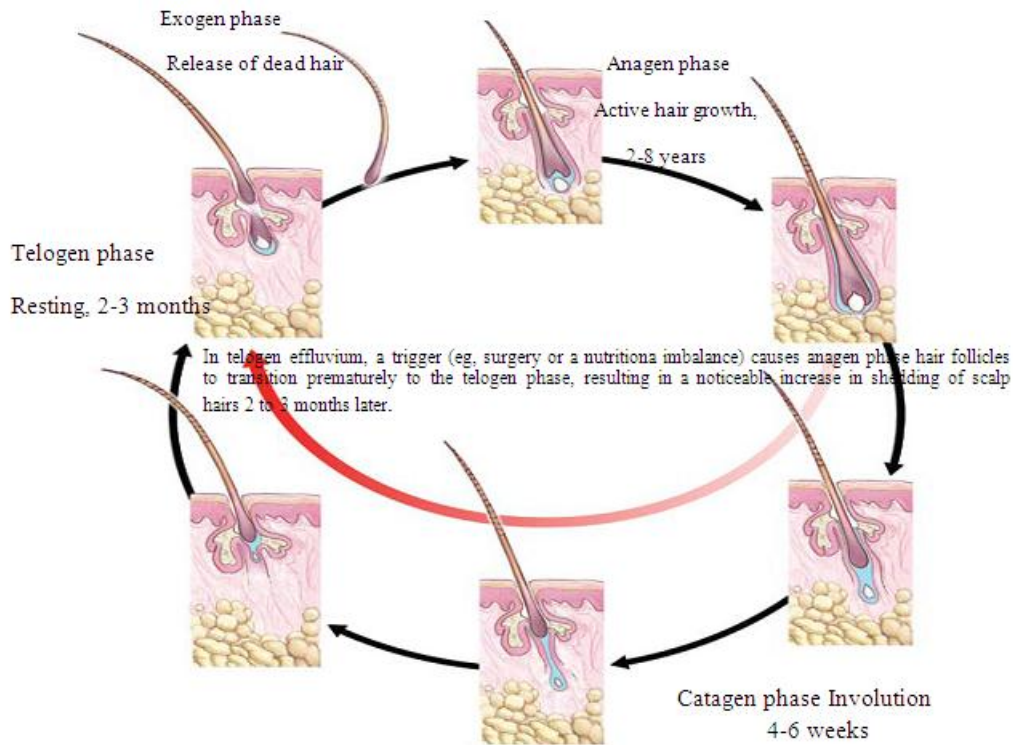
C. Hair Shaft Abnormalities

Hair shaft abnormalities produce fragile and brittle hair. Patients might present with disperse or patchy areas of short hair and a history of hair that will not grow away from a certain length.

Causes: Repeated trauma to the hair shaft from traction, bleaching, perming, or blow-drying is most often the cause of the hair shaft abnor- mality in adults.^[11]

Hair Cycle and Diffuse Hair Loss

The scalp hair grows in cycles of anagen (growth), catagen (involution), telogen (resting), and exogen (release of dead hair) phases. A wide range of triggers can disrupt the normal cycle and lead to diffuse shedding. Diffuse failure of telogen-phase hairs is the most common type of diffuse shedding. Diffuse hair loss during the anagen phase is typically caused by chemotherapy & radiation therapy.^[12]



"Fig. 6": The hair cycle and diffuse hair loss.

Causes of Hair Loss

Hair loss is a dermatological disorder that has been recognised for more than 2000 years. It is common throughout the world and has been estimated to affect nearly 2% of the world's population. Drugs that cause hair loss can cause telogen hair loss that starts about 12 weeks after starting the drug and continues while on the drug. Dosing changes can also precipitate hair shedding. Any medication or over the counter product the patient is taking should be suspected in hair loss. Drugs known to cause telogen effluvium are oral contraceptive pills, androgens, retinoids, anticonvulsants, antidepressants, and the anticoagulants heparin and warfarin. Changing or stopping any oral contraceptive can precipitate telogen hair shedding. Oral contraceptives containing an androgenic progestin and hormonal replacement therapy with high dose progesterone can cause telogen hair shedding with or without patterned alopecia.^[12,13,14] Medicines used to treat arthritis (Penicillamine, Indomethacin, Naprosyn and Methotrexate), parkinson's disease (levodopa); any other medication which has an androgenic (male) hormone action, such as - anabolic steroids, often used by athletes and bodybuilders or danocrine used for treating endometriosis in women causes hair loss. Beta-adrenoceptor antagonists, commonly used to treat hypertension, have been reported to be associated with alopecia. Metoprolol and propranolol have both been described to lead to reversible hair loss from a telogen efflu- vium. Another group of antihypertensives, the angiotensin-converting enzyme inhibitors, may also be associated with alopecia. Captopril is 1 of several drugs in this group and has been shown to induce a diffuse hair loss. Often the hair loss is in association with other

known cutaneous adverse effects. Amiodarone, a popular antiarrhythmic medication, has rarely been reported to be associated with alopecia.^[2,15]

2. Diagnosis of Hair Loss

- **Males:** Usually not necessary unless a female pattern of hair loss, diffuse hair loss, or scalp changes suggestive of cicatricial alopecia confuse the diagnosis.
- **Females:** Sometimes necessary to exclude chronic telogen effluvium, diffuse alopecia areata, or cicatricial hair loss such as early central centrifugal cicatricial alopecia seen commonly in African American women.
- **Site of biopsy:** The preferred area for biopsy is the central scalp in an area representative of the hair loss process. Biopsy should not be from bitemporal area as this region may have miniaturized hairs independent of MPHL or FPHL.
- **Type of biopsy:** A punch biopsy of less than 4 mm in diameter that follows the direction of the hair shafts and is taken deep into the subcutaneous fat where anagen hair bulbs are located is standard. Many dermatopathologists favor horizontal sectioning of biopsies.^[16]
- **Daily hair count:** In this test, hair counting should be performed from the morning combing or during hair washing. This is the clinical hair evaluation method and hair is collected in a plastic transparent poly bag for about 10-14 days. If hair counts more than 100 to 150/day, it is considered as hair fall condition.^[17]

- **Wash test:** The wash test is a valuable method in which hairs shed during shampooing is collected. In this test, hairs were washed, counted and divided into groups of 3cm or shorter, (considered telogen vellus hairs), intermediate length (3–5cm), and 5cm or longer. Patients with 10% telogen vellus hairs were classified as having androgenetic alopecia.^[18]
- **Hair pull test:** This test is performed to evaluate diffuse scalp alopecia. The number of pulled hairs is evaluated by counting under ultra microscopes.^[19]

3. Treatments of Hair Loss

Herbal drug used in treatment of alopecia: To cope the alopecia problem, here we have looked into the treasure of natural origin and found a number of natural

product, which are effective for alopecia treatment. Lots of benefits are associated with natural products such as fewer side effects, improved patient compliance and polyherbal treatment gives more than one mode of action for treatment of Alopecia.^[20] Many natural products having potency for treating alopecia without producing any side effects. Plant extracts having multiple phyto-constituents and can treat hair loss either by providing or by acting as DHT and 5- α -Reductase blockers or nutritional supplements. They also have essential oil, which can helpful in treating alopecia by aromatherapy by improving blood circulation in scalp.^[21,22]

Table 1: List of some herbs used for hair growth & hair care.

S. NO.	Common name	Botanical name	Chemical constituents	Mechanism of action
1.	Avocado	Persea americana	Isoflavonoid, Terpanoids	5- α reductase type 1 inhibitor and Sebum secretion inhibitor Pods
2.	Shikakai	Acacia concinna	Terpenoids	Pods extract is used as hair cleanser for control of dandruff.
3.	Arnica	Arnica montana	Terpenoids	Flowers extract is used in hair tonic material.
4.	Onion	Allium cepa (Onion)	Terpenoids	For hair dyeing.
5.	Birch	Betula pendula	Polyphenol	Extracts of leaves used as anti-dandruff.
6.	Mustard	Brassica spp.	Tannins	Seed oil is used as hair oil and useful for hair nourishment.
7.	Tea	Camellia sinensis	Catechins, Epicatechins	5- α reductase inhibitor
8.	Marigold	Calendula officinalis	Flavonoids	Flower extract is used in hair cream for smoothing effect.
9.	Pepper	Capsicum annum	Isoflavone	Nerve stimulation and production of IGF- I Whole
10.	Mandukparni	Centella asiatica	Essential Oil	Whole plant extract is used for growth & maintenance of hair.

Table 2: The synthetic drug used for treatment of hair loss.

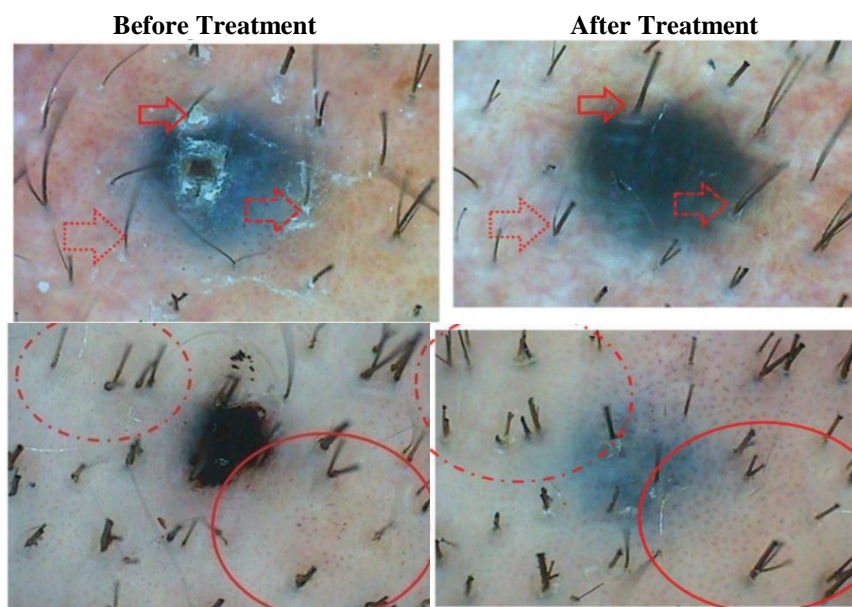
S. NO.	Drug	Mechanism of action	Use
1.	Minoxidil	Act by gradually enlarging and lengthening hair follicles in AA.	Treatment of Androgenetic Alopecia (AA)
2.	Finasteride	It is specific inhibitor of type 2-5 alpha reductase.	Tablet is taken once a day for treatment of AA
3.	Zinc	Zinc inhibits 5a reductase enzyme.	AA, Pattern bald- ness, can be used with vitamin B6 azelaic acid
4.	Skinoren/Azelaic Acid	Potent inhibitor of 5 alpha reductase	n acne, skin conditions, AA
5.	Ketoconazole	Antiandrogenic effect cause reduction in testosterone and other androgens by adrenal gland and reproductive organs	In AA, Antifungal agent, In Sebbhoreic dermatitis
6.	Cyproterone Acetate with Ethinyl oestradiol	Block peripheral action of male hormones in female body	Hormonal contraceptive, severe acne, Hirsutisnim, women, female pattern baldness.
7.	Cimetidine	Blocks binding of dihydro testosterone	Stomach and duodenal ulcers,

		to its receptor.	Hirsutism, AA
8.	Cyproterone Acetate	Block binding of DHT to its receptors	Hirsutism in women
9.	Spironolactone	Antiandrogenic	In treatment of high BP, AA.
10.	Prezatis copper	It is copper binding peptide and required for melanin production	As a anti-inflammatory

4. How Minoxidil Was Transformed From An Antihypertensive To Hair-Loss Drug

When patients taking the antihypertensive agent minoxidil in clinical trials in the late 1960s started getting a bit hairy, executives at Upjohn the US pharmaceutical company that made the drug dismissed it as a harmless side effect. Founded in 1886 to make "friable pills", Upjohn (now part of Pfizer) had a well earned reputation for serious pharmaceutical research, and did not want to get caught up in miracle baldness cures. But once minoxidil was on the market for hypertension, it quickly became an open secret that the drug stimulated hair growth. A topical formulation was developed and shown to induce regrowth of terminal hairs on the scalps of stump-tailed macaques a species prone to hair thinning in adolescence and baldness as adults.^[23,24,25] Minoxidil affects hair follicles by inducing proliferation and differentiation of the dermal papilla cell

at the bulb base. In recent years, a quite a lot of studies have been focused on different types of approaches such as minoxidil, vasodilator to prevent excessive hair loss, enlarge exiting hairs and promote hair growth by affecting hair growth cycle in AGA.^[22,26] AGA is now widely treated with topical minoxidil—2 per cent and 5 per cent solutions are available. FDA approved 2% solutions for female patients. This stops the hair loss in patients with AGA and stimulates new hair growth.^[27] Efficacy and safety of 5% minoxidil topical foam in male pattern hair loss treatment. The study was a before-and-after trial on 17 male patients with male pattern hair loss. Subjects were instructed to apply one capful (1 ml) of minoxidil 5% topical foam on the scalp daily for 6 months. Efficacy was assessed through hair counts, subject assessment, and global photographic review, confirms this improvement in the hair count for two volunteers after 24 weeks.^[28]



"Fig. 7:" Two volunteers with moderate improvement in average hair growth at week 24 (before, after).

CONCLUSION

Today, hair loss is a very serious problem in men and women. There can be many reasons for hair loss from the scalp; some of them are as follows there is any skin disease or can also be caused by the use of prescription medicines. How fast is hairs falling from the head, several types of investigations are done to detect this among them, Skin biopsy, Hair wash test, hair count test & Hair pull test etc? Many Ayurvedic and allopathic medicines are used to prevent hair loss. One of them medicine is minoxidill which were previously used as anti hypertensive drug but they have some side effects

that cause hair grow. Due to this side effect of minoxidill nowadays people are using this medicine to regrow hair in alopecia and this medicine has emerged as a very effective medicine for regrowing hair.

REFERENCES

1. Basheer, Mohammed, A Anil Babu, and T Abdu Rahman. "Treatment for Hair Fall and Premature Hair Greying by Poly Herbal Formulation", 2017; 3(9): 40–43.
2. Patel, Mansi, Shannon Harrison, and Rodney Sinclair. "Drugs and Hair Loss." *Dermatologic*

- Clinics*, 2013; 31(1): 67–73. <https://doi.org/10.1016/j.det.2012.08.002>.
3. Bergfeld WF, Elston DM. Scarring alopecia. In: Roenigk RK, Roenigk HH Jr, editors. *Dermatologic Surgery*. 2nd ed. New York: Marcel Dekker, Inc, 1996; 647–663.
 4. Price VH. Treatment of hair loss. *N Engl J Med*, 1999; 341: 964–973.
 5. Kuster W, Happle R. The inheritance of common baldness: Two B or not Two B? *J Am Acad Dermatol*, 1984; 5: 921–926.
 6. Shapiro J, Price VH. Hair regrowth: therapeutic agents. *Dermatol Clin*, 1998; 16: 341–356.
 7. MacDonald N. Alopecia areata: identification and current approaches. *Dermatol Nurs*, 1999; 11: 356–359.
 8. Reborna A. Telogen effluvium. *Dermatology*, 1997; 195: 209–212.
 9. Kligman AM. Pathologic dynamics of human hair Telogen effluvium. *Arch Dermatol*, 1961; 83: 175–198.
 10. Muller SA. Trichotillomania: a histopathologic study in sixty-six patients. *J Am Acad Dermatol*, 1990; 23: 56–62.
 11. Brenner, Fabiane Mulinari, Wilma F Bergfeld, and Cleveland Clinic, 2003. “Hair Loss:” no. September. <https://doi.org/10.3949/ccjm.70.8.705>.
 12. Harrison, Shannon, and Wilma Bergfeld. “Diffuse Hair Loss: Its Triggers and Management.” *Cleveland Clinic Journal of Medicine*, 2009; 76(6): 361–67. <https://doi.org/10.3949/ccjm.76a.08080>.
 13. Fiedler VC, Gray AC. Chapter 10. Diffuse alopecia: telogen hair loss. In: Olsen EA, ed. *Disorders of Hair Growth: Diagnosis and Treatment*. 2nd ed. New York, NY: McGraw-Hill Publishing, 2003; 303–320.
 14. Hattori M., Ogawa H., Biochemical analysis of hair growth from the aspects of aging and enzyme activities, *J. Dermatol*, 1983; 10: 45–54.
 15. Souleles C., Shamma G., Flavonoids from the leaves of *Zizyphus jujube*, *Fitoterapia*, 1998; 59: 154–156.
 16. Olsen, Elise A., Andrew G. Messenger, Jerry Shapiro, Wilma F. Bergfeld, Maria K. Hordinsky, Janet L. Roberts, Dow Stough, Ken Washenik, and David A. Whiting. “Evaluation and Treatment of Male and Female Pattern Hair Loss.” *Journal of the American Academy of Dermatology*, 2005; 52(2): 301–11.
 17. Lee MS, Kossard S, Wilkinson B, et al. Quantification of hair follicle parameters using computer image analysis: a comparison of androgenetic alopecia with normal scalp biopsies. *Australian Journal of Dermatology*, 1995; 36(3): 143–147.
 18. Van N. Assessment of hair loss: Clinical relevance of hair growth evaluation methods. *Clin Exp Dermal*, 2002; 27(5): 362–369.
 19. Wasko CA, Mackley CL, Sperling LC, et al. standardizing the 60–second hair count. *Arch Dermatol*, 2008; 144(6): 759–762.
 20. Kameyama S. Application and Consideration of Medicinal plant for Hair care products. *Frag J.*, 1995; 23: 28–29.
 21. Rathi V, Rathi JC, Tamizharasia S, et al. Plants used for hair growth promotion. *Pharmacognosy Reviews*, 2008; 2(3): 185–187.
 22. Bansal, K, and Milind Pande. “Alopecia – Reason and Possible Treatments”, 2018; 2(5): 198–208. <https://doi.org/10.15406/mojddt.2018.02.00062>.
 23. Zappacosta AR. Reversal of baldness in patient receiving minoxidil for hypertension. *New England Journal of Medicine*, 1980; 303: 1480.
 24. Uno H. The stump-tailed macaque as a model for baldness: effects of minoxidil. *International Journal of Cosmetic Science*, 1986; 8: 63–71.
 25. Bryan, Jenny. “How Minoxidil Was Transformed from an Antihypertensive to Hair-Loss Drug.” *Pharmaceutical Journal*, 2011; 287(7663–7664): 137–38.
 26. Donald Hull SP, Wood ML, Hutchinson PE, et al. British Association of Dermatologists. Guidelines for the management of alopecia areata. *Br J Dermatol*, 2003; 149: 692–699.
 27. Gupta, Saurabh, and Rubina Khatoon. “Hair Loss- An Analysis and Updated Treatment.” *IOSR Journal of Dental and Medical Sciences Ver. II*, 2015; 14(7): 2279–2861. <https://doi.org/10.9790/0853-14727781>.
 28. Hasanzadeh, Hournaz, Saman Ahmad Nasrollahi, Nader Halavati, Maryam Saberi, and Alireza Firooz. “Efficacy and Safety of 5% Minoxidil Topical Foam in Male Pattern Hair Loss Treatment and Patient Satisfaction.” *Acta Dermatovenerologica Alpina, Pannonica et Adriatica*, 2016; 25(3): 41–44. <https://doi.org/10.15570/actaapa.2016.12>.