Evaluation and Treatment of Hair Loss

New Frontiers in Cosmetic Medicine &
Medical Dermatology Symposium

November 17 - 19, 2023

NEW FRONTIERS IN
COSMETIC MEDICINE &
MEDICAL DERMATOLOGY

Presented by Michael H. Gold, MD
Gold Skin Care Center
Tennessee Clinical Research Center
Nashville, TN 37215

Academic Appointments

01. Assistant Clinical Professor

- Department of Medicine, Division of Dermatology, Nashville, TN USA
- Vanderbilt University School of Medicine: 2006-2014
- Vanderbilt University School of Nursing: 2006-2020

02. Adjunct Assistant Professor

- Meharry Medical College: 2013 – Present
- School of Medicine, Nashville, TN

03. Visiting Professor of Dermatology

- Huashan Hospital, Fudan University (Shanghai Medical University), Shanghai, China
- The First Hospital of China Medical University, Shenyang, China:
- Guangdong Provincial People's Hospital, Guangzhou, Zhejiang

04. Visiting Professor of Plastic Surgery

- First People's Hospital of Foshan University, Guangdong, China
- The First Affiliated Hospital of Zhejiang University, Hangzhou, Zhejiang
- Rongjun Hospital, Jiaxing, China
- The People's Hospital of Hunan Province, Changsha, China

05.

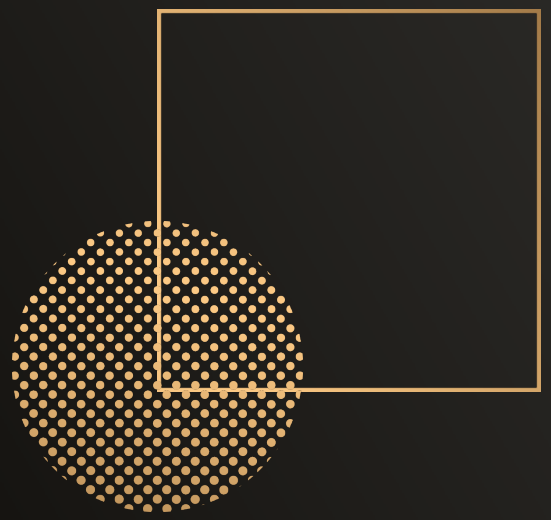
- Editor-in-Chief – Journal of Cosmetic Dermatology – Wiley: 2016-Present
- Editor-in-Chief- Dermatological Reviews – Wiley: 2019 - Present

Conflict of Interest

01. Consultant to many pharmaceutical, cosmeceutical, laser and energy-based device companies

02. Consultant, performs research and speaks on behalf of numerous pharmaceutical and medical device companies

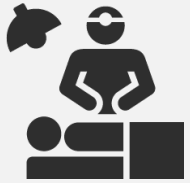
03. For the benefit of this presentation, consultant, Investigator, Speaker for Venus Concepts, Lutronic, Revian, Nutrafol, Eclipse, and Virtue



- Global Market

- Hair Restoration

54 Million Men & 32 Million Women experience some form of hair loss in the US.



Annually, approximately 130,000 patients in the US & 600,00 patients worldwide choose to have a surgical procedure done.

There are over 1 Million people every year who elect for non-surgical treatments.

Hair Loss - 2023

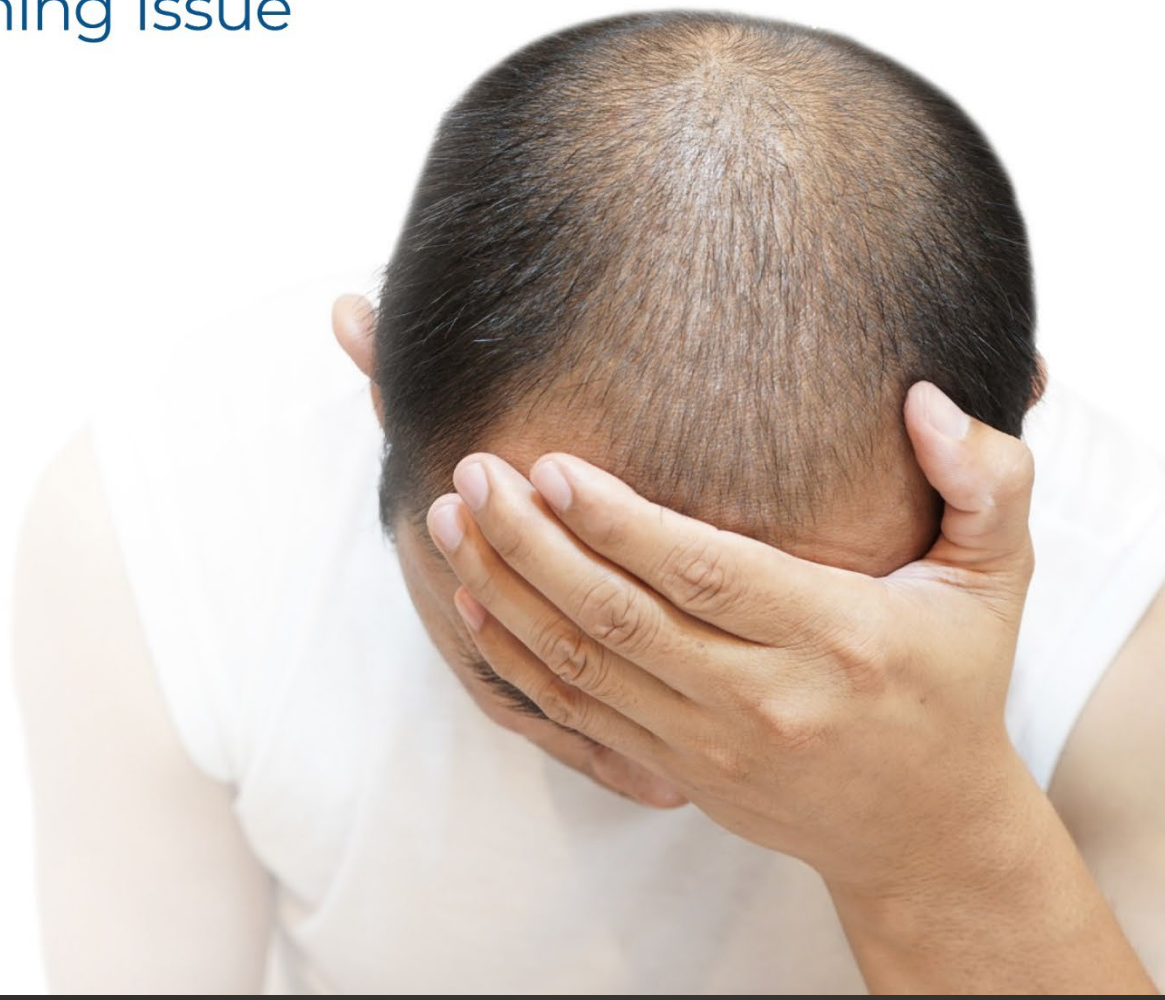
- Hair plays an important role in identity, self-perception, and psychological functioning
- Hair loss can be devastating experience that decreases self-esteem and feelings of personal attractiveness while also leading to depression and anxiety
- Treatment options for hair loss
  - Non-surgical hair restoration
  - Surgical hair restoration

Aging Related Issues

Hair Loss / Thinning Is The Most Concerning Issue

Hair Loss / Thinning	**4.99**
Eyesight	4.76
Weight Gain / Obesity	4.56
Heart Disease	4.05
Loss of Strength	4.45
Prostate Cancer	4.37
Hearing Loss	4.32
High Cholesterol	4.24
Erectile Health Issues	4.23
Hypertension	4.26
Male Incontinence	4.05
Wrinkles	3.93
Graying Hair	3.78

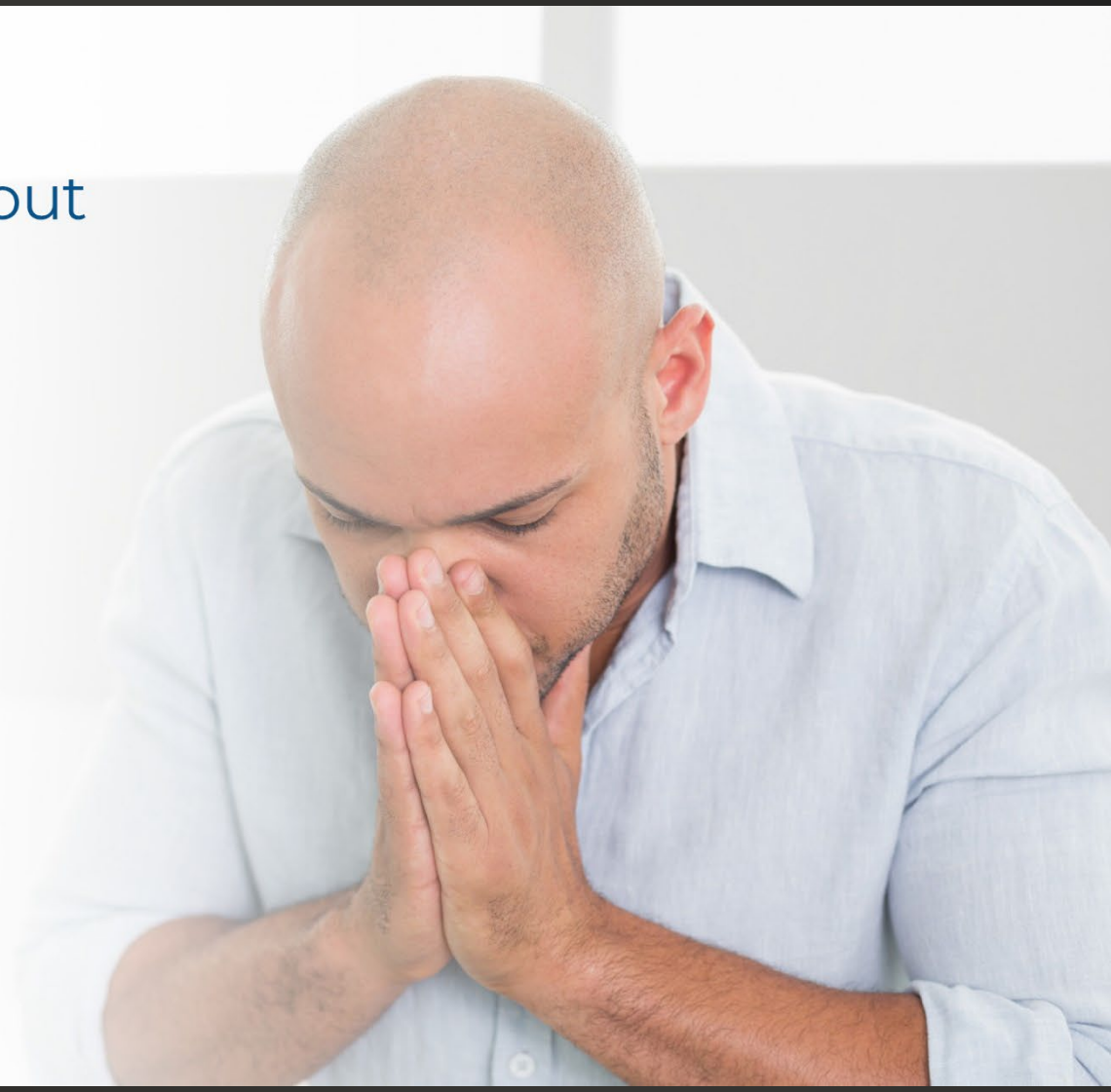
AVG. Rating (On 7-Point Scale)



Concerned About Hair Loss

88% of Men Worry They Would Be Less Attractive And Are Not As Confident About Their Appearance

- 45% Concerned about being less attractive to others or romantic partners
- 43% Not as confident about self appearance
- 37% Concerned about losing hair at an unusually young age
- 34% Concerned about appearing older to others
- 18% Concerned about being ridiculed
- 15% Concerned about impact on career / earning potential
- 04% Other



Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Treatment options for androgenetic alopecia: Efficacy, side effects, compliance, financial considerations, and ethics

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Abstract

Background: Androgenetic alopecia (AGA) is the most common form of hair loss consisting of a characteristic receding frontal hairline in men and diffuse hair thinning in women, with frontal hairline retention, and can impact an individual's quality of life. The condition is primarily mediated by 5-alpha-reductase and dihydrotestosterone (DHT) which causes hair follicles to undergo miniaturization and shortening of successive anagen cycles. Although a variety of medical, surgical, light-based and nutraceutical treatment options are available to slow or reverse the progression of AGA, it can be challenging to select appropriate therapies for this chronic condition.

Aims: To highlight treatment options for androgenetic alopecia taking into consideration the efficacy, side effect profiles, practicality of treatment (compliance), and costs to help clinicians offer ethically appropriate treatment regimens to their patients.

Materials and Methods: A literature search was conducted using electronic databases (Medline, PubMed, Embase, CINAHL, EBSCO) and textbooks, in addition to the authors' and other practitioners' clinical experiences in treating androgenetic alopecia, and the findings are presented here.

Results: Although topical minoxidil, oral finasteride, and low-level light therapy are the only FDA-approved therapies to treat AGA, they are just a fraction of the treatment options available, including other oral and topical modalities, hormonal therapies, nutraceuticals, PRP and exosome treatments, and hair transplantation.

Discussion: Androgenetic alopecia therapy remains challenging as treatment selection involves ethical, evidence-based decision-making and consideration of each individual patient's needs, compliance, budget, extent of hair loss, and aesthetic goals, independent of potential financial benefits to the practitioners.

KEYWORDS
androgenetic alopecia, ethics, review, therapies, treatments

Table 1 Efficacy, Side Effects, Clinical Evidences Supported in Various Treatment Options in AGA

TABLE 1 Efficacy, side effects, clinical evidences supported in various treatment options in AGA

Treatment	Clinical evidence (weak, moderate, strong)	Side effects, short-term	Side effects, long-term	Likelihood of patient compliance (low, moderate, high, extremely high)	Monthly cost ($ ≤ $100; $$ – $100-$1000; $$$ – $1000-$5000; $$$$ – $5000-$15000; $$$$$ ≥ $15000; ? – unknown number of treatments (final cost))	5 year cost ($ ≤ $100; $$ – $100-$1000; $$$ – $1000-$5000; $$$$ – $5000-$15000; $$$$$ ≥ $15000; ? – unknown number of treatments (final cost))	Special considerations
Topical minoxidil	Strong, multiple RCTs	Unlikely, scalp irritation	Rare, dizziness, cardiac arrhythmia	Low to moderate	$	$$	Hair growth in undesired locations. May leave residue on hair which interferes with styling.
Topical finasteride	Weak	Unlikely, skin erythema, contact dermatitis	Rare	High	$	$$	May be used as a maintenance therapy
Oral finasteride	Strong, multiple RCTs	Uncommon	Post-finasteride syndrome	High	$	$$	Avoid in females of childbearing potential
Oral minoxidil	Moderate, mainly retrospective case reviews	Unlikely	Rare, unless patients with cardiovascular comorbidities. Weight gain	High	$	$$	Hair growth in undesired locations
Spironolactone	Weak, but commonly used by clinicians	Rare, possible SE include postal hypotension, electrolytic disturbance	Rare, unless patients with renal failure.	High	$$	$$	Contraindicated in males, pregnant females, and individuals with renal failure
Flutamide & bicalutamide	Weak	Hepatic injury	Flutamide has black box warning of hepatic failure	Moderate to high	$	$$	Potential interaction with other medications
Platelet-rich plasma	Strong	Unlikely, scalp pain	Rare	Moderate	$$	$$$$	Avoid in patients with bleeding disorder, lack of standardized protocol
Exosomes	Moderate	Unlikely, scalp pain	Rare	Moderate	$$$	?	Lack of standardized protocol
Microneedling	Weak to moderate	Unlikely, scalp pain	Rare	Moderate	$$	$$$	Lack of standardized protocol

(Continues)

Table 1 (Continued)
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

TABLE 1 (Continued)

Treatment	Clinical evidence (weak, moderate, strong)	Side effects, short-term	Side effects, long-term	Likelihood of patient compliance (low, moderate, high, extremely high)	Monthly cost ($ ≤ $100; $$ – $100-$1000; $$$ – $1000-$5000; $$$$ – $5000-$15000; $$$$$ ≥ $15000; ? – unknown number of treatments (final cost])	5 year cost ($ ≤ $100; $$ – $100-$1000; $$$ – $1000-$5000; $$$$ – $5000-$15000; $$$$$ ≥ $15000; ? – unknown number of treatments (final cost])	Special considerations
Oral nutraceutical supplement containing Synergen Complex®	Moderate	Unlikely	Rare	PO BID, high compliance	$	$$$	Four capsules daily
Marine complex supplement	Moderate	Unlikely	Rare	PO BID, high compliance	$	$$$	Fishy taste for oral supplement
Serenoa repens	Weak	Unlikely	Rare	PO BID, high compliance	$	$$$	Possibility of missing early detection of prostatic cancer
Light devices	Strong	Unlikely	Rare	Daily, high compliance	$$	$$ or $$$	Noninvasive, convenient to use at home
Hair transplant	Strong	Infection, scarring, pain, itching, swelling, bleeding	Rare	Permanent, one-time treatment	$$$$	?	May need concurrent medical treatment

Hair Loss - 2023

- Non-surgical hair restoration
  - Currently, only topical minoxidil and oral finasteride are the only US FDA approved medications for t he treatment of hair loss
  - Other non-surgical options are increasing in popularity
    - Low-Dose Oral Minoxidil
    - Dutasteride
    - Spironolactone
    - Flutamide and Bicalutamide
    - Cyproterone Acetate
    - Ketoconazole
    - Low-level laser therapy (LLLT)
    - Platelet-rich plasma (PRP)
    - Microneedling
    - Stem cells & Exosomes
    - Nutraceutical supplements
  - New Medicines are in the pipeline in 2023 and beyond
    - Clascoterone
    - Oral JAK inhibitors
    - Prostaglandin Analog

Hair Loss - 2023

- Only three FDA approved therapies for hair loss at this time
  - Topical Minoxidil
  - Oral Finasteride
  - Low-Level Light Therapy
- Other medicines and procedures are being performed off-label and showing nice successes

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Hair Loss - 2023

- COVID -19 and Hair Loss
  - With the pandemic, we have seen an increase in patients with hair loss
  - Both Androgenetic Alopecia and also Telogen Effluvium
  - Need to be aware we are still seeing these effects today

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg
Cutis. 2019;104;17-24

Treatment Modalities for Nonsurgical Hair Restoration

Treatment Modality	Intended Population	Method of Administration	Frequency and Duration of Therapy	FDA Approval Status	Adverse Effects
Minoxidil	M, F	Topical	Daily for >6 mo	2% and 5% foam and solution approved for AGA	Pruritus or burning at application site, irritant or allergic contact dermatitis, hypertrichosis, cardiovascular effects
Finasteride	M	Oral	Daily for >6 mo	1 mg/d approved for AGA	Decreased libido, reduction in penis size, gynecomastia, erectile dysfunction, ejaculation disorder, psychologic impairments (eg, decreased concentration, depression, suicidal ideation)
Dutasteride	M	Oral	Daily for >6 mo	Not FDA approved	Decreased libido, erectile dysfunction, ejaculation disorder, psychologic impairments
Spironolactone	F	Oral	Daily for >6 mo	Not FDA approved for hair loss, used off label for FPHL	Headache, decreased libido, menstrual irregularities, orthostatic hypotension, fatigue, hyperkalemia, feminization of men and male fetuses, gynecomastia
Low-level laser light therapy	M, F	Phototherapy device	Daily to weekly for >6 mo	FDA clearance granted to Hairmax Lasercomb and Laserband (Lexington Intl, LLC) and Lasercap (Lasercap Company)	Dry skin, pruritus, scalp tenderness, irritation and warm sensation at treatment site
Autologous PRP	M, F	Subcutaneous injection	Monthly for 3 mo to 1 y	Not FDA approved	Transient pain and erythema, bleeding, infection, pain
Microneedling (with and without PRP)	M, F	Microneedling device (subcutaneous PRP injection)	Daily to weekly for 3–6 mo	FDA clearance granted to Skinpen (Bellus Medical)	Transient pain and erythema, bleeding, infection
Stem cells	M, F	Subcutaneous injection	1 session of injections	Not FDA approved	Pain, dermatitis, recurrence of alopecia
Nutraceutical supplements	M, F	Oral	Daily for >6 mo	Not FDA approved	None reported

Abbreviations: FDA, US Food and Drug Administration; M, males; F, females; AGA, androgenic alopecia; FPHL, female pattern hair loss; PRP, platelet-rich plasma.

Hair Loss - 2023

- Minoxidil
  - More than 40 years of experience now
  - Introduced as HTN drug in the 1970's with AE of hypertrichosis known
  - 2% solution introduced in 1986
  - Biologic response modifier thought to promote hair growth through vasodilation and stimulation of hair follicles into the growth phase
  - Animal studies – shorten telogen, prolong anagen, and increase hair follicle size
  - Also shown to have anti-inflammatory effects by downregulating IL-1, which may confer and additional role in combatting alopecia

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Hair Loss - 2023

- Minoxidil
  - FDA approved for the treatment of AGA in men and women and often used as first line therapy
  - Need at least 6 months of treatment
  - 3 separate meta-analyses – more effective than placebo
    - 777 males – 2% - 45% subjectively experienced new hair growth
    - Results may vary
    - Higher concentrations are more effective
    - 381 women -2% - nonvellus hair counts of 20.7/cm2 in the minoxidil group versus 9.4/cm2 in the placebo group
    - 5% superior to 2% - mean counts of 26/cm2

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Hair Loss - 2023

- Minoxidil
  - Elicits its greatest effects at the vertex and frontal regions of the scalp
  - It slows the rate of hair loss by prolonging the anagen phase
  - Promotes hair growth by increasing hair diameter and density
  - The active metabolite, minoxidil sulfate, is proposed to bind to ATP sensitive protein channels and relax the surrounding smooth muscle
  - Topical application stimulates blood flow within 10-15 minutes
  - The effect is specific to the hair follicle

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
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Hair Loss - 2023

- Low-Dose Oral Minoxidil

Oral Minoxidil Treatment for Hair Loss: A Review of Efficacy and Safety
J Am Acad Dermatol. 2021 Mar;84(3):737-746.

Oral minoxidil treatment for hair loss: A review of efficacy and safety

Michael Randolph, BS, and Antonella Tosti, MD
Miami, Florida

Background: Although topical minoxidil is an effective treatment option for hair loss, many patients are poorly compliant because of the necessity to apply the medication twice a day, undesirable hair texture, and scalp irritation.

Objective: In recent years, oral minoxidil at low dose has been proposed as a safe alternative. This study reviewed articles in which oral minoxidil was used to treat hair loss to determine its efficacy and safety as an alternative to topical minoxidil.

Methods: PubMed searches were performed to identify articles discussing oral minoxidil as the primary form of treatment for hair loss published up to April 2020.

Results: A total of 17 studies with 634 patients were found discussing the use of oral minoxidil as the primary treatment modality for hair loss. Androgenetic alopecia was the most studied condition, but other conditions included telogen effluvium, lichen planopilaris, loose anagen hair syndrome, monilethrix, alopecia areata, and permanent chemotherapy-induced alopecia.

Limitations: Larger randomized studies comparing the efficacy/safety of different doses with standardized objective measurements will be needed to clarify the best treatment protocol.

Conclusion: Oral minoxidil was found to be an effective and well-tolerated treatment alternative for healthy patients having difficulty with topical formulations. (J Am Acad Dermatol 2021;84:737-46.)

Key words: alopecia; alopecia treatment; androgenetic alopecia; efficacy; hair loss; minoxidil; oral minoxidil; safety; systemic minoxidil.

Table 1. Summary of Studies
J Am Acad Dermatol. 2021 Mar;84(3):737-746

Table I. Summary of studies

Authors and year	Disease	Dosage/regimen	Number of participants	Results	Adverse effects
Vano-Galvan et al,[31] 2020	LPP	Median daily dose: 0.5 mg daily for women and 2.5 mg daily for men Average duration: 21 months There were no changes to concomitant therapies within the last 6 months.	N = 51 (36 F, 15 M) Mean age: 55 y	20 patients (39%) had improved hair thickness 27 patients (53%) remained stable 4 patients (8%) had worsening hair thickness Improvement was more likely with higher doses in male patients. Diffuse LPP was associated with a better response than patchy LPP	27% (n = 14) hypertrichosis 6% (n = 3) postural hypotension 4% (n = 2) tachycardia 2% (n = 1) weight gain
Therianou et al,[33] 2020	FPHL with contact dermatitis to propylene glycol in 2% and 5% solutions of TM.	0.25 mg twice per day Average duration: 17 months	N = 9 (9 F, 0 M)	All patients were satisfied with treatment.	22% (n = 2) facial hypertrichosis
Beach et al,[22] 2018	AGA Traction alopecia	1.25 mg nightly Average duration of prescription: 6 months All patients previously using TM	N = 18 (17 F, 1 M) AGA: n = 14 (13 F, 1 M) Traction alopecia: n = 4 (4 F, 0 M) Average age: 41 y	33% had decreased hair shedding 28% had increased scalp hair	6% (n = 1) hypotension and urticaria 39% (n = 7) hypertrichosis of face In all but 1 patient, blood pressure remained normal or improved in those with hypertension. No heart rate changes were found.
Cranwell and Sinclair,[34] 2018	Loose anagen hair syndrome	0.5 mg daily Previously using 5% topical solution for 5 years	N = 1 (1 F) Age: 11 y	Shedding and hair density improved in first 3 months. Discontinued after 12 months with no recurrence	Hair color change from reddish-brown to light brown
Sinclair and Perera,[26] 2017	Chronic telogen effluvium	Varied between 0.25 mg and 2.5 mg daily (29 patients used 1 mg or less daily) n = 5 at 0.25 mg n = 4 at 0.5 mg n = 19 at 1 mg n = 8 at 2.5 mg	N = 36 (36 F, 0 M) Average age: 46.9 y	Baseline HSS: 5.64 6-month HSS: 3.9 12-month HSS: 3.05	n = 2 with transient postural hypotension that resolved n = 1 with ankle edema n = 14 with hypertrichosis Average blood pressure change: S: -0.5 mm Hg D: +2.1 mm Hg

Table 1. Summary of Studies…Cont'd
J Am Acad Dermatol. 2021 Mar;84(3):737-746

Jimenez-Cauhé et al,[28] 2019	AGA	5 mg daily (10 patients received 2.5 mg daily, 31 patients received 5 mg daily)	N = 41 (41 M, 0 F) OM monotherapy: n = 16 Average age: 33.3 y	n = 37 (90.2%) had clinical improvement. n = 11 (26.8%) had marked improvement. n = 4 (9.8%) showed stabilization. Of OM monotherapy subgroup: All had clinical improvement, with 6 (37.5%) showing marked improvement. OM at a dose of 5 mg daily was effective and presented an acceptable safety profile	n = 10 (24.3%) hypertrichosis n = 2 (4.8%) lower limb edema; 1 patient discontinued
Pirmez and Salas-Callo,[29] 2019	AGA	0.25 mg daily Measured • total hair density • density of terminal hair • new hairs • new terminal hairs	N = 25 (25 M, 0 F), all receiving monotherapy Average age: 36.7 y n = 10 mild AGA n = 15 severe AGA	Improvement or stabilization was seen in a percentage of patients but was not found to be statistically significant. Higher doses such as 2.5 mg or 5 mg might be necessary for significant effects in men	n = 5 (20%) body hypertrichosis n = 4 (16%) hair shedding n = 1 (4%) pedal edema n = 13 (52%) increased beard density
Lueangarun et al,[27] 2015	AGA	5 mg daily for 24 weeks	N = 30 (30 M,0 F) Average age: 38 y	Vertex area showed 100% improvement. Remarkable improvement was seen in 43% of patients. Significantly increased total hair count at the vertex. Significant response at the frontal area but less than at the vertex area.	93% with hypertrichosis 10% with pedal edema 10% with ECG changes
Ramos et al,[24] 2019	FPHL	1 mg daily for 24 weeks vs 5% topical solution daily	N = 52 (52 F, 0 M) TM 5%: n = 26 Average age: 47.3 y OM: n = 26 Average age: 40.6 y	Total hair density increased by 12% in OM and 7.2% in TM No significant difference between them (P = .10) OM provides improvement of FPHL that does not differ from TM, with a safe profile and well-tolerated adverse effects.	Hypertrichosis: • OM: 27% • TM: 4% Edema: • OM: 4% • TM: 0% Scalp pruritus: • OM: 0% • TM: 19% Mean heart rate: • OM: increase by 6.5% • TM: no change No difference in mean blood pressure between groups

Table 1. Summary of Studies…Cont'd
J Am Acad Dermatol. 2021 Mar;84(3):737-746

Table 1. Cont'd

Authors and year	Disease	Dosage/regimen	Number of participants	Results	Adverse effects
Sinclair,[35] 2016	Monilethrix	0.25 mg to 0.5 mg n = 1 at 0.25 mg	N = 2 (2 F, 0 M) 35 y and 40 y	Patient 1: Hair growth with reduced breakage and increased hair volume/length; maintained through 2 years of follow-up. Patient 2: Decreased shedding with 0.25 mg; improved hair density when dosage increased to 0.5 mg Maintained through 18 months of follow-up	No reported adverse effects
Sinclair,[21] 2017	FPHL	Once-daily capsule containing 0.25 mg minoxidil and 25 mg spironolactone	N = 100 (100 F, 0 M) Average age: 48.44 y	Baseline Sinclair hair loss severity score: 2.79 Baseline HSS: 4.82 Reduction in hair loss severity score: 0.1 at 3 months 0.85 at 6 months 1.1 at 9 months 1.3 at 12 months Reduction in HSS: 1.1 at 3 months 2.3 at 6 months 2.7 at 9 months 2.6 at 12 months Low-dose OM is well tolerated and a reasonable alternative to TM.	n = 4 facial hypertrichosis n = 2 postural hypotension n = 2 urticaria (likely due to spironolactone) Average decrease of 4.52 mm Hg in systolic and 6.48 mm Hg in diastolic blood pressure
Wambier et al,[32] 2019	Alopecia areata	Tofacitinib 5 mg 2 times daily or 10 mg 2 times daily OM: 2.5 mg daily for women OM: 2.5 mg twice daily for men	N = 12 (7 F, 5 M)	n = 8 (67%) achieved >75% scalp regrowth. n = 4 (33%) achieved 11% to 75% scalp regrowth. Median baseline SALT score: 99.5% Median final SALT score: 6.5% Combination tofacitinib and OM may be more efficacious than tofacitinib monotherapy.	n = 6 (50%) hypertrichosis n = 2 (17%) acne No reported blood pressure changes, peripheral edema, or symptoms of hypotension
Yang and Thai,[36] 2015	Permanent chemotherapy-induced alopecia	OM 1 mg daily	N = 1 F Age: 39 y	Subjective increase in hair growth was seen at 6 weeks. After 1 year, the patient regrew significant amounts of hair. Significant decreases in telogen follicles and a reversal of follicle miniaturization were seen.	None

Table 1. Summary of Studies…Cont'd
J Am Acad Dermatol. 2021 Mar;84(3):737-746

Rodrigues-Barata et al,[20] 2020	FPHL	0.25 to 2 mg daily	N = 148 (148 F, 0 M) 125 patients received concomitant therapies, including • Dutasteride • Mesotherapy dutasteride • TM 5% • PRP • Finasteride • Flutamide • Bicalutamide • Cyproterone acetate • LLLT • Latanoprost	30 patients (20.3%) had stabilization of hair loss. 118 patients (79.7%) had clinical improvement (95 had slight improvement, 23 had marked improvement) OM may be an effective and safe therapy for FPHL	n = 25 hypertrichosis n = 2 tachycardia n = 1 peripheral edema
Jha et al,[23] 2020	AGA	1.25 mg	N = 32 (0 F, 32 M) Age range: 18-45 y	14/32 patients experienced marked improvement. 13/32 experienced mild improvement on global assessment. 25/32 patients experienced statistically significant improvement in average total hair density per unit area and hair shaft diameter. 1.25 mg/d can be used in male AGA, although 2.5-5 mg/d may be necessary if response is suboptimal after 6 months of treatment.	n = 1 peripheral edema n = 1 hypertrichosis
Sinclair et al,[30] 2020	AGA	0.45 mg daily (sublingual)	N = 64 (31 F, 33 M) Mean age: 50.92 y	Male and female patients had mean reduction of Sinclair stage and Sinclair HSS. Male patients had mean improvement of Investigator Global Assessment. Sublingual minoxidil at a dose of 0.45 mg daily was effective and had an acceptable safety profile.	n = 8 hypertrichosis n = 5 postural dizziness n = 2 peripheral edema Average blood pressure at start of study: 126.27/76.69 mm Hg Average blood pressure after 12 months of OM use: 121.85/77.46 mm Hg

Table 1. Summary of Studies…Cont'd
J Am Acad Dermatol. 2021 Mar;84(3):737-746

Table 1. Cont'd

Authors and year	Disease	Dosage/regimen	Number of participants	Results	Adverse effects
Ramos et al,[25] 2020	FPHL	1 mg daily for 24 weeks	N = 13 (13F, 0M)	Bio-activation of OM related to TM requires a lower sulfotransferase activity threshold. This may be explained by the impact of liver and platelet sulfotransferase activity on OM, as well as greater follicular accumulation of minoxidil.	Not discussed

AGA, Androgenetic alopecia; *D*, diastolic; *F*, female; *FPHL*, female pattern hair loss; *HSS*, hair shedding score; *LLLT*, low-level light therapy; *LPP*, lichen planopilaris; *M*, male; *OM*, oral minoxidil; *PRP*, platelet-rich plasma; *S*, systolic; *SALT*, Severity of Alopecia Tool; *TM*, topical minoxidil.

Role of Oral Minoxidil in Patterned Hair Loss
Indian Dermatol Online J. 2022 Oct 12;13(6):729-733.

Trichology Symposium: Review Article

Role of Oral Minoxidil in Patterned Hair Loss

Abstract

Recent studies have shown that low-dose oral minoxidil (OM) can be a safe and effective treatment of numerous hair disorders including male-patterned hair loss (MPHL) and female-patterned hair loss (FPHL). There are several practical advantages of OM over its topical formulation: enhanced cosmesis, cost-savings, and the possibility of co-therapy with other topical formulations or topicals used for camouflage. This treatment may be particularly helpful for patients who are unable to tolerate topical minoxidil or other systemic treatments. Doses ranging from 0.25 to 1.25 mg daily are usually used for FPHL and doses ranging from 2.5 to 5 mg/day for MPHL. The low side-effect profile of low-dose OM allows for long-term adherence to the medication and favorable clinical response, resulting in stabilization and improvement of hair loss. More studies are needed to test the efficacy of OM in other types of alopecia as well as additional comparative studies assessing OM to other commonly used medications.

Keywords: *Alopecia, alopecia treatment, androgenetic alopecia, hair loss, minoxidil, oral minoxidil, systemic minoxidil*

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Hair Loss - 2023

- Low-Dose Oral Minoxidil
  - 17 studies – 634 patients using oral minoxidil as the primary treatment for hair loss
  - Rodrigues-Barata et al (2020) – mean dose 1 mg – 148 women – significant results
  - Sinclair (2018) – 0.25 mg – significant improvement in women
  - Beach et al (2018) – 1.25 mg – 33% decreased hair shedding, 28% increased scalp hair – 17 women, 1 man
  - Jha et al (2020) – 1.25 mg – similar to above
  - Ramos et al (2020) – men – compared 1 mg OM to 5% solution – OM as effective
  - Sinclair and Perara (2017) – OM effective for telogen effluvium
  - Many others

Oral Minoxidil Treatment for Hair Loss: A Review of Efficacy and Safety
J Am Acad Dermatol. 2021 Mar;84(3):737-746.

Hair Loss - 2023

- Low-Dose Oral Minoxidil
  - More convenient to use then topical
  - Adverse events (up to 1.7% of the patients) –
    - increased heart rate
    - Weight gain
    - Hirsutism
    - Hypertichosis – up to 15%
    - Lower extremity edema

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2023

- Finasteride
  - Oral medication, FDA approved at a dose of 1 mg daily for the treatment of AGA in men
  - It competitively inhibits the type I and type II 5 alpha reductase enzymes, with a strong affinity for type II, thereby inhibiting the conversion of testosterone to dihydrotestosterone (DHT), the potent androgen responsible for terminal hair f ollicle miniaturization and transformation of terminal hairs into vellus hairs
  - 3177 Japanese men – 87.1% grew hair; AE of decreased libido in 0.7%
  - Not approved by the FDA for use in women
  - Category X in pregnancy

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Hair Loss - 2023

- Finasteride
  - It is used off-label to treat women
  - 2683 women (doses of 0.5 to 5 mg) in 65 studies – improvements noted after 6-12 months of therapy
  - Further studies are needed

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Hair Loss - 2023

- Finasteride
  - Adverse effects –
    - Orthostatic hypertension (9%)
    - Erectile dysfunction (5-19%)
    - Ejaculatory dysfunction (1-7%)
    - Decreased libido (2-10%)

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2023

- Compounded Topical Medicines
- How about combinations of minoxidil or with other actives
- Although not FDA approved, these are becoming more and more popular

Hair Loss - 2023

- Dutasteride
  - Dutasteride is 100-times more potent than finasteride as an inhibitor of type I 5 alpha reductase enzymes
  - Hypothesized may be more effective for restoring hair loss
  - Not FDA approved
  - 153 men – 0.5 mg daily – superior to placebo (12.2/cm2 vs 4.7/cm2)
  - Also being used off-label to treat women – little evidence
  - AE profile similar to finasteride

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Hair Loss - 2023

- Spironolactone
  - Off label use in women – not FDA approved for hair loss
  - Synthetic steroid that has been used as a potassium-sparing diuretic for more than 60 years
  - It’s primary metabolite, canrenone, competitively inhibits aldosterone
  - FDA approved for the treatment of essential HTN, CHF, diuretic-induced hypokalemia, and primary hyperalsosteronism
  - Also can treat hirsutism, acne, and seb derm associated with POS

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Hair Loss - 2023

- Spironolactone
  - Studies suggest that hair growth in women possible
  - One study – 44% hair regrowth, 44% no progression in hair loss, and 12% continuing with hair loss
  - Spironolactone with minoxidil better

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Bridging the Gap: Sustained Treatment Effect of Glabellar Lines With Twice-A-Year Treatment With DaxibotulinumtoxinA
Dermatol Surg. 2023 Sep 1;49(9):862-864

Bridging the Gap: Sustained Treatment Effect of Glabellar Lines With Twice-A-Year Treatment With DaxibotulinumtoxinA

Jeffrey S. Dover, MD, FRCPC,*†‡ Nowell Solish, MD, FRCPC,§ Todd M. Gross, PhD,|| Conor J. Gallagher, PhD,¶ and Jessica Brown, PharmD#

BACKGROUND To achieve natural-looking outcomes when treating dynamic lines with botulinum toxin (BoNT), retreatment must be timed such that the patient maintains a relatively constant aesthetic outcome. Although first-generation BoNT products require retreatment with 3- to 4-month frequency to avoid discontinuous correction, the average patient returns for treatment every 6 months, when these toxins have generally fully worn off.

OBJECTIVE To discuss the number of days a typical patient treated with daxibotulinumtoxinA for injection (DAXI) or legacy BoNT products will spend undertreated or uncorrected in a given calendar year.

MATERIALS AND METHODS Median time for maintaining glabellar lines in the "none" or "mild" severity range was compared for approved doses of onabotulinumtoxinA (ONA; 120 days) and DAXI (168 days).

RESULTS The average patient treated with 40U of DAXI every 6 months can expect to be uncorrected (with "moderate" or "severe" glabellar lines) for 14.5 days between visits compared with 61.5 days for 20U of ONA.

CONCLUSION An extended duration BoNT product can be expected to create greater consistency in aesthetic outcome and minimize the discontinuous correction commonly seen with first-generation BoNT products for patients treated twice a year, without requiring a change in patient behavior regarding visit frequency.

Hair Loss - 2023

- Flutamide and Bicalutamide
  - Flutamide is an oral antiandrogen rarely used in clinical practice
  - Camina and Lobo (2003) – first report
  - Yazdabadi and Sinclair (2011) – 250 mg daily – useful in refractory case to topical minoxidil and oral spironolactone
  - Paradisi et al (2011) – large population study – significant decrease in alopecia score – 4% dropped out of study due to liver toxicity
  - Bicalutamide is a nonsteroidal antiandrogen
  - Better safety profile than Flutamide when treating prostate cancer
  - Fernandez-Nieto et al (2020) – 17 women – useful option especially with com orbidities such as PCOD or hirsutism

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2023

- Cyproterone Acetate
  - Inhibits gonadotrophin secretion and cutaneous 5-alpha-reductase activity and inhibits the androgen receptor
  - It is not available in the US
  - Coneac et al (2014) – efficacy in AGA and Acne Vulgaris in female patients
  - May be associated with weight gain, breast tenderness, and decreased libido

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2023

- Ketoconazole
  - Long term use has shown efficacy
  - Antifungal and anti-inflammatory – plus antiandrogenic properties with DHT inhibition
  - Fields et al (2020) – increased hair shaft diameter and increased pilary index plus photographic improvement
  - Shampoos containing 2% ketoconazole promising alternative 4
  - More studies are needed

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2023

- Clascoterone
  - 2020 – FDA approval as first topical antiandrogen to treat hormonal acne
  - Molecule resembles DHT and spironolactone in molecular structure
  - Works by antagonizing androgen receptors on dermal papillae and inhibiting DHT's effect on miniaturization and dermal inflammation
  - Potential then for AGA
  - 6 month dose ranging study – Sun and Sebaratnam (2020) – 7.5% BID – significant improvement

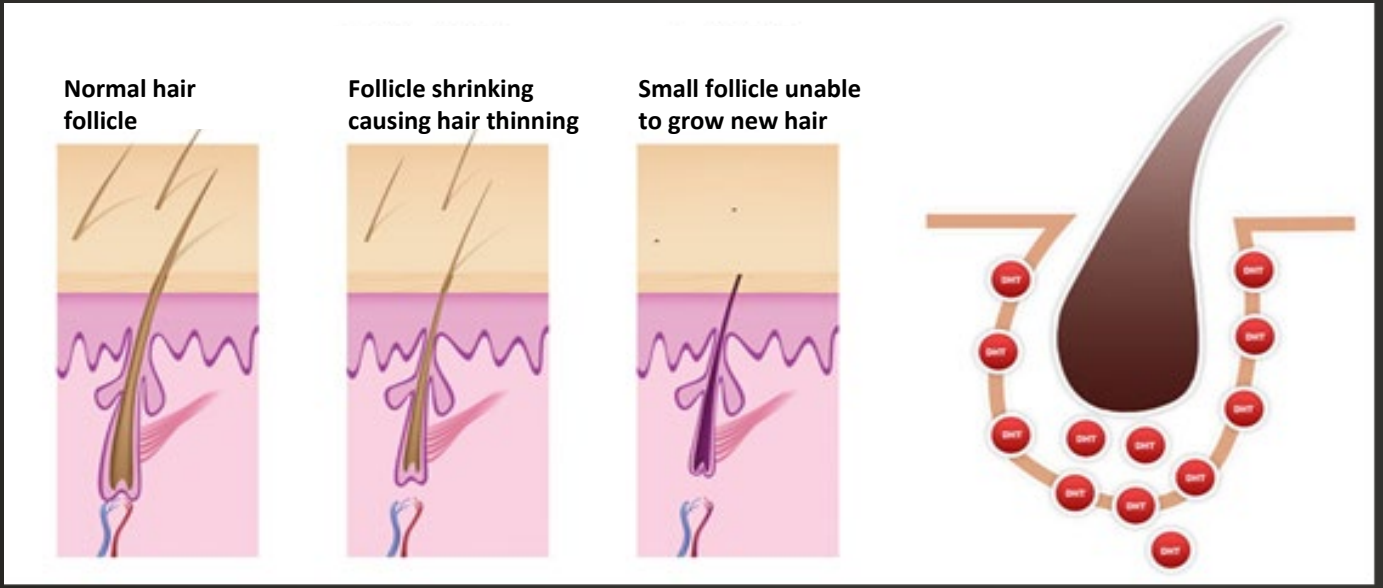
Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Clascoterone: A Novel Topical Androgen Receptor Inhibitor

- Clascoterone is the active ingredient in Winlevi (clascoterone) cream 1%[1]
  - FDA approved for the topical treatment of acne in people aged 12 years and older[1-3]
  - Clascoterone cream is not FDA approved for androgenetic alopecia (AGA)
- Clascoterone is the active ingredient in clascoterone solution[4]
  - Clascoterone solution is not FDA approved
    - Phase 2 clinical trials have been completed in males and females with AGA[4]
    - Higher concentration of clascoterone in the solution vs. the cream[4]
    - Different vehicle used in AGA studies (solution) vs a cream used in the clascoterone acne studies[4]
    - Studies have shown a potential AGA treatment effect with ≥ 5% solution[4]

1. US FDA. https://www.fda.gov/drugs/new-drugs-fda-cders-new-molecular-entities-and-new-therapeutic-biological-products/novel-drug-approvals-2020 2. Winlevi Prescribing Information - https://www.winlevi.com/assets/WINLEVI-clascoterone-cream-prescribing-info-08-2020.pdf 3. US FDA Drug Trial Snapshot: WINLEVI. September 3, 2020. https://www.fda.gov/drugs/drug-approvals-and-databases/drug-trial-snapshot-winlev 4. Cassiopea S.p.A.: Elevating the science of dermatology with new therapeutics. Nature Dealmakers. 2020; Nov 30, 2020. https://www.nature.com/biopharmdeal/volumes/14/issues/4

Clascoterone Solution: A Potential New Topical Treatment Androgenetic Alopecia in Males and Females[1,2]



DHT = Dihydrotestosterone

Existing Treatments

Propecia™ (finasteride)

- Has anti-androgenic activity on follicle by inhibiting 5 alpha reductase, an enzyme required for synthesis of DHT[3]
- However, serious side effects due to hormonal imbalance[3]
- Not indicated for women[3]

Minoxidil®

- Shows a vasodilator effect, ensuring a better flow of nutrients to the papilla[3]

Clascoterone Solution

A Novel Topical Androgen Receptor Inhibitor

- Antagonizes DHT's negative effects on dermal papilla by competing with DHT at the androgen receptor[1]
- Reduces hair miniaturization[1]
- Reduces dermal inflammation[1]

1. Rosette C, Rosette N, Mazzetti A et al.. *J Drugs Dermatol*. 2019; 18(2)197-201. 2. Cassiopea S.p.A.: Elevating the science of dermatology with new therapeutics. Nature Dealmakers. 2020; Nov 30, 2020. 3. Ashique S, et al. . *Nat Prod Bioprospect.* 2020;10(6):345-365. doi:10.1007/s13659-020-00267-9

Clascoterone solution is not FDA approved.

Hair Loss - 2023

- Oral JAK Inhibitors
  - Recent approval for alopecia areata
    - Baricitinib (Olumiant®)
    - Ritlecitinib (Litfulo®)
  - Underlying mechanism of AA involves an autoimmune attack on hair follicles with IL-15 production in response to interferon-gamma secretion
  - This is mediated by JAK ½ and JAK 1/3 signaling in T Cells via a positive feedback loop
  - JAK inhibitors disrupt this cycle and cause reentry of hair follicles into the anagen phase leading to hair growth
  - Further studies are needed to see their effects on ALA

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2023

- Prostaglandin Analog
  - Latanoprost – originally used to treat glaucoma
  - 1997 – side effects of hypertrichosis reported (Johnstone)
  - Johnstone (2002) – scalp alopecia as it prolongs anagen phase
  - Blume-Peytavi et al (2012) – daily application 0.1% solution – 17 men with mild AGA – increase hair density
  - More needed

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2023

- Low-Level Laser Therapy and Light-Emitting Diode Devices

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2023

- Low-Level Laser Therapy and Light-Emitting Diode Devices
  - LLLT discovered serendipitously in the 1960's when mice irradiated with a low fluence red laser were found to grow hair
  - LLLT has emerged as a commercially viable option to grow hair with a single collimated wavelength of light
  - Light-Emitting Diodes deliver small band of wavelengths
  - Home Use Devices – combs, helmets, and caps

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Hair Loss - 2022

- Low-Level Laser Therapy (LLLT)
  - LLLT has been used to reduce pain, treat edema, and promote wound healing for almost 50 years
  - One of the few FDA cleared devices to treat alopecia
  - Uses red or near IR light – at wavelengths of 600-1000 nm and from 5-500 mW
  - Exact mechanism unknown
  - Believed to accelerate mitosis, stimulate hair follicle stem cells to activate follicular keratinocytes, and altering cellular metabolism by inhibiting nitric oxide from cytochrome c oxidase

Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Non-Surgical Hair Restoration – 2023
Home Devices – Red Light

Photobiomodulation Devices for Hair Regrowth and Would Healing Exp Dermatol. 2016 Oct;25(10):745-9.

Photobiomodulation devices for hair regrowth and wound healing: a therapy full of promise but a literature full of confusion

Charles Mignon[1,2], Natalia V. Botchkareva[1], Natallia E. Uzunbajakava[2] and Desmond J. Tobin[1]

[1]Centre for Skin Sciences, Faculty of Life Sciences, University of Bradford, Bradford, UK; [2]Philips Research, Eindhoven, the Netherlands
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Abstract: Photobiomodulation is reported to positively influence hair regrowth, wound healing, skin rejuvenation and psoriasis. Despite rapid translation of this science to commercial therapeutic solutions, significant gaps in our understanding of the underlying processes remain. The aim of this review was to seek greater clarity and rationality specifically for the selection of optical parameters for studies on hair regrowth and wound healing. Our investigation of 90 reports published between 1985 and 2015 revealed major inconsistencies in optical parameters selected for clinical applications. Moreover, poorly understood photoreceptors expressed in skin such as cytochrome c oxidase, cryptochromes, opsins etc. may trigger different molecular mechanisms. All this could explain the plethora of reported physiological effects of light. To derive parameters for optimal clinical efficacy of photobiomodulation, we recommend a more rational approach to underpin clinical studies, with research on molecular targets and pathways using well-defined biological model systems to enable translation of optical parameters from *in vitro* to *in vivo*. Furthermore, special attention needs to be paid when conducting studies for hair regrowth, aiming for double-blind, placebo-controlled randomized clinical trials as the gold standard for quantifying hair growth.

Abbreviations: ATP, Adenosine triphosphate; Coherence, Degree of similarity between the phase and frequency of the optical wave emitted by a light source; DMEM, Dulbecco's Modified Eagle Medium; ERK, Extracellular signal regulated kinases; IR, Infrared radiation, [700 nm]; Irradiance, Optical power impinging over a defined area W/m^2; NADPH, Nicotinamide adenine dinucleotide phosphate; NIR, Near infrared radiation, restricted part of the IR [700–2500 nm]; NO, Nitric oxide; Optical energy, Energy emitted by a light source in the form of photons (J); Optical power, Optical energy emitted per unit time by a light source (W); Optical Transport, Propagation of light photon in a defined medium; Phase, Fraction of a complete cycle corresponding to an offset in the displacement from a specified reference point at time $t = 0$ (degree or radian); Polarisation, Direction of variation of the electromagnetic field; Pulsing, Emission of light characterized by successive emission and stop period; Radiant Exposure, Optical energy received by a defined area (J/m^2); ROS, Reactive oxygen species; TRPA1, Transient receptor potential cation channel, subfamily A, member 1; UV, Ultraviolet radiation, [10–400 nm]; Vis, Visible radiation, [400–800 nm].

Key words: cryptochromes – opsins – optical parameters – photobiology – skin and hair regeneration

Accepted for publication 15 April 2016

Role of Low-Level Light Therapy (LLLT) in Androgenetic Alopecia
J Cutan Aesthet Surg. 2021 Oct-Dec;14(4):385-391

J Cutan Aesthet Surg. 2021 Oct-Dec; 14(4): 385–391.
doi: 10.4103/JCAS.JCAS_218_20
PMCID: PMC8906269
PMID: 35283601

Role of Low-Level Light Therapy (LLLT) in Androgenetic Alopecia

Jisha K Pillai and Venkataram Mysore

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Abstract

Go to: ▸

Androgenetic alopecia (AGA) is the commonest type of alopecia affecting over half of men and women. Only two drugs have been approved so far (minoxidil and finasteride), and hair transplant is the other treatment alternative. Low-level laser therapy (LLLT) has been claimed to be a new safe devise-based modality for stimulating hair growth in men and women in AGA. Searches of PubMed and Google Scholar were carried out using keywords alopecia, hair loss, and LLLT. Fifteen studies were found to be strongly relevant and were analyzed. Studies have shown that LLLT stimulated hair growth in both men and women. Studies with largest randomized controlled trials demonstrated statistically significant hair regrowth by terminal hair count in both males and females. One study also showed that LLLT and minoxidil had similar efficacy in hair growth and that combination therapy was even more effective. LLLT represents a non-invasive, safe, and potentially effective treatment option for patients with AGA who do not respond or are not tolerant to standard treatment of AGA. Moreover, combining LLLT with topical minoxidil solution and oral finasteride may act synergistic to enhance hair regrowth. However, the level of evidence of the studies is still low and hence more controlled large studies are needed.

Keywords: Alopecia, androgenic alopecia, hair loss, low-level laser therapy

Efficacy Assessment For Low-Level Laser Therapy in the Treatment of Androgenetic Alopecia: A Real-World Study on 1383 patients
Lasers Med Sci 37, 2589–2594 (2022)

ORIGINAL ARTICLE

Efficacy assessment for low-level laser therapy in the treatment of androgenetic alopecia: a real-world study on 1383 patients

Jun Qiu[1] · Yanhua Yi[1,2] · Linlang Jiang[3] · Yong Miao[1] · James Jia[1] · Jian Zou[4] · Zhiqi Hu[1]

Received: 17 June 2021 / Accepted: 2 February 2022 / Published online: 8 February 2022

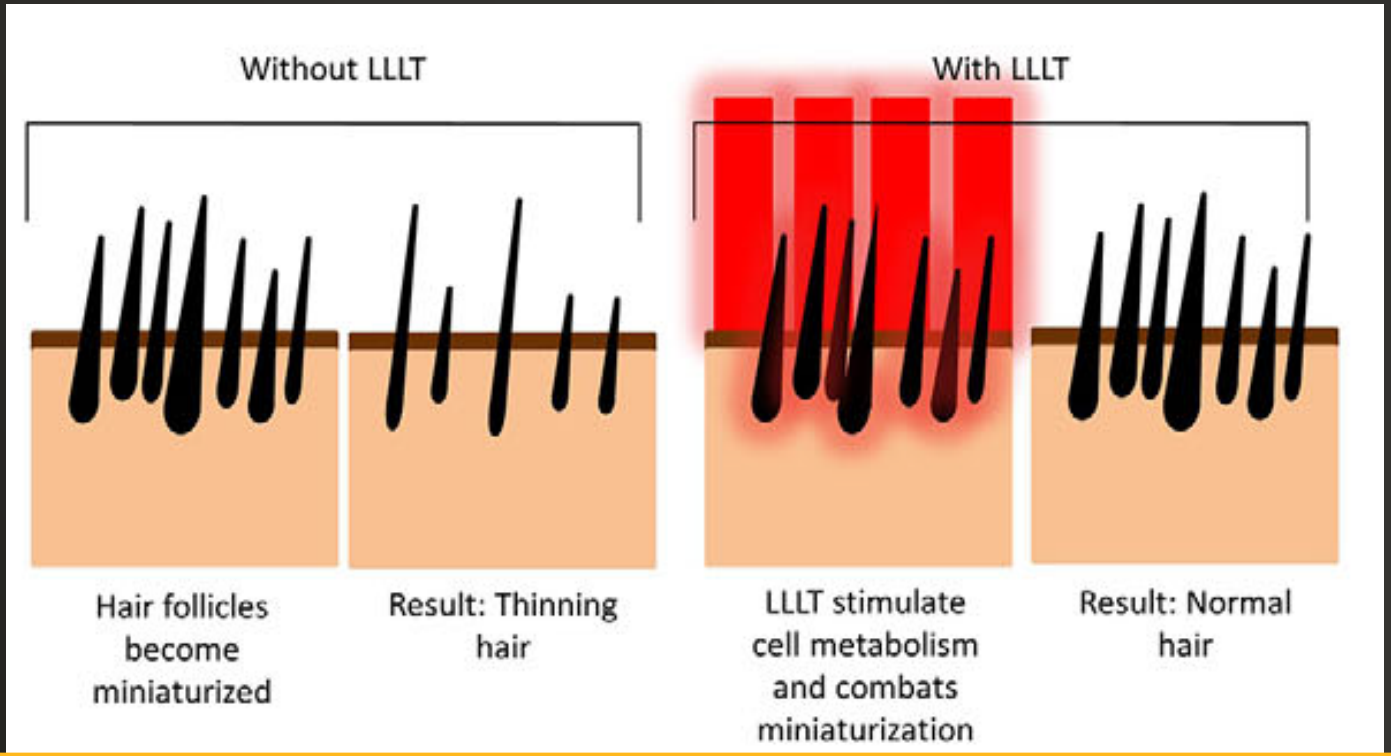
Abstract

Low-level laser therapy (LLLT) has been a treatment modality by many androgenetic alopecia (AGA) patients in recent years. It remained unclear as to how long the treatment regime should be maintained, and which characteristics of patients should this be recommended. A real-world study was carried out with an FDA-cleared low-level laser helmet for 1383 patients. Ordinal logistic regression analysis with propensity score matching (PSM) was used to investigate the factors related to efficacy assessment. More than 80% of users were between 18 and 40 years old. The median use times were 133 for mild AGA patients and 142 for moderate-to-severe AGA patients, which equated to 38 weeks and 40 weeks, respectively. The overall clinical effectiveness was nearly 80%. PSM analysis revealed that gender ($P=0.002$), use period ($P=0.068$), scalp conditions with dandruff, rash, and itchy symptoms were associated with the grading of efficacy assessment. Male users (ordinal OR: 1.35, CI: (1.01, 1.79)); use for more than 180 times or use period for 1 year (ordinal OR: 1.40, CI: (1.11, 1.96)); and those with scalp dandruff (ordinal OR: 1.34, CI: (1.01, 1.87)), rash (ordinal OR: 1.47, CI: (1.04, 2.07)), and itchy symptoms (ordinal OR: 1.51, CI: (1.12, 2.03)) had better efficacy assessments. The recommended treatment regime with low-level laser helmet was more than 1 year or 180 use times. Male patients with dandruff, rash, and itchy symptoms in scalps tended to have a better efficacy assessment.

Keywords Low-level laser therapy (LLLT) · Efficacy assessment · Androgenetic alopecia (AGA) · Real-world study (RWS)

What We Know About Red Light and Hair Loss

Literature review of 22 published clinical studies of non-surgical low-level laser treatment (LLLT) with >2400 participants with hair loss



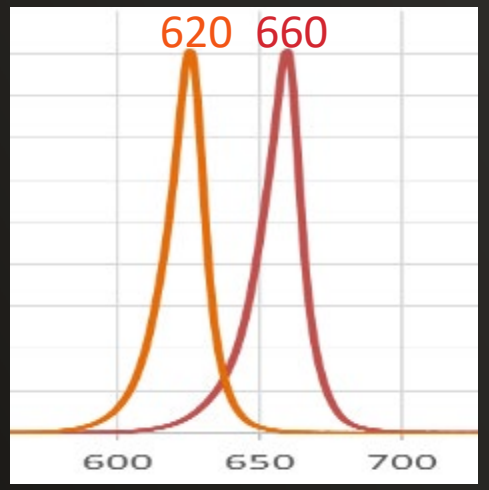
Of the available treatment options, the authors concluded red light therapy was the superior treatment for patients.

Gupta AK, Mays RR, Dotzert MS, et al. J Eur Acad Venereol. 2018;32(12):2112-2115.

What's New In Red Light Therapy?
Patented REVIAN® Red System Is FDA-Cleared for Androgenetic Alopecia

Patented Dual-Band LED Wavelength Delivery for Optimal Hair Growth

Combines 620 and 660 nm Wavelengths to Accelerate Healing and Renew Cells That Grow Hair



Wavelength (nm)

First & Only Mobile App-Driven + Uniform LED Hair Loss Device

Improves Results and Enhances Compliance with 10 Minutes Per Day

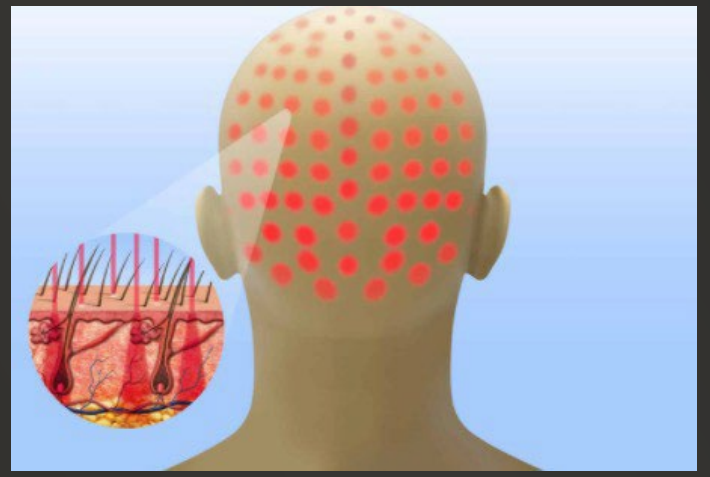
Indications for Use:

The *REVIAN* RED System is indicated to treat Androgenetic Alopecia and to promote hair growth in males who have Norwood-Hamilton classifications of IIa–V patterns of hair loss and to treat androgenetic alopecia and promote hair growth in females who have Ludwig-Savin Scale I-1 to I-4, II-1, II-2 or frontal patterns of hair loss; both with Fitzpatrick Skin Types I–IV.

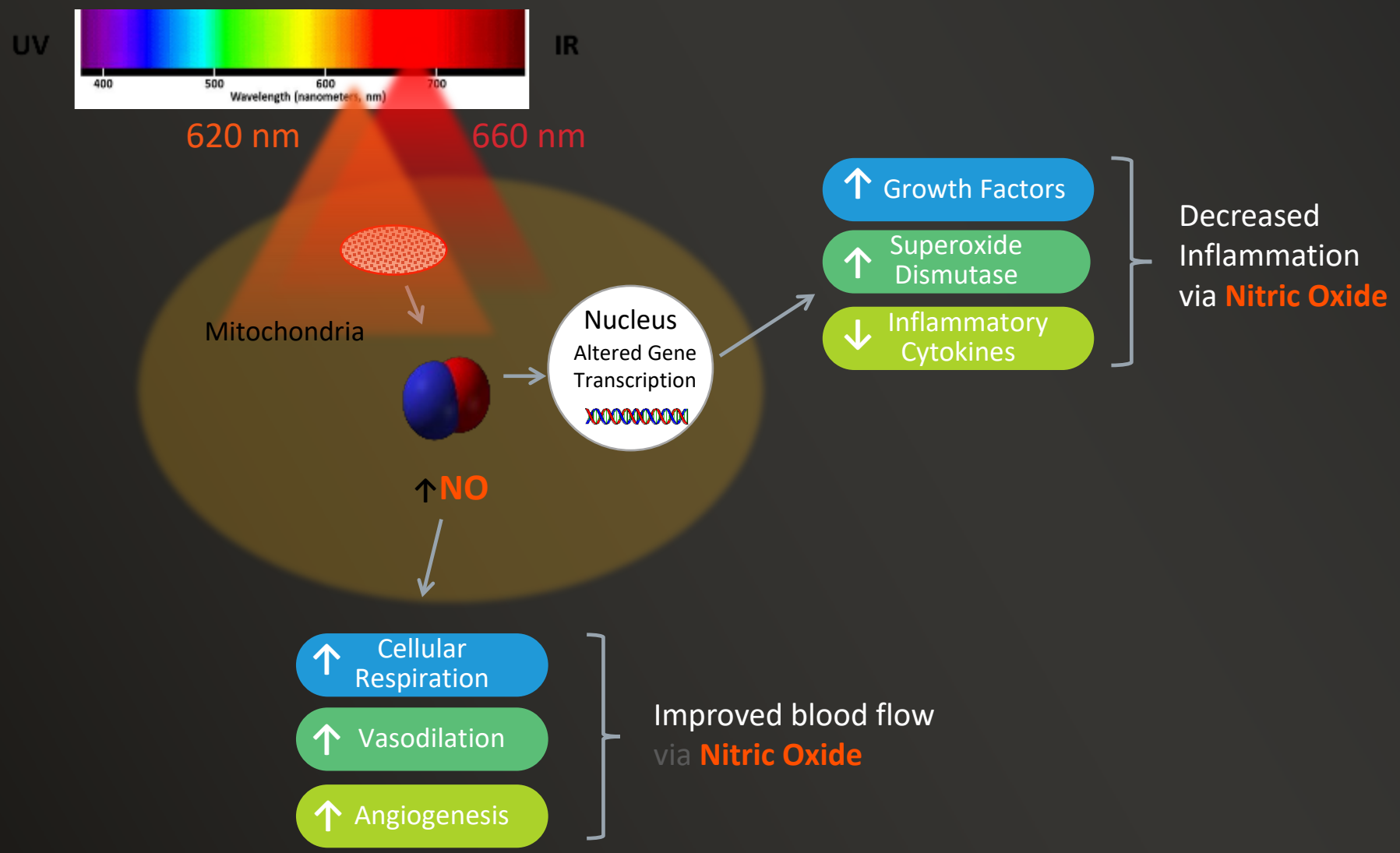
LED: LIGHTWEIGHT & BETTER COVERAGE

Uniform Light Coverage

Uneven Laser Spots



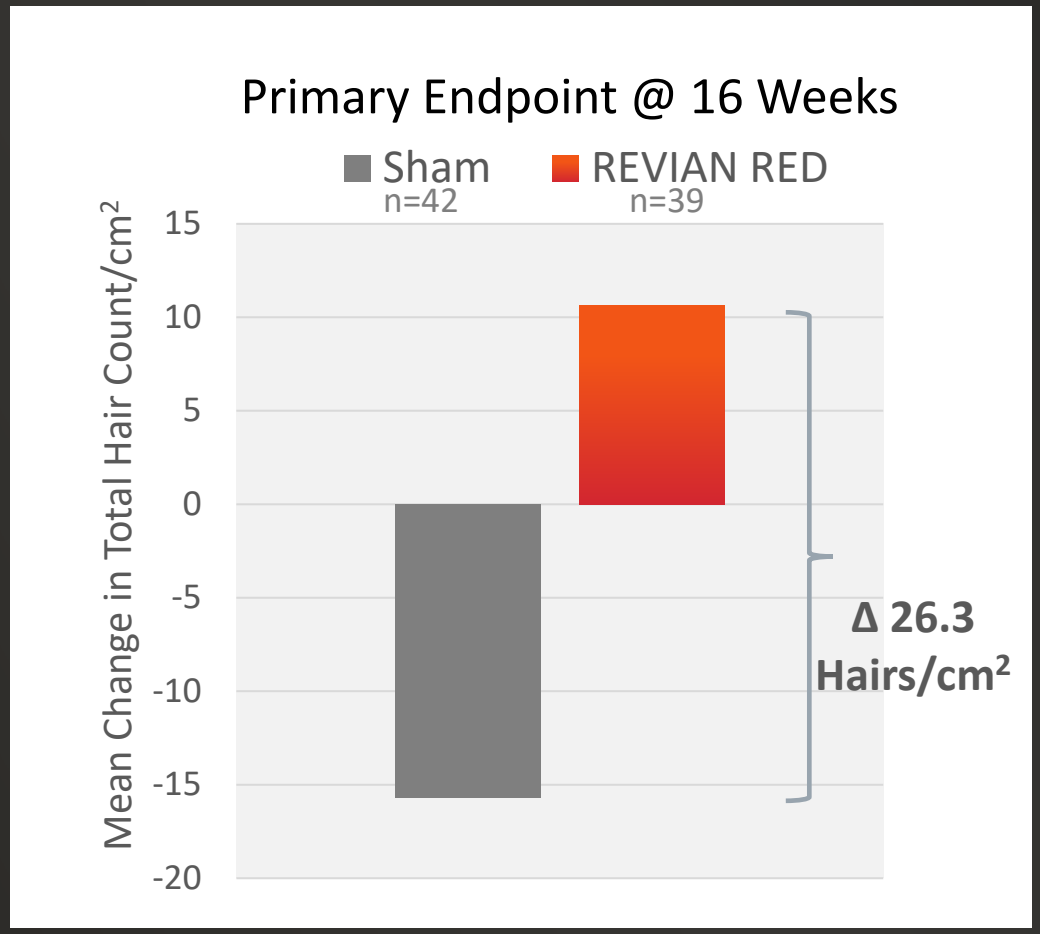
Dual-Band LED Light Offers Unique Mechanism of Action



1. Karu, TI. In: Biomedical Photonics Handbook, CRC Press: 2003. 2. Karu, T. *Photomed Laser Surg*. 2010;28(2):159-160.
3. Karu TI. *IUBMB Life*. 2010;62(8):607-610.

Revian Red Safety and Efficacy Results

- Multicenter, randomized, controlled, double-blind study evaluated the safety and efficacy of the patented Revian cap versus a sham device (N=81)
- Enrollment: Males and females, up to 40 per arm
- Primary Study Endpoint:
  Quantitative scalp hair growth
  - Δ Terminal hair count at 16 weeks
  - Final Results: 26.3 hairs/cm^2
- Secondary Study Endpoint:
  Subjective scalp hair growth
  - Global image analysis at 26 weeks
- Safety Results:
  There were no treatment discontinuations due to an adverse event (AE) and no reported device-related AEs
- PI: Rodney Daniel Sinclair, MBBS, MD, FACD
  Melbourne, Australia



https://clinicaltrials.gov/ct2/show/NCT04019795

Hair Loss - 2023

- Platelet-Rich Plasma (PRP)
  - Used to promote hair growth by releasing platelet-derived growth factors, vascular endothelial growth factor, epidermal growth factor, insulin-like growth factor, and fibroblast growth factors to stimulate vascularization to the dermal papillary cells
  - PRP is not approved for the treatment of hair loss
  - Several studies indicate its usefulness

What is Platelet Rich Plasma?

History of PRP*

- Platelet-rich plasma therapy was developed in the 1970s.
- in the late 1980s, **PRP** therapy was first used during open heart surgery.
- In the 1990s, used for maxillofacial surgery, to aid patients in healing wounds from reconstructive skins flaps
- In 1999, PRP therapy used as a part of the treatment for a torn Achilles tendon. This is one of the first reports of PRP being used in Sports Medicine.
- While the exact date of first procedure is not known, it is believe that the first use of PRP for hair restoration occurred in the early-mid 2000's

*For non-cleared FDA uses; https://www.movementortho.com/2017/11/03/the-history-of-prp-therapy/

What is Platelet-Rich Plasma?

- Platelet Rich Plasma is a concentration of autologous platelets separated from whole blood suspended in a small volume of p lasma with a platelet concentration higher than whole blood.
- Completely Autologous
- Concentration levels of PRP can vary from 1.2x – 10x+ depending on device.
- Either single or multi-spin centrifuge process.
- Test tube based systems range from 10mL – 30mL whole blood volume.

510(k) Definition

- **The 510(k) application is the pathway used to bring PRP preparation systems to the market.**
  - The 510(k) application allows devices that are "substantially equivalent" to a currently marketed device to come to the market.
- Obtaining the 510(k) clearance from the FDA shows that the manufacturer has proven their device to be safe, sterile, a nd provides an equivalent concentration level to a product currently on the market.
  - For PRP, this include things like demonstrating sterility and equivalent concentration levels to an already cleared device.

- **All PRP systems require prior 510(k) clearance from the FDA to be legally sold in the US. Systems without 510(k) clearance, and practices that use them, may be held legally liable by the federal government.**

PRP is a Blood Component

- **Recently there have been concerns with a certain FDA letter regarding tissue based biologics**
  - Framework for the Regulation of Regenerative Medicine Products", 21CFR Part 1271 regulation of human cellular tissue/ pro ducts (HCT/P)
- **The FDA guidance and 21CFR Part 1271 does not apply to the use of PRP as it is considered a blood component, not a human cellular/tissue product.**
- **AMSPA Legal Coordinator Patrick O'Brein:**
  - The FDA's framework for regenerative medicine products using human cells or tissues (referred to as HCT/P) has very specific definitions regarding which type of tissues or products qualify as a HCT/P. While the FDA may change its guidance in the future, PRP that is derived from the patient's own blood (such as through a centrifuge) is currently not considered an HCT/P; instead, products and treatments that use stem cells, liquids and other substances extracted from other tissue—such as adipose fat or placental/umbilical cord blood—do fall under these rules

Am I Working with an Established Company?

- Do they have a Medical Affairs Division that can support proper research and questions
- These companies usually have local support staff to help you with your purchase and subsequent training needs.
- Are they utilizing industry leaders assisting in development and refinement of their product as well as to address questions
- Are their products manufactured with strict quality control and direct oversight to minimize any potential issues
- Do they have an established supply chain in place to minimize shortages

Does the Company Adhere to FDA Guidelines?

- Product manufacturers are not legally allowed to promote the usage of PRP for anything other than enhancing bone graft handling properties in orthopedic practices.
- The manufacturer website should only offer information about its product relating to concentration levels, how its system works and general information regarding PRP, including the science behind it.
- A private practice is allowed to market and administer the product differently, as it falls under “practice of medicine” (as long as it has a 510(k)).
- It is your responsibility to determine if the company you are considering purchasing PRP from has the proper 510(k) clearance, visit the **FDA Establishment Registration & Device Listing website**.

Major PRP Manufacturers Globally

Beijing Hanbiahan
Beijing China

available from

BIMINI HEALTHTECH

Juventix REGENERATIVE MEDICAL

CROWN AESTHETICS SKIN SCIENCE FOR LIFE

SUNEVA MEDICAL

MEDSHIFT

Estar Medical
Holon Israel

available from

AESTHETIC MANAGEMENT PARTNERS

Formerly

ECLIPSE PRP

Cellenis PRP

Regen Labs
Switzerland

available from

regenlab PRP & CELL THERAPY SPECIALISTS

Independent Reps

Reputable Companies in the US PRP Space

- Personal Opinion – In Alphabetical Order
- All have gone through the proper channels to have their product in our hands
  - Aesthetic Medical Partners – Cellenis PRP
  - Crown Laboratories – Progen PRP
  - Regen Labs – Regen PRP
  - Suneva Medical – Amplifine PRP

Platelet-Rich Plasma for Androgenetic Alopecia: A review of the Literature and Proposed Treatment Protocol
Int J Womens Dermatol. 2018 Sep 21;5(1):46-51

Platelet-rich plasma for androgenetic alopecia: A review of the literature and proposed treatment protocol☆,☆☆

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ABSTRACT

Androgenetic alopecia (AGA) is a common hair loss disorder caused by genetic and hormonal factors that are characterized by androgen-related progressive thinning of scalp hair in a defined pattern. By the age of 60 years, 45% of men and 35% of women develop AGA. Currently, U.S. Food and Drug Administration-approved treatments for AGA include oral finasteride and topical minoxidil. Due to the limited number of effective therapies for AGA, platelet-rich plasma (PRP) has become an effective alternative treatment. PRP is an autologous concentration of platelets in plasma with numerous growth factors that contribute to hair regeneration. The growth factors contained within the alpha granules of platelets act on stem cells in the bulge area of the hair follicles and stimulate the development of new follicles along with neovascularization. PRP has become a promising treatment modality for AGA. Although there have been several studies previously reported, a standard practice for PRP preparation and administration as well as a method to evaluate results have not been established. This literature review was conducted to evaluate the effectiveness of PRP for AGA and discuss the various treatment protocols that have been proposed.

Table 1. Summary of Cited Studies
International Journal of Women's Dermatology 5(2019)46–51

Table 1
Summary of cited studies

Author	Patient characteristics (n, % female)	Objective outcome measures	PRP preparation	Use of activator	Platelet enrichment	Treatment protocol	Follow-up time	Positive results
Alves and Grimalt, 2016	22 (11, 50%)	Hair count, hair density, anagen hair, anagen:telogen ratio, terminal hair density	Single-spin method	Calcium chloride	×3	3 treatment sessions, 1 month apart	6 months	Yes
Gentile et al., 2015	23 (0, 0%)	Hair density, hair count, epidermal thickness and hair follicle density, number of Ki67 + basal keratinocyte proliferation, number of small blood vessels around hair follicles	Cascade-Selphyl-Esforax system (platelet-rich lipotransfert system)	Ca^{2+}	–	3 treatment sessions, 1 month apart	24 months	Yes
Cervelli et al., 2014	10 (0, 0%)	Hair count, terminal hair density, number of small vessels around follicles, number of basal keratinocytes	Cascade-Selphyl-Esforax	Ca^{2+}	–	3 treatment sessions, 1 month apart	12 months	Yes
Schiavone et al., 2014	64 (0, 0%)	Hair count, hair thickness	GPS III platelet separation system, single spin at baseline and double spin at 3 months	No	×6-×7	2 treatment sessions, 3 months apart	6 months	Yes
Singhal et al., 2015	10 (2, 20%)	Hair count (hair pull test)	Double-spin method	Calcium chloride	–	4 treatment sessions, 2 weeks apart	3 months	Yes
Gkini et al., 2014	20 (2, 10%)	Hair density	Single spin method (Regenlab SA)	Calcium gluconate in a 1:9 ratio (0.1 ml per 0.9 ml of PRP)	×5.8	3 treatment sessions, 3 weeks apart followed by booster at 6 months	12 months	Yes
Takikawa et al., 2011	26 (10, 38%)	Hair count, hair diameter	Manual double spin	No	×6	5 treatment sessions at weeks 0, 2, 4, 6, and 9	4 months	Yes
Puig et al., 2016	26 (26, 100%)	Hair count, hair mass index	Angel PRP system	No	×2.75-3.4	1 treatment	26 weeks	No
Ayatollahi et al., 2017	13 (0, 0%)	Hair density, hair diameter	Single-spin method (Regenlab PRP Kit-RegenACR)	No	–	5 treatment sessions, 2 weeks apart	3 months	No

PRP, platelet-rich plasma.

Platelet Rich Plasma and Its Use in Hair Regrowth: A Review. Drug Des Devel Ther. 2022 Mar 10;16:635-645

Drug Design, Development and Therapy

Dovepress
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REVIEW

Platelet Rich Plasma and Its Use in Hair Regrowth: A Review

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Abstract: Platelet rich plasma (PRP) was described as a small volume of plasma containing higher concentrations of platelets than those found in peripheral blood and initially used as a transfusion product for treatment of thrombocytopenia. To date, it was discovered that there are several growth factors and cytokines that can accelerate wound healing and tissue regeneration, leading to a wider range of applications in the medical field, such as in sport medicine, regenerative medicine, and aesthetic medicine. Several studies have shown that PRP can be used effectively for treatment of hair loss. Although it has been widely used, the exact mechanism of action of PRP is still not fully elucidated. In this article, we aim to review and update current information on the definition, classification, mechanism of action, clinical efficacy in hair regrowth, and adverse events of PRP.

Keywords: platelet rich plasma, androgenetic alopecia, female pattern hair loss, alopecia areata, cicatricial alopecia, hair transplantation

Table 2 Randomized Controlled Trials of PRP in Male Androgenic Alopecia Drug Design, Development and Therapy 2022:16635–645

Table 2 Randomized Controlled Trials of PRP in Male Androgenic Alopecia

Author, Year	Number of Patients	Platelet Rich Plasma Preparation	Treatment Regimen	Results
Qu Q et al 2021[42]	N= 52 (32M 20F)	- Double spin - without PLT activator - PLT count: NR	3 injections (monthly) with PRP VS saline (half-head study)	6 months: significant increase in hair density, hair thickness and anagen hair ratio in PRP compared to placebo
Pakhomova EE et al 2020[44]	N= 69 M	- Double spin - with PLT activator - PLT count: 882.5 ± 143.62 × 10^9/L	1. Topical minoxidil 5% (23) 2. 4 injections (monthly) with PRP (23) 3. 4 injections (monthly) with PRP + topical minoxidil 5% (23)	4 months: significant increase in hair density and hair thickness in PRP + topical minoxidil group followed by PRP monotherapy group
Shapiro et al 2020[45]	N= 35 (18M17F)	- Single spin - without PLT activator - PLT count: NR	3 injections (monthly) with PRP VS saline (two 7.6-cm × 7.6-cm squares, split head study)	3 months: significant increase in hair density and hair thickness in PRP compared to baseline, but not significant increase compared to placebo
Dicle et al 2020[46]	N= 30 M	- Single spin - with PLT activator - PLT count: NR	3 injections (monthly) with PRP first (10) VS saline first (15) (first half of crossover trial)	4 months: significant increase in hair density in the group that received placebo and subsequently received PRP injections (after wash- out period)
Singh et al 2020[47]	N= 80 M	- Double spin - with PLT activator - PLT count: 4.2-fold higher than whole blood	1.Topical minoxidil 5% + 3 injections (monthly) with saline (20) 2.Topical minoxidil 5% + 3 injections (monthly) with PRP (20) 3.Topical placebo + 3 injections (monthly) with saline (20) 4.Topical placebo + 3 injections (monthly) with PRP (20)	5 months: significant increase in hair density in PRP + topical minoxidil group followed by PRP + topical placebo group
Rodrigues et al 2019[48]	N= 26 M	- Double spin - with PLT activator - PLT count: 1200×10^6 /μL	4 injections (every 15 days) with PRP (15) VS saline (11)	3 months: significant increase in hair density and percentage of anagen hairs in PRP group compared to placebo group
Gentile et al 2017[31]	N= 18 M	- Single spin - without PLT activator - PLT count: 5 - fold higher than whole blood	3 injections (monthly) with PRP VS saline (half-head study)	3 months: significant increase in hair density in PRP compared to placebo

Abbreviations: PLT, platelet; NR, not reported.

Table 3 Randomized Controlled Trials of PR Pin Female Pattern Hair Loss Drug Design, Development and Therapy 2022:16635–645

Table 3 Randomized Controlled Trials of PRP in Female Pattern Hair Loss

Author, Year	Number of Patients	Platelet Rich Plasma Preparation	Treatment Regimen	Results
Dubin DP et al 2020[54]	N= 30F	- Single spin - without PLT activator - PLT count: NR	3 injections (monthly) with PRP (14) VS saline (14; 2- loss follow up)	6 months: significant increase in hair density and hair thickness in PRP group compared to placebo group
Bruce et al 2019[55]	N= 20F	- Double spin - with PLT activator - PLT count: NR	3 injections (monthly) with PRP first (9) VS minoxidil foam first (9) (first half of crossover trial)	4 months: significant increase in vellus hair density and hair count in both groups compared to baseline
Tawfik and Osman, 2018[56]	N= 30F	- Double spin - with PLT activator - PLT count: NR	4 injections (weekly) with PRP VS saline (half-head study)	6 months: significant increase in hair density and hair thickness in PRP compared to placebo
Lee et al 2015[57]	N= 40F	- Single spin - with PLT activator - PLT count: 1,256,950 ± 371,397 cells/μL	Single PRP with 12 sessions of PDRN injections (20) VS 12 sessions of PDRN injections only (20)	3.25 months: combined therapy with PRP induced more hair thickness than PDRN alone

Abbreviations: PLT, platelet; NR, not reported; PDRN, polydeoxyribonucleotide.

Table 4 Randomized Controlled Trials of PRP in Alopecia Areata Drug Design, Development and Therapy 2022:16635–645

Table 4 Randomized Controlled Trials of PRP in Alopecia Areata

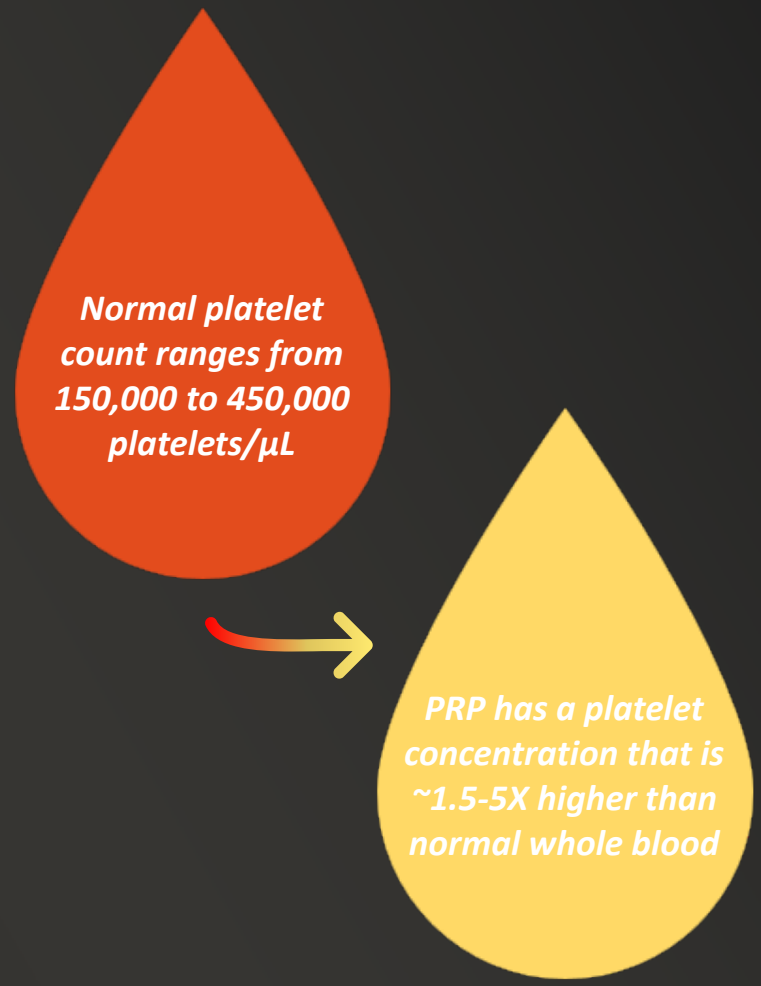
Author, Year	Number of Patients	Platelet Rich Plasma Preparation	Treatment Regimen	Results
Fawzy MM et al 2021[62]	N= 31 (23M8F)	- Single spin - without PLT activator - PLT count: 750,000–1,000,000/μL	3 injections (monthly) with 1.PRP (17) 2.Triamcinolone acetonide 40 mg/mL (14)	4 months: significant reduction in SALT score in both groups compared to baseline
Balakrishnan A et al 2020[63]	N= 40 (22M18F)	- Double spin - without PLT activator - PLT count: NR	3 injections (monthly) with 1.PRP (16) 2.Triamcinolone acetonide 10 mg/mL (16)	3 months: significant improvement in clinical symptoms in both groups, but there was no significant difference between these two groups
Hegde P et al 2020[64]	N= 50	- Double spin - without PLT activator - PLT count: NR	3 injections (monthly) Right side of the scalp with 1.PRP (25) 2.Triamcinolone acetonide 10 mg/mL (25) Left side of the scalp with saline	5 months: SALT score showed statistically significant improvement from baseline in both groups. Steroid group showed the most hair regrowth, followed by PRP group
Kapoor P et al 2020[68]	N= 40	- Single spin - without PLT activator - PLT count: 3.5-fold higher than whole blood	4 injections (every 3 weeks) with 1.PRP (20) 2.Triamcinolone acetonide 10 mg/mL (20)	6 months: significant reduction in SALT score in triamcinolone group compared to PRP group
Albalat et al 2019[65]	N= 80 (68M12F)	- Double spin - with PLT activator - PLT count: NR	3-5 injections (every 2 weeks) with 1.PRP (40) 2.Triamcinolone acetonide 5 mg/mL (40)	6 months: significant increase in hair regrowth and reduction of dystrophic hair in both groups, but there was no significant difference between these two groups
Agrawal P et al 2018[67]	N= 30	- Double spin - with PLT activator - PLT count: NR	3 injections (monthly) with 1.PRP (15) 2.Triamcinolone acetonide 5 mg/mL (15)	6 months: significant increase in the percentage of hair regrowth in triamcinolone group compared to PRP group

Abbreviations: PLT, platelet; NR, not reported; SALT, severity of alopecia tool score.

What is PRP?

PRP is Platelet Rich Plasma

- An autologous solution separated from the patients' own blood
- Contains a HIGHER than baseline CONCENTRATION of PLATELETS suspended in a SMALL VOLUME of PLASMA produced by centrifugation separation of whole blood.
- Provides increased concentrations of autologous **growth factors** a nd other signaling molecules that are involved in **tissue repair** and **regeneration**.



The overall number of platelets at baseline is variable from patient to patient.
Thus, final concentration of PRP will be variable between patients.

1. Hausauer AK, et al. *Dermatol Surg*. 2020;46(3):348-357. 2. Kushida S, et al. *J Artif Organs*. 2014;17(2):186-192.
3. Alves R, et al. *Skin Appendage Disord*. 2018;4(1):18-24.

History

1970

The concept of PRP originated with hematologists, who used PRP to treat patients with thrombocytopenia (i.e., low platelets).

1980

Use of PRP to promote tissue regeneration began as a technique to hasten recovery from surgery (e.g., oral surgery, plastic surgery, orthopedics).

1990

PRP started to be implemented in dentistry, to improve incorporation of dental implants and facilitate bone regeneration.

2000

Since the early 2000s, PRP has been used predominantly in the musculoskeletal field in sports injuries.

2010

Most recently, the use of PRP has expanded into aesthetics and dermatology.

2020

1. Alves R, et al. *Skin Appendage Disord*. 2018;4(1):18-24. 2. Mościcka P, et al. *J Cosmet Dermatol*. 2021;20(9):2712-2714.

PRP & Regenerative Aesthetics

- Historically, platelets were thought to have only hemostatic (blood clotting) activity, but in recent years, studies suggest that platelets contain an **abundance of growth factors** and other cell-signaling molecules that affect:
  - Tissue repair and regeneration
  - Stem cell migration
  - Cell proliferation
  - Inflammation
- PRP is a ***natural source*** of growth factors and signaling molecules.

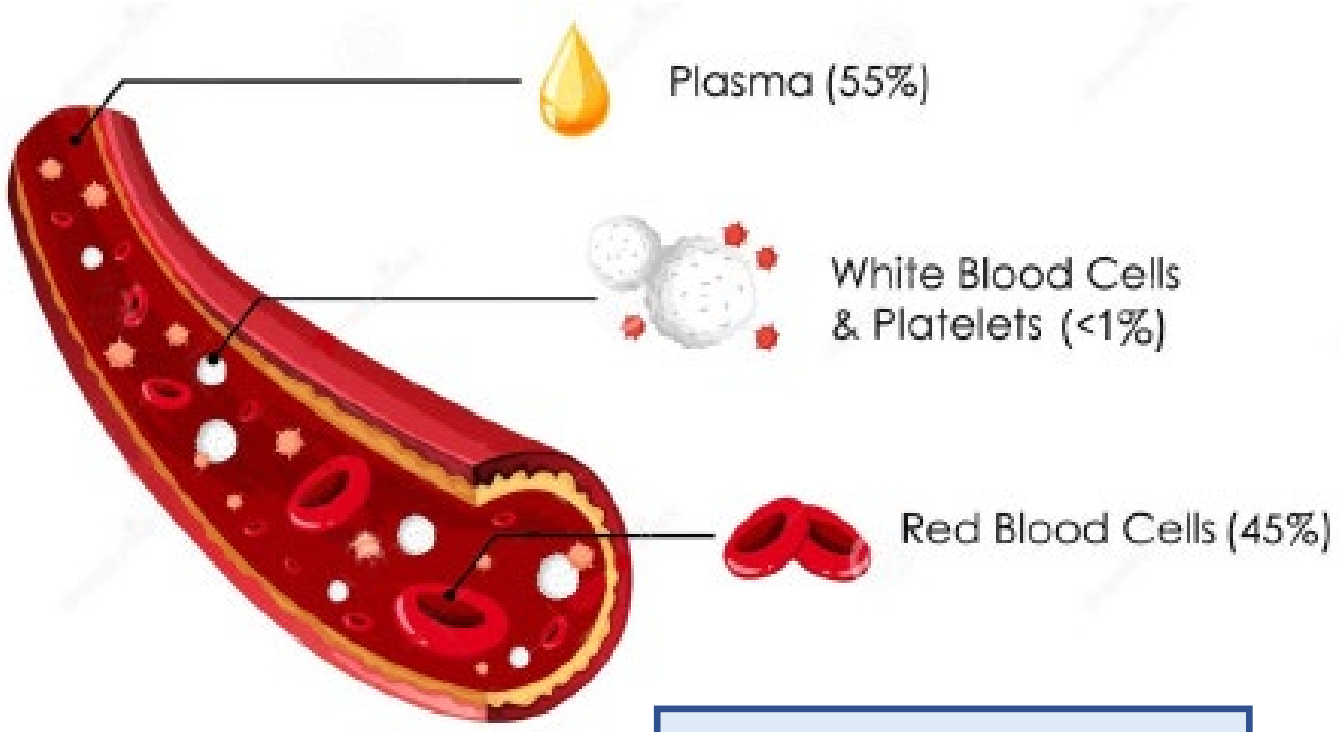
Goal of PRP Treatment:
Access this wealth of growth factors to signal tissue regeneration, increase collagen production, and promote would healing.

1. Alves R, et al. *Skin Appendage Disord*. 2018;4(1):18-24. 2. Hausauer AK, et al. *Dermatol Surg*. 2020;46(3):348-357.

Composition of Blood

Blood is comprised of 4 major components:

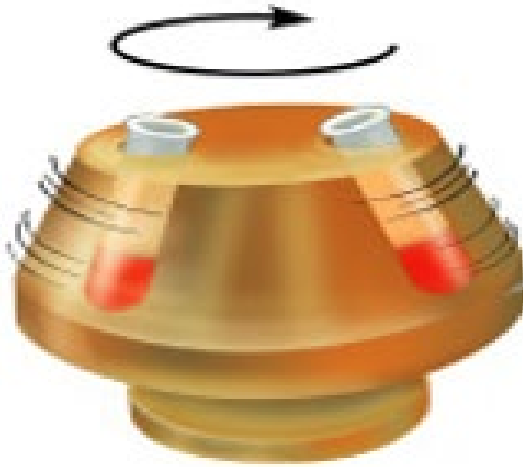
- Plasma **(55%)**
- Red blood cells (RBCs) **(45%)**
  - Also known as Erythrocytes or Hematocrit
- White blood cells (WBCs)
  - Also known as Leukocytes
- Platelets



Platelets are only 2µm in diameter, the smallest density of all blood cells

1. Composition of the Blood. National Institutes of Health website. 2. Kuruc M, et al. *Proteomics & Bioinformatics*. 2020;2(2):90-107. 3. Alves R, et al. *Skin Appendage Disord*. 2018;4(1):18-24.

Centrifugation



- A **separation** technique based on **density**
- ***Definition***: A method of separating particles of different densities by spinning them in solution around an axis (in a centrifuge rotor) at a high speed.
- When a solution (e.g., ***blood***) is spun at a high speed, particles with:
  - Higher molecular weight settle down ↓
  - Lower molecular weight rise ↑
- Thus, centrifugation **separates whole blood into layers** based on the densities of its components.

Goal of Centrifugation of Whole Blood:

To capture the highest percentage of platelets into the plasma while removing the contaminants from whole blood

1. Alves R, et al. *Skin Appendage Disord*. 2018;4(1):18-24.
2. 2. Stephenson FH. *Calculations for […] Biotechnology*. 3rd ed. Academic Press; 2016: 431-438.
3. 3. Taulbee DN, Maroto-Valer MM. *Encyclopedia of Separation Science*. Academic Press; 2000:17-40.

What Do Platelets Do?

Regulators of Hemostasis

- Platelets play a crucial role in primary hemostasis (blood coagulation/clotting).
- "First responders" in would healing
- Upon tissue damage, platelets:
  - Form a platelet plug (coagulate)
  - Release active biomolecules that promote coagulation

Repository & Release of Growth Factors

- In addition to releasing biomolecules that promote coagulation, platelets release growth factors that are integral to tissue repair and regeneration.

1. Alves R, et al. *Skin Appendage Disord*. 2018;4(1):18-24. 2. White C, et al. *J Clin Aesthet Dermatol*. 2021;14(11):44-57.

PRP: Underlying Principle & Rationale

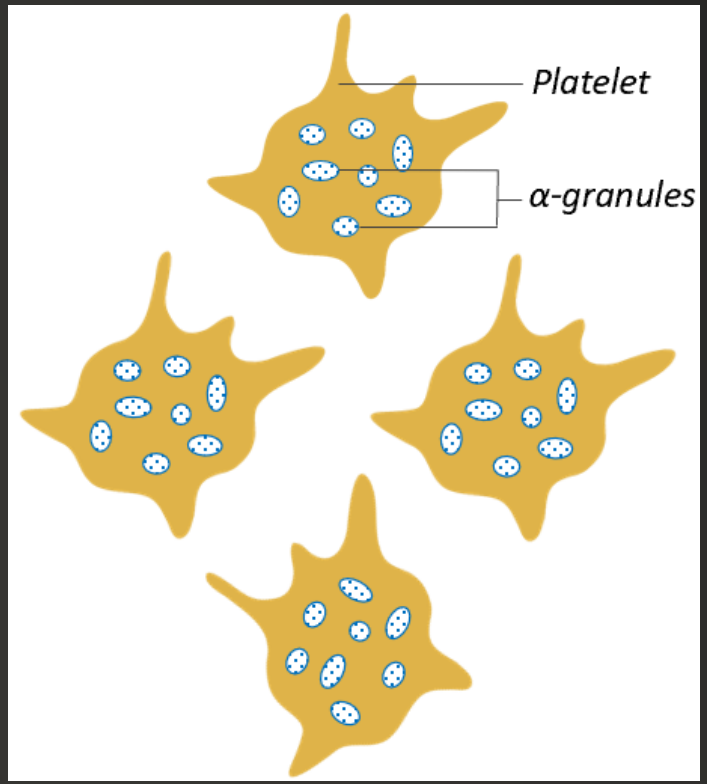
- The underlying scientific rationale for PRP therapy is that application of concentrated platelets (i.e., PRP) may initiate tissue repair and regeneration via supraphysiologic release of growth factors.

- PRP technology has been summarized by its ability to introduce and release growth factors to a local microenvironment.

1. Everts P, et al. *Int J Mol Sci*. 2020;21(20):7794.

How Does PRP Work?

- Platelets contain several secretory granules that are crucial to platelet function.
  - Each platelet contains ~50-80 granules.
  - α-granules have the highest content of active biomolecules related to tissue repair, including:
    - Growth factors
    - Coagulation factors
    - Antimicrobial molecules
- α-granules contain over 20 growth factors that are essential to tissue synthesis and repair.

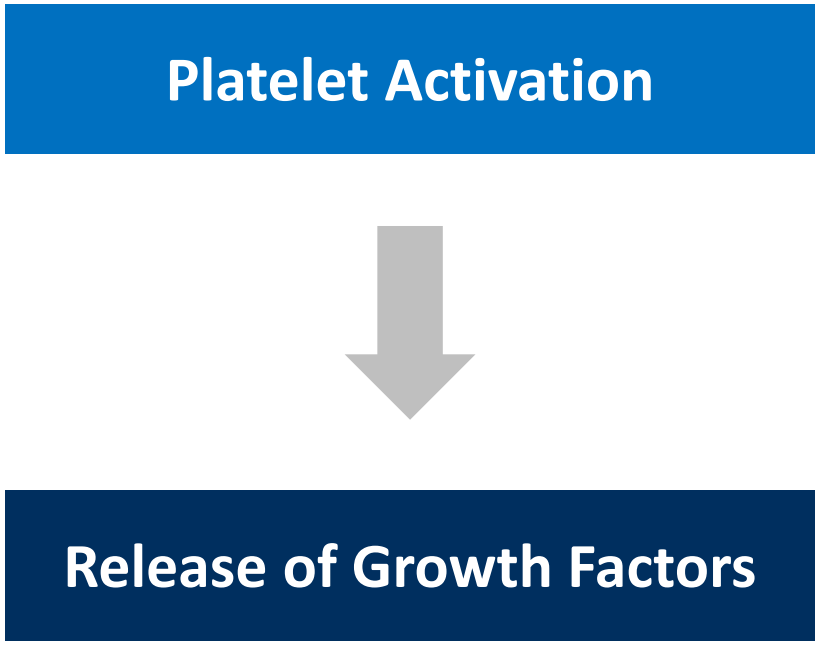


Remember:
α-granules contain growth factors

1. Hausauer AK, et al. *Dermatol Surg*. 2020;46(3):348-357. 2. Alves R, et al. *Skin Appendage Disord*. 2018;4(1):18-24.

Growth Factors

- There are **hundreds of biologically active substances** in platelets that are involved in wound healing and tissue repair.
- **Growth factors** are one of these biologically active substances and are released from platelets following platelet activation.
- In healthy humans, growth factors play a ubiquitous role in normal cell development, cell growth, and wound healing. However, in a malignant environment, growth factors are major regulators of tumor survival and progression.



1. Everts P, et al. *Int J Mol Sci*. 2020;21(20):7794.
2. 2. Rozman P, et al. *Acta Dermatovenerol Alp Pannonica Adriat*. 2007;16(4):156-165.
3. 3 Witsch E, et al. *Physiology (Bethesda)*. 2010;25(2):85-101.
4. Sánchez M, et al. *Regenerative Medicine*. IntechOpen; 2020.

Growth Factors: A Closer Look

VEGF[1-5]

Vascular Endothelial Growth Factor

- Increases development of new blood vessels and permeability of existing blood vessels
- Promotes formation of new hair follicles

PDGF[1-6]

Platelet-Derived Growth Factor

- Increases development of new blood vessels
- Increases collagen production
- Decreases inflammation around hair follicle and increases hair growth

FGF[3-5]

Fibroblast Growth Factor

- Stimulates cell growth
- Increases production of fibroblasts
- Increases hair follicle size and increases hair growth

EGF[3-5]

Epidermal Growth Factor

- Increases production of epidermal, epithelial, and hair cells
- Increases development of new blood vessels

TGF[1-5]

Transforming Growth Factor

- Stimulates production of undifferentiated mesenchymal stem cells
- Increases collagen production

Growth factors play an integral role in all 3 phases of wound healing[7]

1. Hausauer AK, et al. *Dermatol Surg*. 2020;46(3):348-357. 2. Kushida S, et al. *J Artif Organs*. 2014;17(2):186-192.
3. Rozman P, et al. *Acta Dermatovenerol Alp Pannonica Adriat*. 2007;16(4):156-165. 4. Witsch E, et al. *Physiology (Bethesda)*. 2010;25(2):85-101.
5. Alves R, et al. *Skin Appendage Disord*. 2018;4:18-24. 6. Huang F, et al. *Int J Clin Exp Med*. 2017;10(7):9918-9929.
7. Everts P, et al. *Int J Mol Sci*. 2020;21(20):7794.

Platelet Activation

A Highly Debated Topic

- Activation of platelets causes the release of platelet content.
  - i.e., release of **growth factors** from α-granules
- Activation occurs via:
  - Spontaneous **endogenous** activation
  - **Exogenous** application of a chemical substance

Amplifine HD PRP Gel Tubes contain ACD-A, an anticoagulant that halts the formation of blood clotting, thus halting platelet activation.

Endogenous Activation

NO addition of a chemical substance prior to PRP administration

- Relies on spontaneous platelet activation that occurs after exposure to native thrombin and native collagen present in human connective tissues

Exogenous Activation

Addition of a chemical substance to PRP prior to PRP administration

- Calcium chloride (CaCl)
- Calcium gluconate (CaGl)
- Animal-derived thrombin

ACD-A: **A**nticoagulant **C**itrate **D**extrose Solution, Solution **A**

1. Cavallo C, et al. *Biomed Res Int*. 2016:6591717. 2. Hausauer AK, et al. *Dermatol Surg*. 2020;46(3):348-357. 3. Sánchez M, et al. *Regenerative Medicine*. IntechOpen; 2020. 4. Amplifine HD PRP Gel Tube (15 mL/30mL) [Instructions for Use]. San Diego, CA: Suneva Medical, Inc.; 2020.

Risks and Complications

- Little to no risk of allergic reaction or immune re sponse since the plasma is taken from the patie nts' own blood (i.e., autologous).
- Side effects and complications are rare, but may include:
  - Pain at injection site
  - Erythema
  - Edema
  - Infection

1. White C, et al. *J Clin Aesthet Dermatol*. 2021;14(11):44-57.
2. Platelet-Rich Plasma (PRP) Injections. Johns Hopkins Medicine website.

Hair Loss - 2023

- Stem Cells and Exosomes
  - New and promising area of research
  - Not FDA approved for injecting into the scalp (or anywhere else)
  - Can be applied topically
  - Human umbilical cord blood-derived mesenchymal stem cells (HUCB-MSCs) have received some interesting work
  - Plant-based products as well

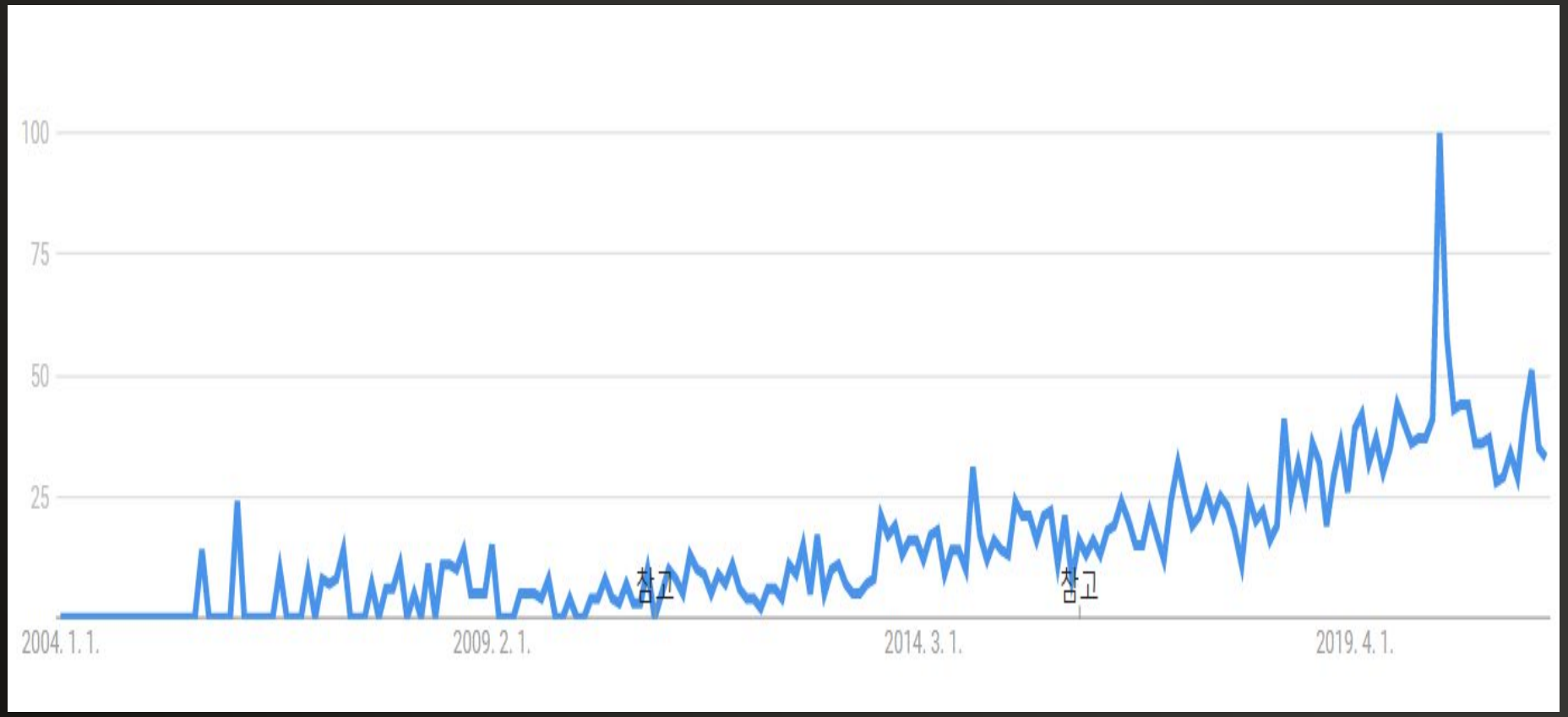
Hair Loss - 2023

- Stem Cells and Exosomes
  - Initial studies have demonstrated that MSC exosomes induce proliferation and migration of human dermal papilla cells and secretion of VEGF and IGF-1 *in vitro*
  - Mice intradermally injected with MSC exosomes underwent telogen to anagen conversion, suggesting hair growth stimulation *in vivo*
  - Zhou et al (2018) – injection of dermal papilla cell-derived exosomes in mice was shown to accelerate the onset of hair follicle anagen phase and delay catagen phase, while simultaneously the expression of beta-catenin and sonic hedgehog growth factors
  - Chung et al (2021) – increased mean hair density and thickness – 20 patients – 12 weeks of exosome treatment

Treatment Options for androgenetic Alopecia: Efficacy, Side Effects, Compliance, Financial Considerations, and Ethics
J Cosmet Dermatol. 2021 Dec;20(12):3759-3781

Google Trend on Exosomes

Interest over Time on Google Trends: 10X increase for last 10 years

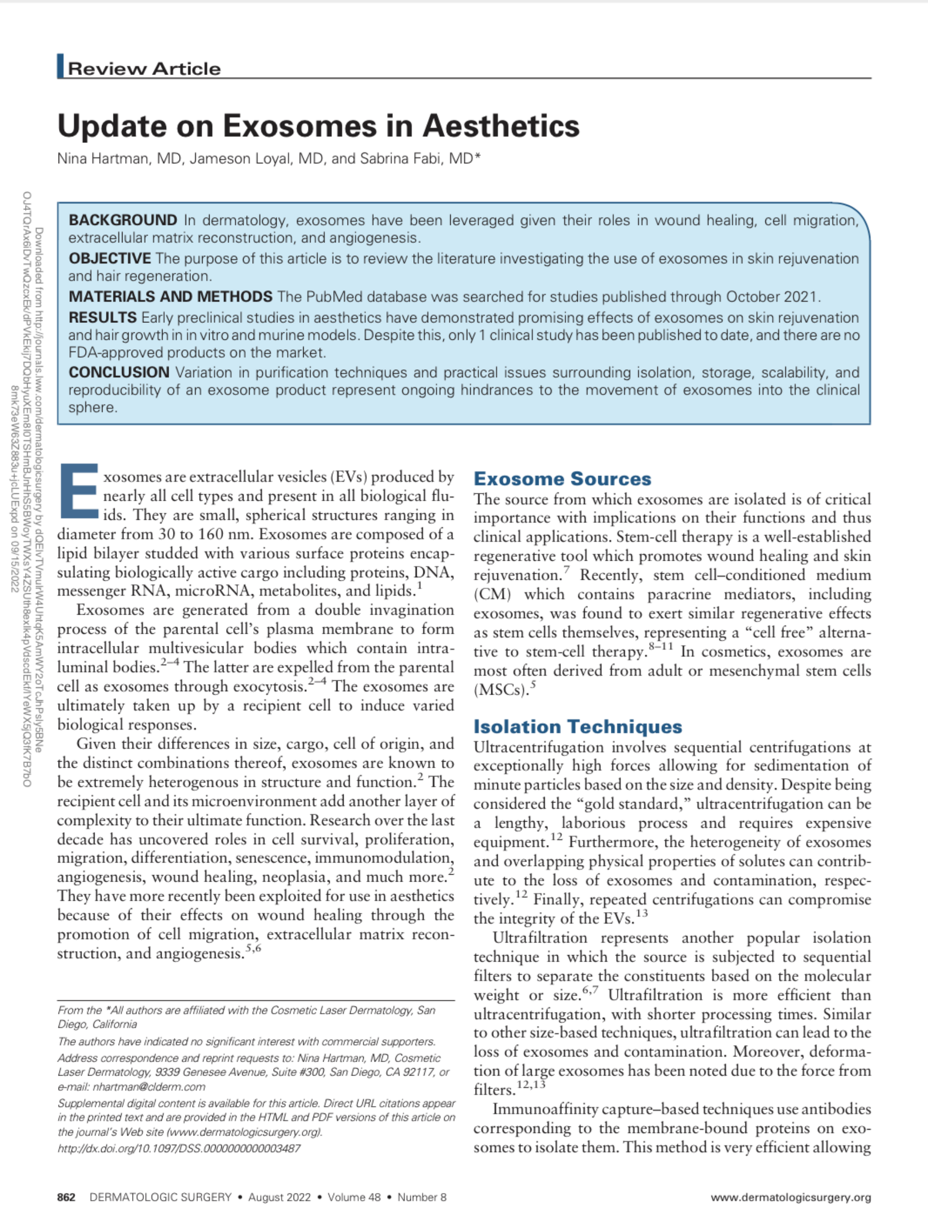


Source: Google Trends, https://bioinformant.com/exosomes/

What we know about Exosomes

And What is yet to be discovered

Photo Courtesy of Glynis Ablon, MD



Review Article

Update on Exosomes in Aesthetics

Nina Hartman, MD, Jameson Loyal, MD, and Sabrina Fabi, MD*

BACKGROUND In dermatology, exosomes have been leveraged given their roles in wound healing, cell migration, extracellular matrix reconstruction, and angiogenesis.

OBJECTIVE The purpose of this article is to review the literature investigating the use of exosomes in skin rejuvenation and hair regeneration.

MATERIALS AND METHODS The PubMed database was searched for studies published through October 2021.

RESULTS Early preclinical studies in aesthetics have demonstrated promising effects of exosomes on skin rejuvenation and hair growth in in vitro and murine models. Despite this, only 1 clinical study has been published to date, and there are no FDA-approved products on the market.

CONCLUSION Variation in purification techniques and practical issues surrounding isolation, storage, scalability, and reproducibility of an exosome product represent ongoing hindrances to the movement of exosomes into the clinical sphere.

Exosomes are extracellular vesicles (EVs) produced by nearly all cell types and present in all biological fluids. They are small, spherical structures ranging in diameter from 30 to 160 nm. Exosomes are composed of a lipid bilayer studded with various surface proteins encapsulating biologically active cargo including proteins, DNA, messenger RNA, microRNA, metabolites, and lipids.[1]

Exosomes are generated from a double invagination process of the parental cell's plasma membrane to form intracellular multivesicular bodies which contain intraluminal bodies.[2–4] The latter are expelled from the parental cell as exosomes through exocytosis.[2–4] The exosomes are ultimately taken up by a recipient cell to induce varied biological responses.

Given their differences in size, cargo, cell of origin, and the distinct combinations thereof, exosomes are known to be extremely heterogenous in structure and function.[2] The recipient cell and its microenvironment add another layer of complexity to their ultimate function. Research over the last decade has uncovered roles in cell survival, proliferation, migration, differentiation, senescence, immunomodulation, angiogenesis, wound healing, neoplasia, and much more.[2] They have more recently been exploited for use in aesthetics because of their effects on wound healing through the promotion of cell migration, extracellular matrix reconstruction, and angiogenesis.[5,6]

From the *All authors are affiliated with the Cosmetic Laser Dermatology, San Diego, California

The authors have indicated no significant interest with commercial supporters.

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http://dx.doi.org/10.1097/DSS.0000000000003487

Exosome Sources

The source from which exosomes are isolated is of critical importance with implications on their functions and thus clinical applications. Stem-cell therapy is a well-established regenerative tool which promotes wound healing and skin rejuvenation.[7] Recently, stem cell–conditioned medium (CM) which contains paracrine mediators, including exosomes, was found to exert similar regenerative effects as stem cells themselves, representing a "cell free" alternative to stem-cell therapy.[8–11] In cosmetics, exosomes are most often derived from adult or mesenchymal stem cells (MSCs).[5]

Isolation Techniques

Ultracentrifugation involves sequential centrifugations at exceptionally high forces allowing for sedimentation of minute particles based on the size and density. Despite being considered the "gold standard," ultracentrifugation can be a lengthy, laborious process and requires expensive equipment.[12] Furthermore, the heterogeneity of exosomes and overlapping physical properties of solutes can contribute to the loss of exosomes and contamination, respectively.[12] Finally, repeated centrifugations can compromise the integrity of the EVs.[13]

Ultrafiltration represents another popular isolation technique in which the source is subjected to sequential filters to separate the constituents based on the molecular weight or size.[6,7] Ultrafiltration is more efficient than ultracentrifugation, with shorter processing times. Similar to other size-based techniques, ultrafiltration can lead to the loss of exosomes and contamination. Moreover, deformation of large exosomes has been noted due to the force from filters.[12,13]

Immunoaffinity capture–based techniques use antibodies corresponding to the membrane-bound proteins on exosomes to isolate them. This method is very efficient allowing

Exosomes in Aesthetics: A Growing Trend

Clinical Applications:

- Skin Remodeling
- Hyperpigmentation
- Scarring
- Alopecia

"Mesenchymal stem cell–derived exosomes have been established as hypoimmunogenic"

Hartman N, Loyal J, Fabi S. Update on Exosomes in Aesthetics. *Dermatol Surg*. 2022;48(8):862-865. doi:10.1097/DSS.0000000000003487

Role of Exosomes in Skin Diseases
J Cosmet Dermatol. 2022;21:3219–3225

REVIEW ARTICLE

JCD Journal of Cosmetic Dermatology WILEY

Role of exosomes in skin diseases

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Abstract

Background: Exosomes, as a family member of extracellular vesicles, are cell-secreted nanoscale structures that play pivotal roles in regulating physiological and pathophysiological processes of the skin. Exosomes induce communication between cells and are responsible for transporting cellular components such as microRNAs, mRNAs, DNA, lipids, metabolites, and cell-surface proteins. Numerous preclinical and clinical trials searched the contribution of exosomes to skin functions and disorders. Thus, exosomes are gaining increasing attention within investigational dermatology. In advance, stem-cell-derived exosomes were integrated into the functional cosmetics industry nominated as cell-free regenerative medicine.

Objective: This review aims to demonstrate the roles of exosomes in inflammatory skin disorders, stem cell, and tumor biology through a comprehensive evaluation of the diagnostic, prognostic, and therapeutic perspectives.

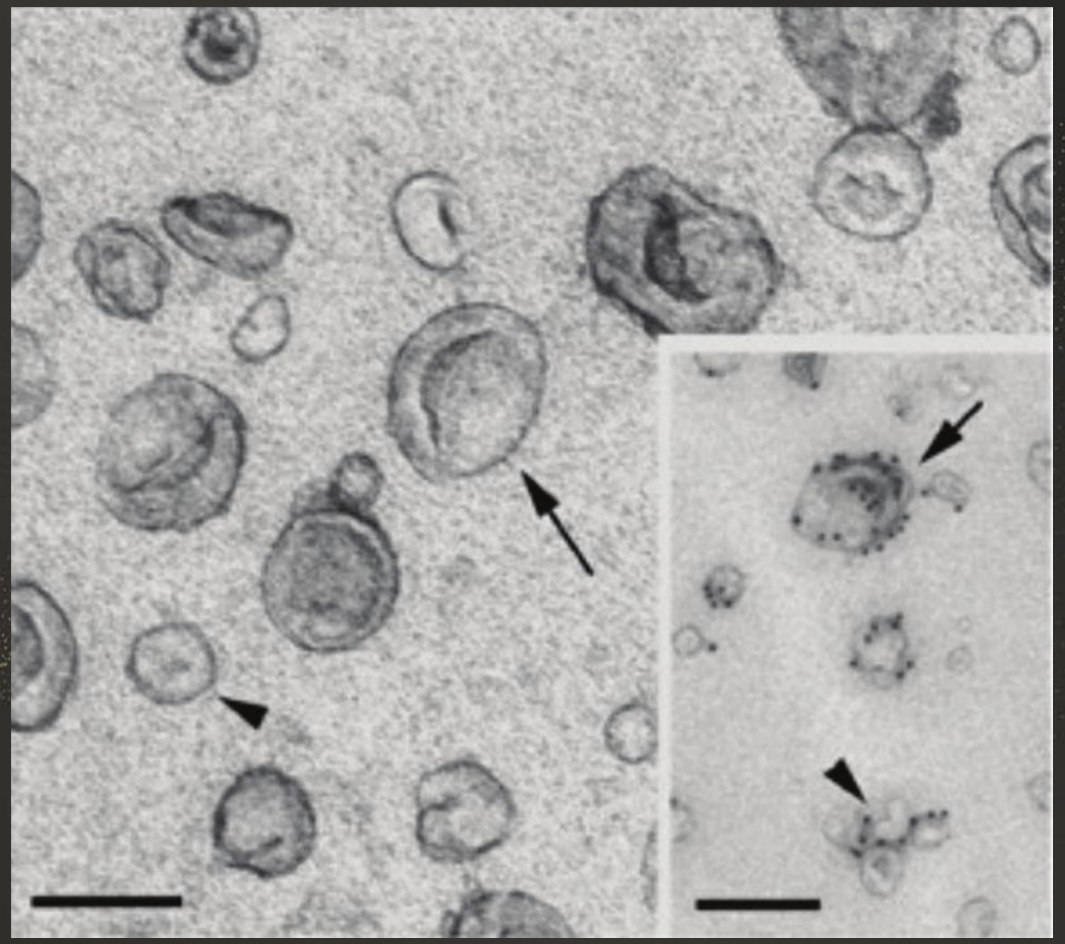
Methods: A comprehensive literature search was performed using electronic online databases "PubMed" and "Google Scholar" using key words "exosomes", "skin", "wound healing".

Conclusion: Exosomes are regarded as promising diagnostic and prognostic biomarkers for various skin diseases. Future prospects are repurposing exosomes to treat skin disorders, either as drug carriers or drugs themselves.

KEYWORDS
cancer, exosome, extracellular vesicle, inflammatory skin diseases, stem cell

Exosomes

- Extracellular vesicles (EVs)
- 100nm in size
- Found in all biological fluids
- Delivery mechanism for Growth Factors + mRNA



Topical Exosome Cosmeceuticals

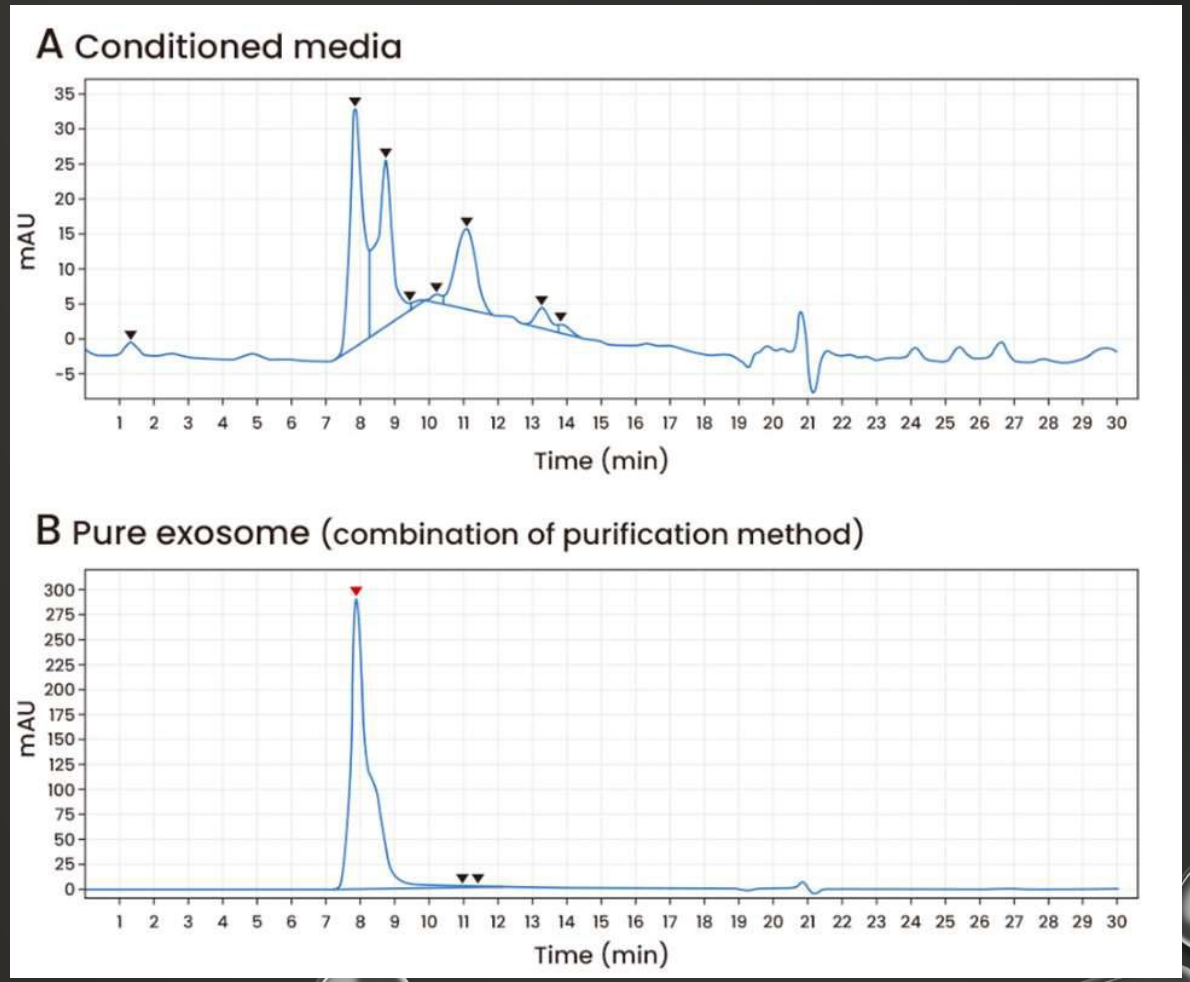
The US Food and Drug Administration (FDA) regulates regenerative medicine products. There continues to be broad marketing of unapproved products considered regenerative medicine therapies that are intended for the treatment or cure of a wide range of diseases or medical conditions. These products require FDA licensure/approval to be marketed to consumers. Before approval, these products require FDA oversight in a clinical trial. These unapproved products whether recovered from your own body or another person's body, include stem cells, stromal vascular fraction (fat-derived cells), umbilical cord blood and/or cord blood stem cells[1], amniotic fluid, Wharton's jelly, ortho-biologics, and exosomes. FDA has received reports of blindness, tumor formation, infections, and more, detailed below, due to the use of these unapproved products.

Topical Exosome Cosmeceuticals

- There have been several companies entering into the exosome space in the past several years
- The exosomes are human and plant derived
- We will review the human derived ones first and then the plant derived ones
- More clarity over time is expected on the entire field

Challenges Using Exosomes

- Cell-line development-
  - sophisticated composition, small cell size and heterogenous population
- Scalability
- Upstream cell culture
- Downstream purification processes
- Characterization and quality control
- Stability (shelf-life)
- Regulatory considerations
- typically derived from Bone Marrow or Umbilical tissue



Taylor and Taylor.Exosomes/microvesicles: mediators of caner-associated immunosuppressive microenvironments.*Semin Immunopathol.2011*(33):441-54

Photo Courtesy of Glynis Ablon, MD

Exosome Cell Sources

Umbilical Cord Mesenchymal Stem Cells-Exos	Adipose Derived Stem Cells-Exos	Bone Marrow Derived Stem Cell-Exos	Human Trophoblast-Exos	Plant derived Exos
• Skin rejuvenation • Human dermal fibroblast(HDF) migration and upregulation of collagen	•Cell proliferation and migration •Decrease ROS production and DNA damage	• Exosomes concentrate the natural function of a stem cell. • Regenerative for skin	• Superior regenerative capabilities • Prolif and migration of HDF • Increase collagen I and III, elastin • Decr MMP1,3	• Regenerative capacity • promote cellular growth with protective effects against inflammation, oxidation and stress. • Exosome like nano-vesicles

Photo Courtesy of Glynis Ablon, MD

Exosomes & Extracellular vesicles

Photo Courtesy of Glynis Ablon, MD

Benev Exosome Regenerative Complex

- BENEV Exosome Regenerative Complex powered by Exo-SCRT ™ and BENEV Exosome Regenerative Complex + powered by Exo-SCRT™ are post care “topical use” cosmetic solutions. The isolated and purified exosomes in both products have been accepted by the PCPC, and International Cosmetic Ingredient Nomenclature Committee (INC), and the name ‘Human Adipose Stromal Cell Exosomes’ was given and published in the International Cosmetic Ingredient Dictionary and Handbook, known as INCI book. There are at this time no other cosmetic INCI name(s) assigned to exosome products in the market prior to this accomplishment. These products are not drug products. They are not intended to prevent, treat or cure diseases or medical conditions. They are not intended to be injected or delivered intravenously.

Topical Exosome Cosmeceuticals

The US Food and Drug Administration (FDA) regulates regenerative medicine products. There continues to be broad marketing of unapproved products considered regenerative medicine therapies that are intended for the treatment or cure of a wide range of diseases or medical conditions. These products require FDA licensure/approval to be marketed to consumers. Before approval, these products require FDA oversight in a clinical trial. These unapproved products whether recovered from your own body or another person's body, include stem cells, stromal vascular fraction (fat-derived cells), umbilical cord blood and/or cord blood stem cells[1], amniotic fluid, Wharton's jelly, ortho-biologics, and exosomes. FDA has received reports of blindness, tumor formation, infections, and more, detailed below, due to the use of these unapproved products.

Microneedling and Microneedling RF Devices for Hair Growth 2023

Microneedling and Microneedling RF Devices for Hair Growth

Microneedling has become very popular for hair growth in 2023

Many kinds of microneedling devices are now available

From rollers to pens to RF pins and RF needles

Stimulate hair growth – documented evidence and for adjuvant therapy

Also great source for drug delivery

A Randomized Evaluator Blinded Study of Effect of Microneedling in Androgenetic alopecia: a pilot study.
Int J Trichology. 2013 Jan;5(1):6-11. doi: 10.4103/0974-7753

A Randomized Evaluator Blinded Study of Effect of Microneedling in Androgenetic Alopecia: A Pilot Study

Rachita Dhurat, MS Sukesh, Ganesh Avhad, Ameet Dandale, Anjali Pal, and Poonam Pund

‣ Author information ‣ Copyright and License information Disclaimer

Abstract

Go to: ‣

Introduction:

Dermal papilla (DP) is the site of expression of various hair growth related genes. Various researches have demonstrated the underlying importance of Wnt proteins and wound growth factors in stimulating DP associated stem cells. Microneedling works by stimulation of stem cells and inducing activation of growth factors.

Materials and Methods:

Hundred cases of mild to moderate (III vertex or IV) androgenetic alopecia (AGA) were recruited into 2 groups. After randomization one group was offered weekly microneedling treatment with twice daily 5% minoxidil lotion (Microneedling group); other group was given only 5% minoxidil lotion. After baseline global photographs, the scalp were shaved off to ensure equal length of hair shaft in all. Hair count was done in 1 cm^2 targeted fixed area (marked with tattoo) at baseline and at end of therapy (week 12). The 3 primary efficacy parameters assessed were: Change from baseline hair count at 12 weeks, patient assessment of hair growth at 12 weeks, and investigator assessment of hair growth at 12 weeks. A blinded investigators evaluated global photographic response. The response was assessed by 7- point scale.

Results:

(1) Hair counts – The mean change in hair count at week 12 was significantly greater for the Microneedling group compared to the Minoxidil group (91.4 vs 22.2 respectively). (2) Investigator evaluation – Forty patients in Microneedling group had +2 to +3 response on 7-point visual analogue scale, while none showed the same response in the Minoxidil group. (3) Patient evaluation – In the Microneedling group, 41 (82%) patients reported more than 50% improvement versus only 2 (4.5%) patients in the Minoxidil group. Unsatisfied patients to conventional therapy for AGA got good response with Microneedling treatment.

Conclusion:

Dermaroller along with Minoxidil treated group was statistically superior to Minoxidil treated group in promoting hair growth in men with AGA for all 3 primary efficacy measures of hair growth. Microneedling is a safe and a promising tool in hair stimulation and also is useful to treat hair loss refractory to Minoxidil therapy.

Microneedling for Hair Loss
J Cosmet Dermatol. 2022;21:108–117

Microneedling for Hair Loss

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Abstract

Background: Microneedling is a relatively novel therapeutic modality introduced in the 1990s where small, fine needles are used to create micro punctures in the skin. It is a minimally invasive procedure used for various dermatological conditions, including androgenetic alopecia (AGA).

Objective and Methods: We comprehensively summarize the literature regarding microneedling in dermatology. We performed linear multivariable regressions to synthesize evidence from the clinical trials that investigated the efficacy of microneedling for AGA. Studies eligible for quantitative analyses were assessed for evidence quality.

Results: The exact mechanism of microneedling action is yet to be determined, with theories that include the wound-healing cascade. Microneedling monotherapy significantly increased total hair count more than topical minoxidil 5% ($\beta = 12.29$; $p < 0.001$). The combination treatment of microneedling with topical 5% minoxidil increased total hair count significantly compared to monotherapy with microneedling ($\beta = 7.63$, $p < 0.05$). Increasing the overall treatment duration of microneedling and reducing the frequency of microneedling sessions may positively influence an increase in total hair count.

Conclusion: There are limited studies that investigate microneedling as a monotherapy for hair loss since majority of the trials combine it with other therapies such as topical minoxidil or platelet-rich plasma. While preliminary results look promising, further investigation of microneedling as a monotherapy in larger, randomized controlled trials will help determine its safety and efficacy, and place in treating AGA.

Characteristics of the 9 Studies Investigating Microneedling for Pattern Hair Loss

TABLE 2 Characteristics of the 9 studies investigating microneedling for pattern hair loss

Study	General description of severity	N	Study type	Treatment regimen	Microneedling (MN) procedure	No. of MN sessions	Treatment duration
Dhurat 2013[28]	Mild to moderate male AGA	50	Combination	Weekly MN + twice daily 5% minoxidil lotion	Dermaroller of 1.5 mm sized needles	12	12 weeks
Faghihi 2021[34]	Moderate to severe AGA	20	Combination	MN with a depth of 1.2 mm + twice daily 5% minoxidil lotion	Electrical pen-shaped device with adjustable depth of penetration from 0.1-2 mm	6	12 weeks
		20		MN with a depth of 0.6 mm + twice daily 5% minoxidil lotion			
Aggarwal 2020[33]	Norwood-Hamilton Grade II-V male AGA	22	Split-scalp study	MN + PRP (left side) MN + saline (right side)	Dermaroller of 1.5-2 mm sized needles	4	16 weeks
		22		MN + PRP (right side) MN + saline (left side)			
Bao 2020[37]	Norwood-Hamilton Grade III-VI male AGA	20	Combination	MN	Electrodynamic MN with adjustable depth between 1.5 and 2.5 mm	12	24 weeks
		20		MN + twice daily 5% minoxidil lotion			
Bao 2020[36]	Norwood-Hamilton Grade III-VI male AGA	23	Combination	MN	Electrodynamic MN with adjustable depth between 1 and 2 mm	8	24 weeks
		25		MN + twice daily 5% minoxidil lotion			
Kumar 2018	Norwood-Hamilton Grade III and IV male AGA	34	Combination	MN + twice daily 5% minoxidil lotion	Dermaroller of 1.5 mm sized needles	8 (weekly for 4 sessions and fortnightly for 4 sessions)	12 weeks
Lee 2013[39]	Ludwig Grade I female pattern hair loss	11	Split-scalp study	Growth factor solution* + MN (one half) Saline solution + MN (other half)	Automatic MN device with nine 33-G needles	5	5 weeks
Sohng 2021[40]	Norwood-Hamilton Grade II-V male AGA	11	Combination	MN	Home-use MN device with 0.25 mm long spiral-grooved needles	48	24 weeks
	Ludwig Grade I female AGA	9		MN + twice daily 5% minoxidil lotion			
Yu 2021[41]	Male AGA	10	Combination	Saline using MN	Nano MN device	16	16 weeks
		10		Growth factors using MN			
		10		Growth factors using MN + twice daily 5% minoxidil solution			

Note: *Basic fibroblast growth factor, insulin-like growth factor-1, vascular endothelial growth factor, stem cell factor, keratinocyte growth factor-2, superoxide dismutase - 1, and Noggin

Microneedling and Its Use in Hair Loss Disorders: A Systematic Review
Dermatol Ther (Heidelb) (2022) 12:41–60

Microneedling and Its Use in Hair Loss Disorders: A Systematic Review

Robert S. English Jr. · Sophia Ruiz · Pedro DoAmaral

Received: November 8, 2021 / Published online: December 1, 2021

ABSTRACT

Introduction: Microneedling (MN) is a minimally invasive procedure involving the induction of percutaneous wounds with medical-grade needles. In this literature review, we investigate clinical data on MN for the treatment of hair loss disorders.

Methods: A literature search was conducted through PubMed up to November 2021 to identify original articles evaluating the use of MN on hair loss disorders. The database was searched using the following keywords: "microneedling," "micro needling," "micro needle," "microneedle," "needle," "dermaroller" and "alopecia," "hair loss," "alopecia," "areata," "cicatricial," or "effluvium."

Results: A total of 22 clinical studies featuring 1127 subjects met our criteria for inclusion. Jadad scores ranged from 1 to 3, with a mean of 2. As an adjunct therapy, MN improved hair parameters across genders and a range of hair loss types, severities, needling devices, needling depths of 0.50–2.50 mm, and session frequencies from once weekly to monthly. Across 17 investigations totaling 911 androgenic alopecia (AGA) subjects, MN improved hair parameters when paired with 5% minoxidil, growth factor solutions, and/or platelet-rich plasma (PRP) topicals, or when introduced to subjects whose hair count changes had plateaued for $\geq$ 6 months on other treatments. Across four investigations on 201 alopecia areata (AA) subjects, MN improved hair parameters as a standalone therapy versus cryotherapy, as an adjunct to 5-aminolevulinic acid and photodynamic therapy, and equivalently when paired with topical PRP versus carbon dioxide laser therapy with topical PRP. Across 657 subjects receiving MN, no serious adverse events were reported.

Conclusions: Clinical studies demonstrate generally favorable results for MN as an adjunct therapy for AGA and AA. However, data are of relatively low quality. Significant heterogeneity exists across interventions, comparators, and MN procedures. Large-scale randomized controlled trials are recommended to discern the effects of MN as a standalone and adjunct therapy, determine best practices, and establish long-term safety.

Keywords: Microneedling; Alopecia; Hair loss

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s13555-021-00653-2.

Hair Loss - 2022

- Microneedling
  - Minimally invasive procedure to increase collagen and elastin formation
  - Proposed to increase hair growth by triggering the wound response, which ultimately augments the release of platelet-derived and epidermal growth factors while also activating the hair bulge
  - Rollers or pens – 0.5-2.5 mm long
  - Daily to weekly treatments – 12-28 weeks to demonstrate an effect
  - Several studies support its effects
  - In conjunction with PRP – better perhaps

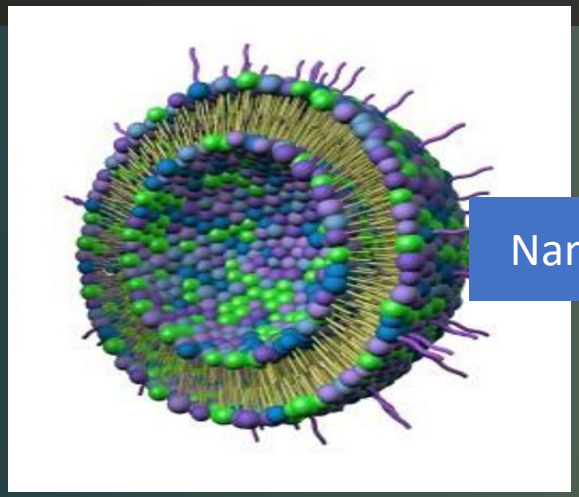
Nonsurgical Hair Restoration Treatment
Roya S. Nazarian, Aaron S. Farberg, Peter W. Hashim, Gary Goldenberg Cutis. 2019;104;17-24

Lasers and Laser Assisted Drug Delivery for Hair Growth - 2023

Lasers and Laser Assisted Drug Delivery for Hair Growth - 2023

- Several popular laser systems gaining traction in 2023
  - 1927 nm fractional thulium device - Lutronic
  - Erbium YAG (2940 nm) and Nd: YAG (1064) – Fotona

What is KeraFactor?



Nanoliposome

KeraFactor contains **ZERO** Minoxidil® finasteride or other prescriptive hormones or medications.

Many of those are prohibited to use in conjunction with hair transplants and other procedures.

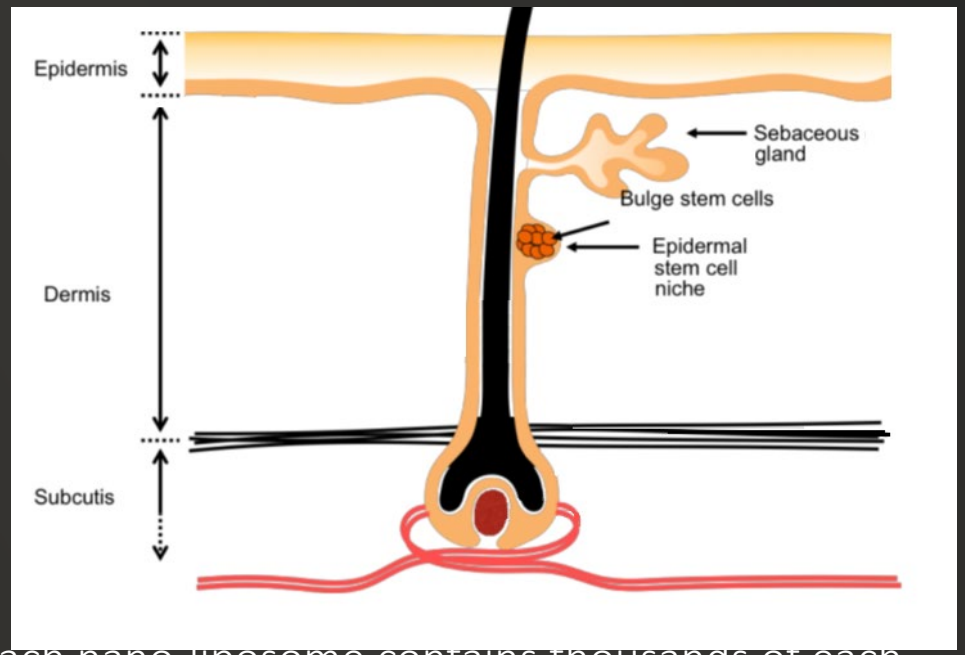
- A specific selection and concentration of EACH of the 5 biomimetic human growth factors and 2 skin proteins for Scalp Revitalization
- Unique and proprietary formulation derived by studying scalp growth factor deficiencies during hair loss and poor hair health
- Each type of growth factor and skin protein is individually wrapped in a nano-liposome carrier for enhanced absorption

The Importance of Nano-Liposomes

GF ***WITHOUT*** Liposome

GF ***WITH*** **Nano-Liposome** Absorption at depth of bulge area

— Each “Nano” liposome is wrapped to a particle size of <200nm to ensure absorption via the hair duct into the epidermis **(sebaceous gland & bulge area)**



— Each nano-liposome contains thousands of each specific growth factor

Laser-assisted Hair Regrowth: Fractional Laser Modalities for the Treatment of Androgenic Alopecia
Plast Reconstr Surg Glob Open. 2019 Apr 11;7(4):e2157

OPEN

PRS GLOBAL OPEN

SPECIAL TOPIC

Laser-assisted Hair Regrowth: Fractional Laser Modalities for the Treatment of Androgenic Alopecia

Robert J. Dabek, MD
William G. Austen, Jr, MD, FACS
Branko Bojovic, MD, FACS

Background: A large proportion of the population is at sometime affected by androgenic alopecia. Current therapies consisting of minoxidil or finasteride are often the first choices for treatment. These regimens are limited by their efficacy, side-effect profiles, and often lengthy treatment courses. Low level laser/light has shown to be relatively effective and safe for the treatment of hair loss, and a number of products are currently available to consumers. Recently, fractional lasers have been examined as treatment options for androgenic alopecia. The mechanism of action of these minimally invasive resurfacing procedures is thought to be 2-fold. First, the microscopic injuries created by these treatments may induce a favorable wound healing environment that triggers hair growth. Alternatively, disruption of the stratum corneum allows for improved transdermal passage of well-established therapeutic drugs to the hair roots.

Methods: A literature review was performed to evaluate the efficacy of these emerging treatments on hair regrowth.

Results: Nine original studies examining the effect of fractional lasers on hair growth in androgenic alopecia have been reviewed.

Conclusions: Preliminary evidence suggests that fractional laser therapies have a positive effect on hair regrowth; however, most of the literature is limited to case reports, and small prospective and retrospective series. Further studies, in the form of well-designed randomized controlled trials, are necessary to evaluate the efficacy, safety, and optimal treatment courses. *(Plast Reconstr Surg Glob Open 2019;7:e2157; doi: 10.1097/GOX.0000000000002157; Published online 11 April 2019.)*

Treatment of Alopecia Areata with 2940-nm Fractional Erbium:yttrium-Aluminum-garnet Laser
doi:10.1111/dth.13978

Title: Treatment of Alopecia Areata with 2940-nm Fractional Erbium:yttrium-aluminum-garnet Laser

Authors: Ali Tanakol[1i], Muazzez Cigdem Oba[1ii], Tugba Kevser Uzuncakmak[1], Ozge Askin[1], Zekayi Kutlubay[1]

Institution: [1]Istanbul University-Cerrahpasa, Cerrahpasa Medical Faculty, Department of Dermatology and Venereology

Acknowledgements: None

Abstract

Background: Various laser therapies have been used for the treatment of alopecia areata (AA). Enhanced hair regrowth was reported with the use of ablative fractional 2940-nm erbium:yttrium-aluminum-garnet (Er:YAG) laser in a murine model. However, clinical effectiveness of fractional Er:YAG laser for hair disorders has not been investigated in human studies. The aim of our study was to assess effectiveness of 2940 nm fractional Er:YAG laser in the treatment of chronic AA that is unresponsive to conventional therapies.

Methods: Twenty-five AA patients underwent three sessions, each 4-6 weeks apart, of fractional Er:YAG laser. Clinical evaluation was done at baseline and one-month post-treatment (follow-up) by photographic assessment. Subjective evaluation by patient satisfaction score was also performed.

Results: Photographic evaluation of the patients revealed a mean percent change in SALT score of 17.4±3,5% at follow-up. A total of 16 patients who were treated for patchy AA of the scalp showed 27,8±31,3% regrowth. Five patients who were treated for AA of the beard had 39±34,2% regrowth.

2020

Case Report: Experience in Treatment of Androgenetic Alopecia using: Er: YAG Laser Journal of the Laser and Health Academy Vol. 2021, No. 1

ISSN 1855-9913

Journal of the Laser and Health Academy
Vol. 2021, No.1; www.laserandhealth.com

CASE REPORT: Experience in Treatment of Androgenetic Alopecia using Er:YAG Laser (SMOOTH™ Mode) Combined with Platelet-rich Plasma

Dmitry Vladimirovich Maksimov
Clinic of Aesthetic Medicine "Green Island", Nizhny Novgorod, Russia

ABSTRACT

Lasers are becoming important as an alternative or adjuvant treatment modality for the treatment of androgenetic alopecia. Another emerging modality for hair regrowth is autologous platelet-rich plasma. A combination therapy consisting of nonablative 2940-nm Er:YAG laser in SMOOTH™ mode and the subcutaneous injection of platelet-rich plasma seems to result in significant hair regrowth. We present a case of a grade-3 androgenetic alopecia patient with evident restoration of hair density after three sessions of the combined treatment, with preservation of the achieved result several months after therapy and no adverse effects.

of AGA [4], owing to the fact that laser phototherapy has demonstrated proliferative effects in a variety of tissues and cell types, including hair follicles [5]. It has been reported that 2940-nm Er:YAG laser promotes hair growth in mice [6] via induction of hair cycle transition from the telogen to the anagen phase. The positive effect of Er:YAG laser monotherapy on hair regrowth in humans was published in a recent study [7]. Another emerging modality for AGA is platelet-rich plasma (PRP) [8], an autologous serum harvested from venous blood, which contains high concentrations of platelets and growth factors. PRP promote hair regrowth by stimulating stem cell differentiation of hair follicles [9]. Combining PRP injections with other hair restoration treatments may

2021

Non-ablative Er:YAG Laser is an Effective Tool in the Treatment Arsenal of Androgenetic Alopecia
J Cosmet Dermatol. 2022;21:2056–2063

Non-ablative Er:YAG laser is an effective tool in the treatment arsenal of androgenetic alopecia

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Funding information
No funding

Abstract

Background: Up to 70% of the adult population worldwide is affected by androgenetic alopecia (AGA) hair loss. Laser therapy offers an addition or alternative to pharmaceutical and surgical treatment of hair regrowth, with non-ablative lasers being preferred over ablative lasers in terms of safety and downtime. Combining laser therapy with different topical agents may result in better hair regrowth.

Objective: The aim was to evaluate the effectiveness and safety of non-ablative Er:YAG laser used in clinical practice, alone or in combination with other treatment modalities, in patients with both early and advanced stages of AGA.

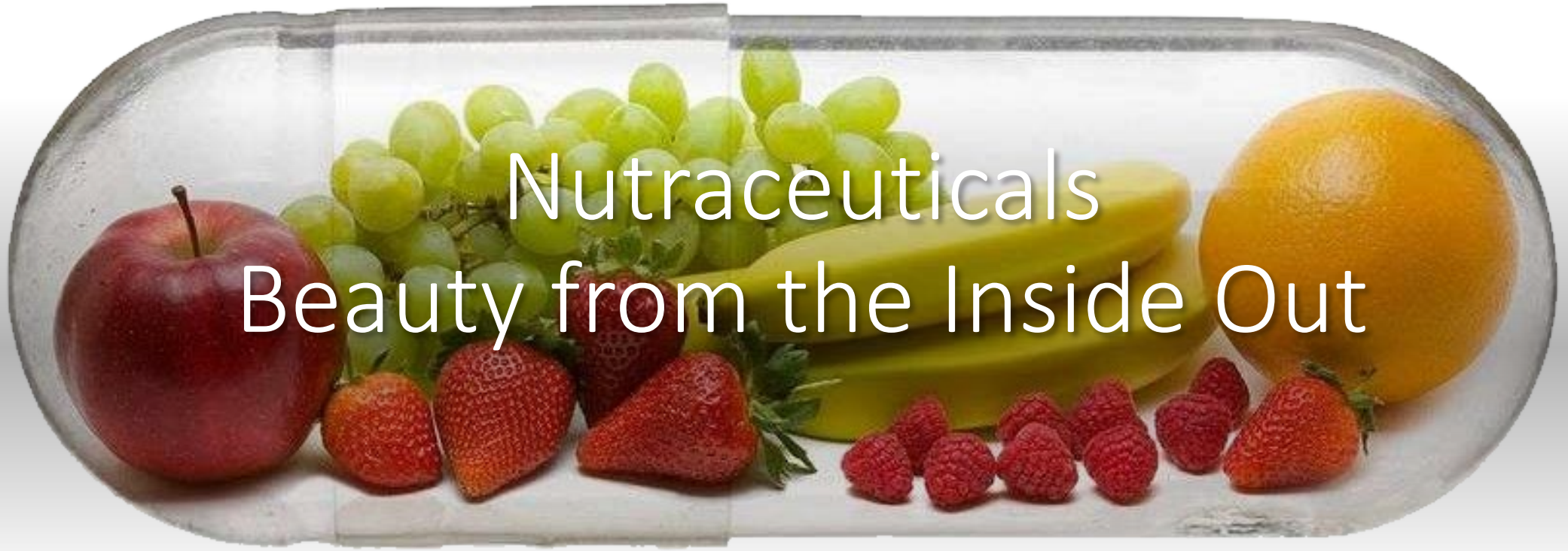
Methods and patients: Sixteen patients (7 male and 9 female) with active AGA in different stages were treated with the non-ablative Er:YAG laser (SMOOTH^{TM} mode, 7 mm spot size, 7.00 J/cm^2 pulse fluence, 3.3 Hz frequency) as a monotherapy or in combination with injections of platelet-rich plasma (PRP) to the scalp, topical minoxidil, and oral supplements for the promotion and support of hair growth. Efficacy was assessed with clinical assessment of AGA grade (Ludwig scale for female / Norwood-Hamilton scale for male) and with blind evaluation of hair quality in global photographs before and after treatment. Patients subjectively rated their satisfaction with the laser treatment on a scale from 0–3 and pain on a VAS scale from 0–10.

Results: AGA grade after treatment was lower compared to baseline ($p = 0.015$ and $p = 0.125$ in female and male patients, respectively). Blind evaluation indicated an improvement in hair quality in 93% of patients, either being described as much better (14%) or as better (79%), which was not correlated with age or AGA grade. The median satisfaction score was 3, and the median VAS score for pain was 2. The positive effect of the treatment on the hair quality is ongoing. No adverse reactions were reported.

Conclusions: The treatment was effective in treating AGA, confirmed by a decrease in AGA grade and by blinded evaluation of global photographs. Although the possible additive or complementary effect of topical minoxidil or nutraceuticals cannot be excluded, our results suggest that the non-ablative Er:YAG laser SMOOTH$^{™}$ mode as a monotherapy, or in combination with PRP, is an efficient and safe treatment for AGA—with a high satisfaction rate among patients regardless of patient age, AGA duration, or AGA stage.

Hair Loss - 2023

- Nutraceuticals
  - Having an increasing role in the treatment of hair loss
  - More and more with good science
  - Need to be careful in all that’s out there == science counts



Nutraceuticals
Beauty from the Inside Out

Image compliments of Dr. Patricia Farris

Vitamins for Hair Skin and Nails

- **Vitamin A**
  - Retinol is a diet-derived lipid soluble vitamin
  - Retinol is converted to retinaldehyde and retinoic acid
  - Support growth and differentiation
  - Modulates gene transcription
  - Photoprotective
  - Anti-inflammatory activity

Schagen SK, et al Dermatoendocrinol. 2012;4(3):298-307

Image compliments of Dr. Patricia Farris

Vitamins for Hair Skin and Nails

- **Vitamin C and E**
  - Vitamin C regenerates oxidized vitamin E
  - Antioxidants and anti-inflammatory
  - Vitamin C is a co-factor for the enzymes that make collagen
  - Tyrosinase inhibitor
  - Vitamin E prevents lipid peroxidation and cross-linking of collagen

Schagen SK, et al Dermatoendocrinol. 2012;;4(3):298-307

Image compliments of Dr. Patricia Farris

Vitamins for hair skin and nails

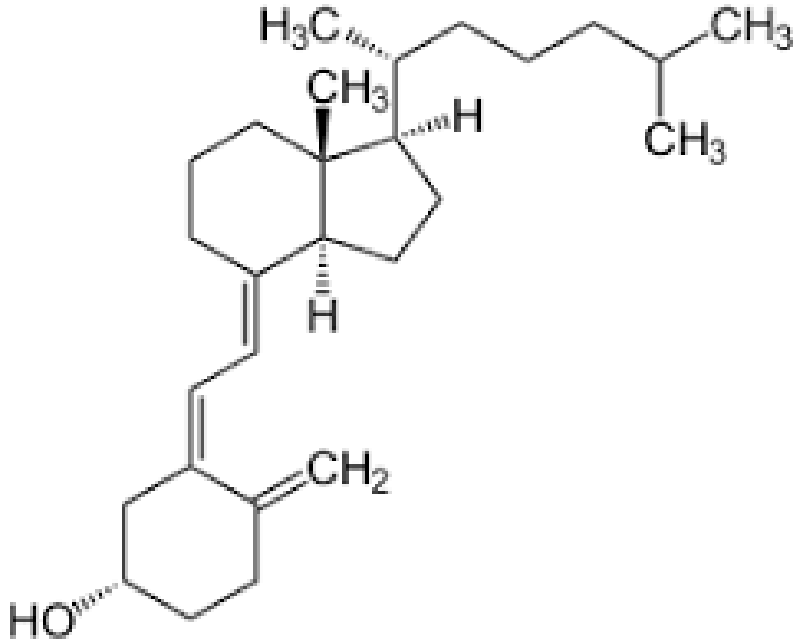
- Vitamin D
  - A fat-soluble prohormone steroid
  - Sources include sunlight, diet and supplements
  - *Endocrine function* to control serum calcium homeostasis
  - *Paracrine and autocrine effects* depend on gene transcription by cells that express vitamin D receptors
  - Inhibits cell proliferation
  - Promotes cell differentiation and apoptosis
  - Plays a role in many organ systems

Schagen SK, et al Dermatoendocrinol. 2012;;4(3):298-307

Image compliments of Dr. Patricia Farris

Vitamins for hair skin and nails

- **Vitamin D**
  - Essential for barrier function
  - Increases expression of involucrin, transglutaminase, loricrin, and filaggrin.
  - Increases keratinocyte cornified envelop
  - Induce toll-like receptor 2 (antimicrobial)
  - Affects innate and adaptive immunity
  - Promotes the progression of the hair cycle
  - Suppresses proliferation of sebocytes
  - Photoprotection
  - Promotes wound healing



Schagen SK, et al Dermatoendocrinol. 2012;;4(3):298-307

Image compliments of Dr. Patricia Farris

Biotin
What do we know?

- Biotin is water soluble vitamin
- Co-factor for carboxylase enzymes
- Carboxylase enzymes important for gluconeogenesis, fatty acid synthesis and amino acid catabolism
- Most hair, skin nails contain 5-10 mg
- RDA is 0.03mg/day
- FDA Warning: high doses of biotin interfere with troponin testing
- Can alter pregnancy test, TFT and prolactin

Patel DP et al. A review of the use of biotin for hair loss. Skin Appendage Disorder 2017;3:166-169

Image compliments of Dr. Patricia Farris

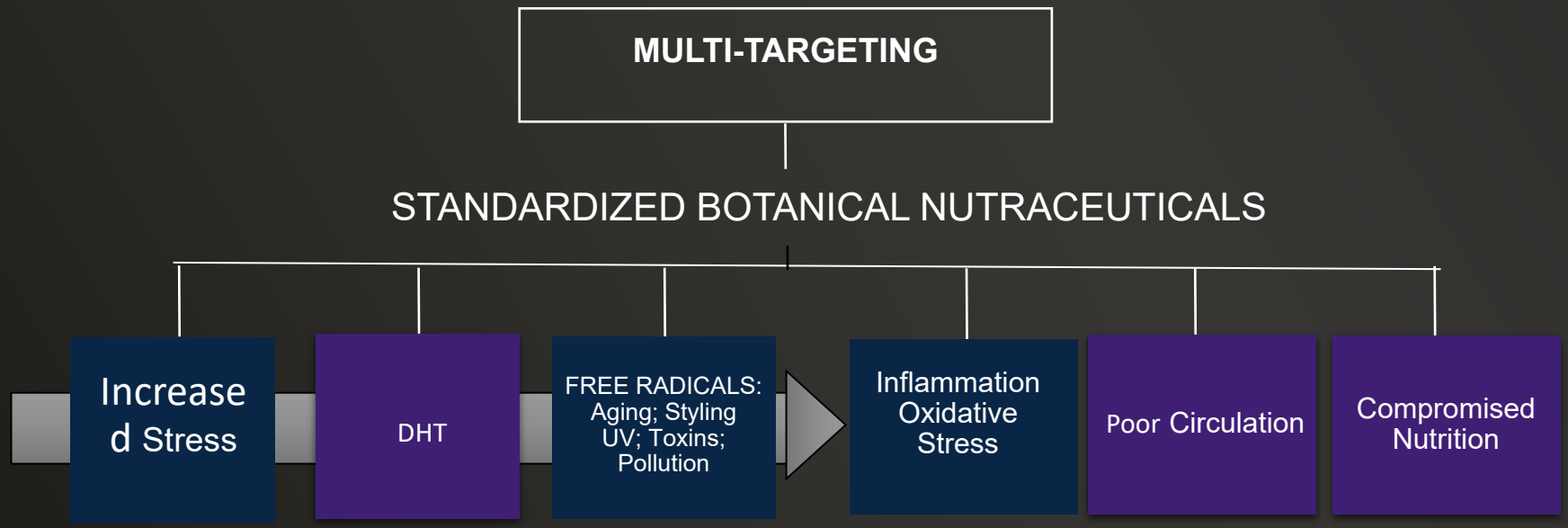
What about biotin
Is it helpful in hair loss?

- Biotin is a coenzyme for carboxylases found in the hair root
- Cases of congenital biotin deficiency
  - Biotinidase
  - Holocarboxylase synthase
- Acquired biotin deficiency
  - Valproic acid, isotretinoin , antibiotics
  - Raw egg white ingestion
  - Alcoholism
  - Pregnancy
- Little scientific evidence to support use in healthy individuals for hair growth or treat hair loss

Patel D, et al Skin Append Disord 2017;3:166

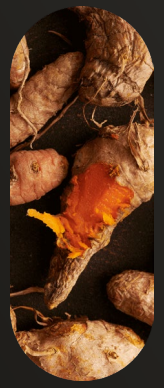
Image compliments of Dr. Patricia Farris

A multi-targeted approach to addressing hair loss



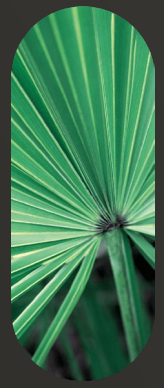
Patented Nutraceutical Complex with Standardized Botanicals

Targeted formulations for women and men
With standardized, patented, clinically tested ingredients.



Standardized Curcumin

- Derived from turmeric
- Clinically proven anti-inflammatory
- Proven to lower CRP and boost immune system
- Lowers TGF-b, TNF-a, IL-1

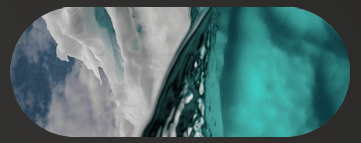


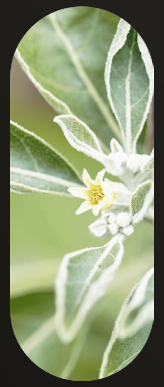
Standardized Saw Palmetto

- Dual-patented CO2 ultra-high pressure technology
- A clinically proven and recognized potent natural DHT-inhibitor
- Helps prevent conversion of T to DHT and binding to androgen receptors

Fortified with:

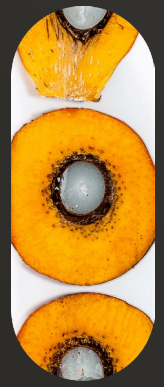
Hydrolyzed Marine Collagen & Hyaluronic acid





Standardized Ashwagandha

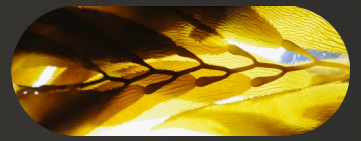
- 10% Withanaloids, derived from most powerful stress adaptogen
- Builds resistance to stress
- Clinically proven to decrease levels of cortisol by 24.5%, reduce CRP by 35.2% in chronically stressed adults



Standardized Tocotrienol/ Tocopherol Complex

- Potent form of Vitamin E
- Tocotrienol antioxidant with enhanced penetration into lipid membranes
- Prevents lipid peroxidation
- Raises innate antioxidants to counter aging
- Clinically shown to increase hair growth

Vitamins + Minerals + Amino acids + Horsetail + Resveratrol + Bioperine + Kelp



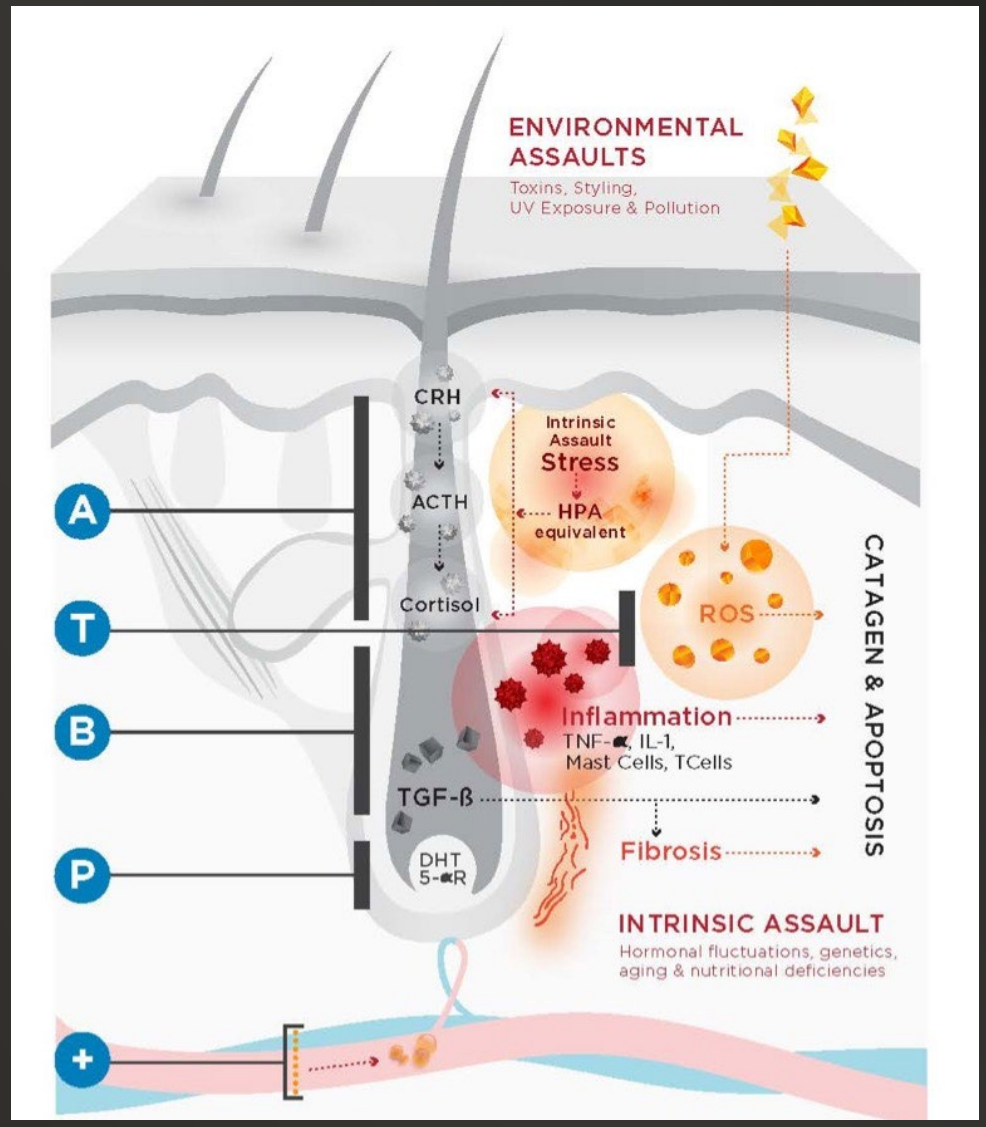
Shehzad, A., & Lee, Y. S. (2013). Biofactors, 39(1),27-36
Tabrizi, R., Vakili S., Akabari M., et al. (2019). Phytother Res. 2019 Feb;33(2):253-262
Auddy, B., Hazra, J., Mitra, A., et al. (2008). JANA 11(1), 50-56
Chandrasekhar, K., Kapoor, J., & Anishetty, S. (2012). Indian journal of psychological medicine. 34(3), 255.
Prager, N., Bickett, K., French, N., et al. (2002). The Journal of Alternative & Complementary Medicine, 8(2), 143-152.
Schroeder, M. T., Becker, E. M., & Skibsted, L. H. (2006). Journal of agricultural and food chemistry, 54(9), 3445-3453.

Standardized Botanical Nutraceutical Formulation

Synergistic activity against triggers of hair thinning

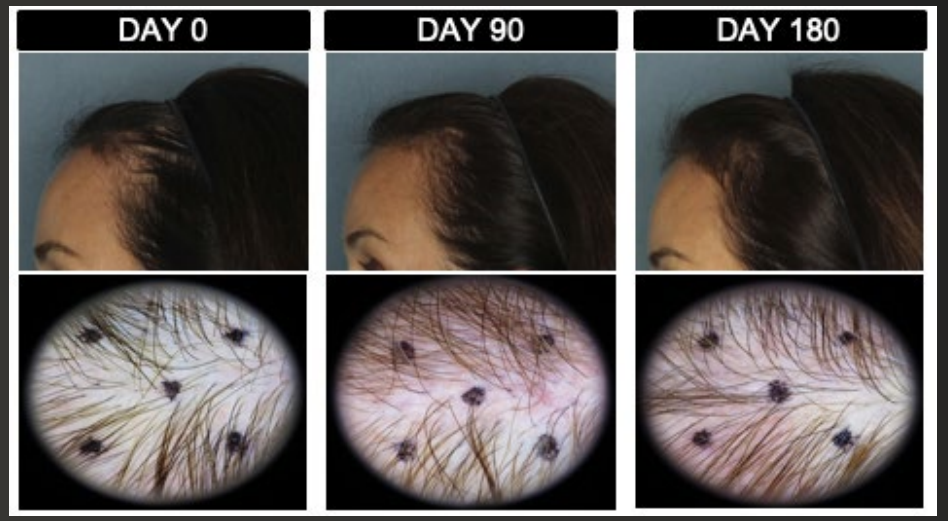
STANDARDIZED & CLINICALLY TESTED

- A — ASHWAGANDHA: Stress Adaptogen
- T — TOCOTRIENOLS: Super Antioxidant
- B — CURCUMIN: Super Anti-inflammatory
- P — SAW PALMETTO: Natural DHT-inhibitor
- \+ — MARINE COLLAGEN & NUTRIENTS



Farris, P.K., et al., J Drugs Dermatol, 2017. 16(11): p. s141-s148.

Clinical results on Patented Nutraceutical Complex with Standardized Botanicals



A Six-Month, Randomized, Double-Blind, Placebo-Controlled Study Evaluating the Safety and Efficacy of a Nutraceutical Supplement for Promoting Hair Growth in Women With Self-Perceived Thinning Hair

May 2018 | Volume 17 | Issue 5 | Original Article | 558 | Copyright © 2018

Glynis Ablon MD FAAD[a] and Sophia Kogan MD[b]

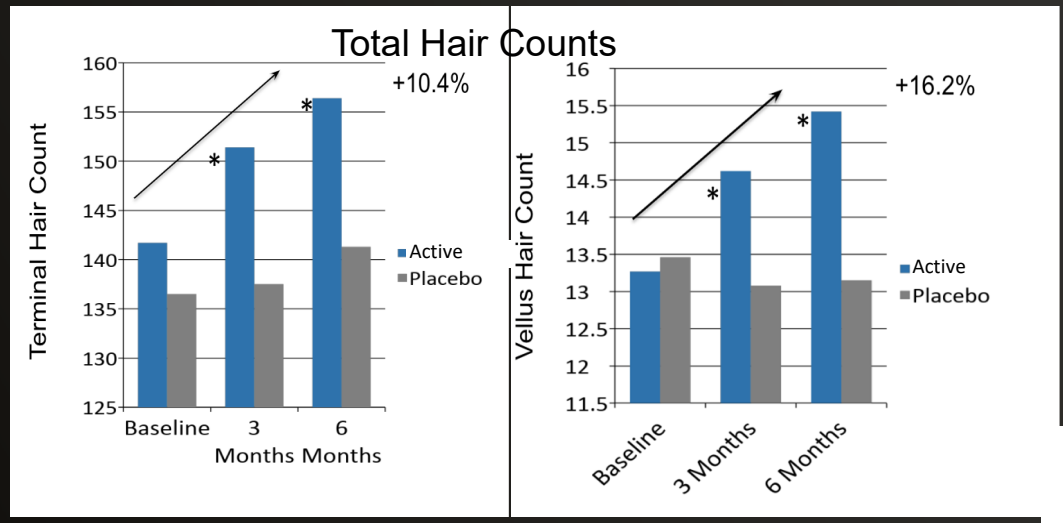
Study parameters included:
40 subjects, 6 months, Double-blind, placebo controlled

Endpoints measured:

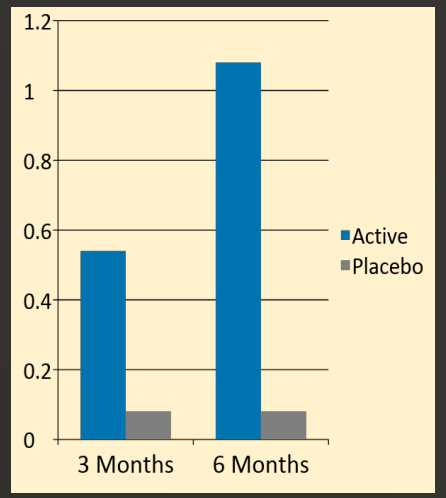
Primary: Change in hair count (terminal and vellus) and physician assessment of global hair quantity and quality

Secondary: Self-assessment and quality of life questionnaire

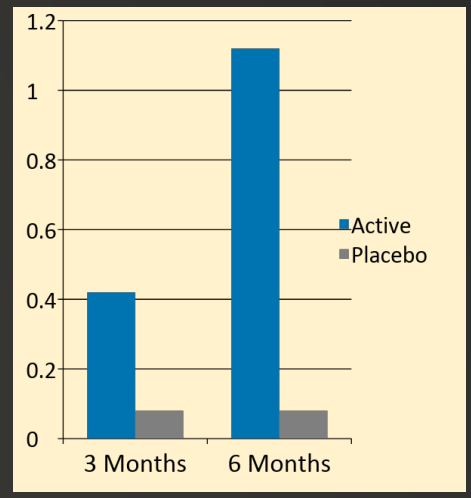
Results:



Hair Growth Global Improvement



Hair Quality Global Improvement



The dermatologist controlled double-blind, two cell study was conducted on 40 subjects, ages 21-65 for 6 months. Subjects took Nutrafol supplement (n=26) or placebo (n=14) once daily. * STATISTICAL SIGNIFICANT IMPROVEMENT VERSUS PLACEBO P =0.001

Menopause and hair thinning

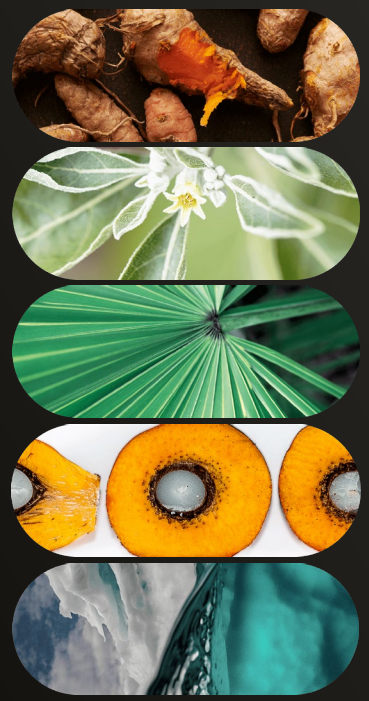
Genetic and non-genetic factors contribute to hair thinning

- Androgens, aging, stress, environmental factors, other hormones
- Androgens contribute more significantly for women during and after menopause
- Relative androgen excess
  - Estrogen and progesterone decrease abruptly after menopause
  - Androgen secretion declines gradually with age
  - ↓ SHBG
  - Insulin Resistance & Thyroid Disorder
- Heightened levels of inflammation & oxidative stress
  - Decreased DNA transcription
  - Decline in mitochondrial function
  - Less defense against pro-inflammatory mediators

Patented Nutraceutical Complex Plus

Targeted Solution for women in stages of menopause and hormonal changes

Nutraceutical Complex with Standardized Botanicals

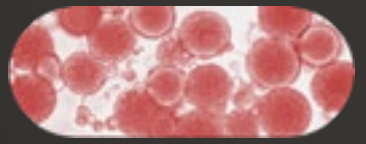


Nutraceutical Complex Plus

MACA

- Organic bio-optimized Maca root (Peru)
- Macamides are phytoactives adaptogens
- Helps to balance sex hormone signaling: Estrogen, Testosterone, Progesterone
- Tones the Brain to Gonad and Adrenal axis before, during, and after menopause
- DHT blocking action
- Side benefits: Alleviates menopausal symptoms: hot flashes, sweating, sleep, mood, headaches

ASTAXANTHIN



- Extracted from Red Algae
- Most powerful antioxidant
  - 6000x greater than Vitamin C
  - 550x greater than ECGC in Green tea
  - 550x greater than Vitamin E
- Reduces levels of oxidative stress in mitochondria
- Reduces pro-inflammatory cytokines (IL-8)
- Protects against lipid peroxidation
- Improves skin related signs of aging

EXTRA SAW PALMETTO

- Added DHT-blocking support
- Dual-patented CO_2 ultra-high-pressure technology
- A clinically proven and recognized potent natural DHT-Inhibitor
- Helps prevent conversion of T to DHT and binding to androgen receptors

Clinical Data on a Formulation with Synergen Complex Plus®

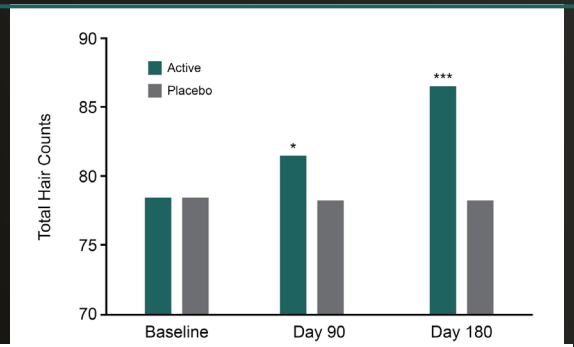
JANUARY 2021 | 55 | VOLUME 20 • ISSUE 1
COPYRIGHT © 2021 | ORIGINAL ARTICLE | JOURNAL OF DRUGS IN DERMATOLOGY

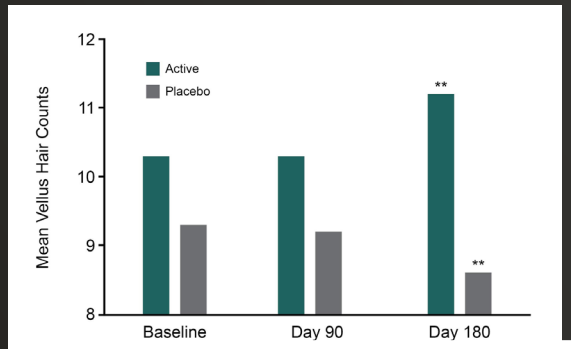
A Randomized, Double-Blind, Placebo-Controlled Study of a Nutraceutical Supplement for Promoting Hair Growth in Perimenopausal, Menopausal, and Postmenopausal Women With Thinning Hair

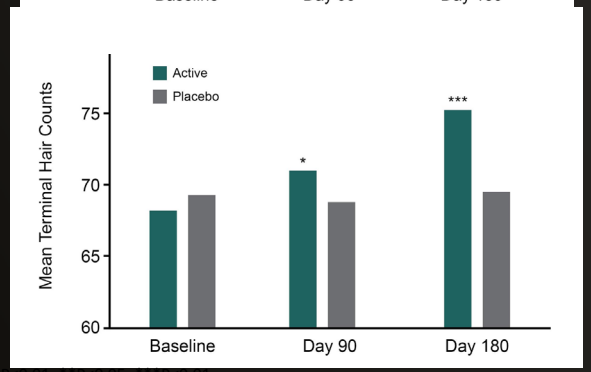
Glynis Ablon MD FAAD,[a] Sophia Kogan MD[b]

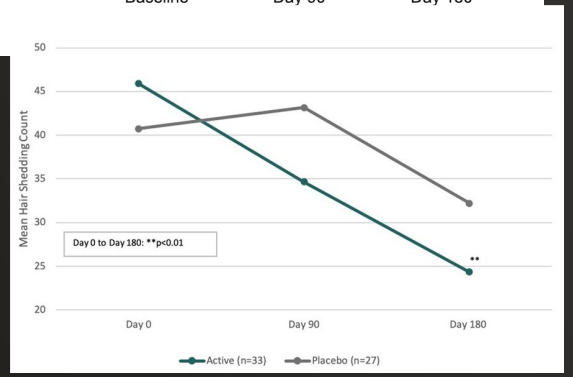
Sixty subjects (33 active; 27 placebo) completed the 6-month randomized phase of the study.

Statistically significant improvements compared to placebo for the number of terminal, vellus, total hair counts and shedding across the duration of the study.

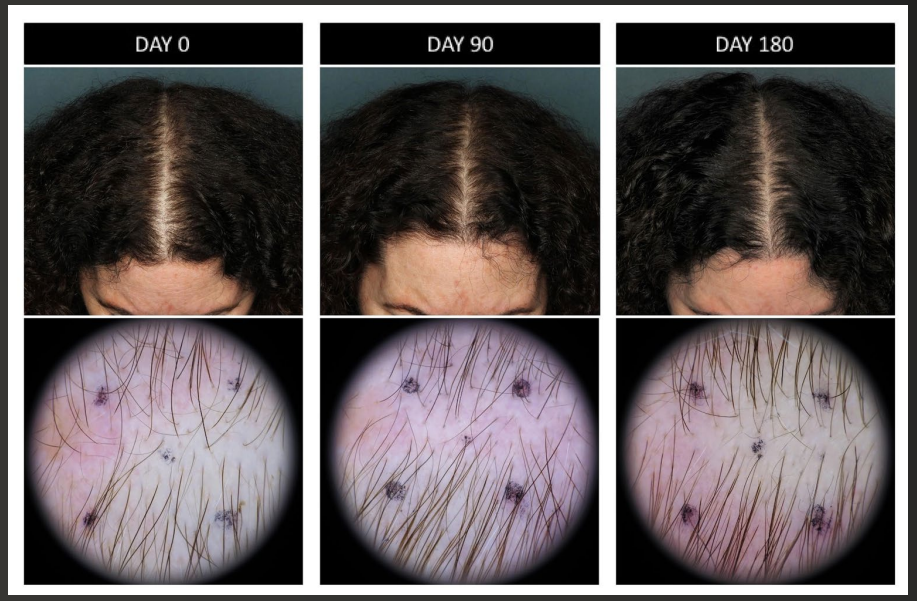






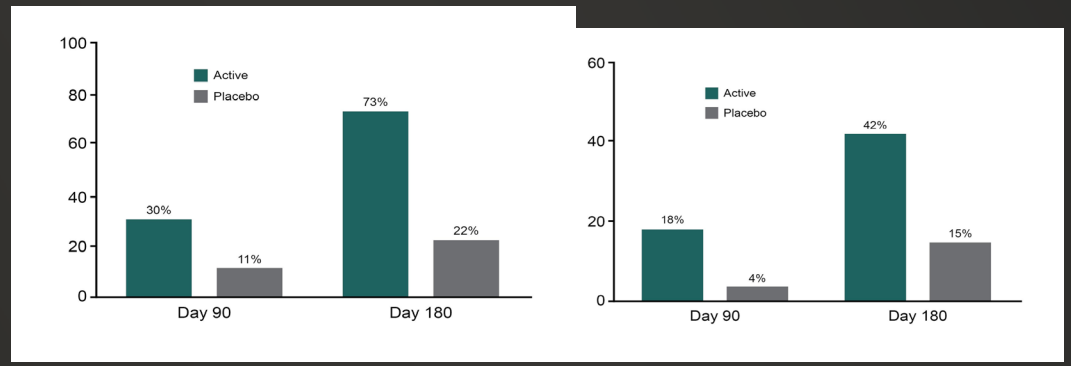


* P<0.01; **P<0.05; ***P<0.01.



62 year old, post-menopausal asian women

Secondary Endpoints
Blinded physician assessment of global photographs for hair quantity & quality



Statistically significant and progressive improvement for the active compared to the placebo across visits on both Growth and Quality scales (all) ps<0.05)

Clinical Results on Nutraceutical Complex Plus

In a study of 30 women with self-perceived hair thinning in peri-, during, and post-menopause, daily administration resulted in:

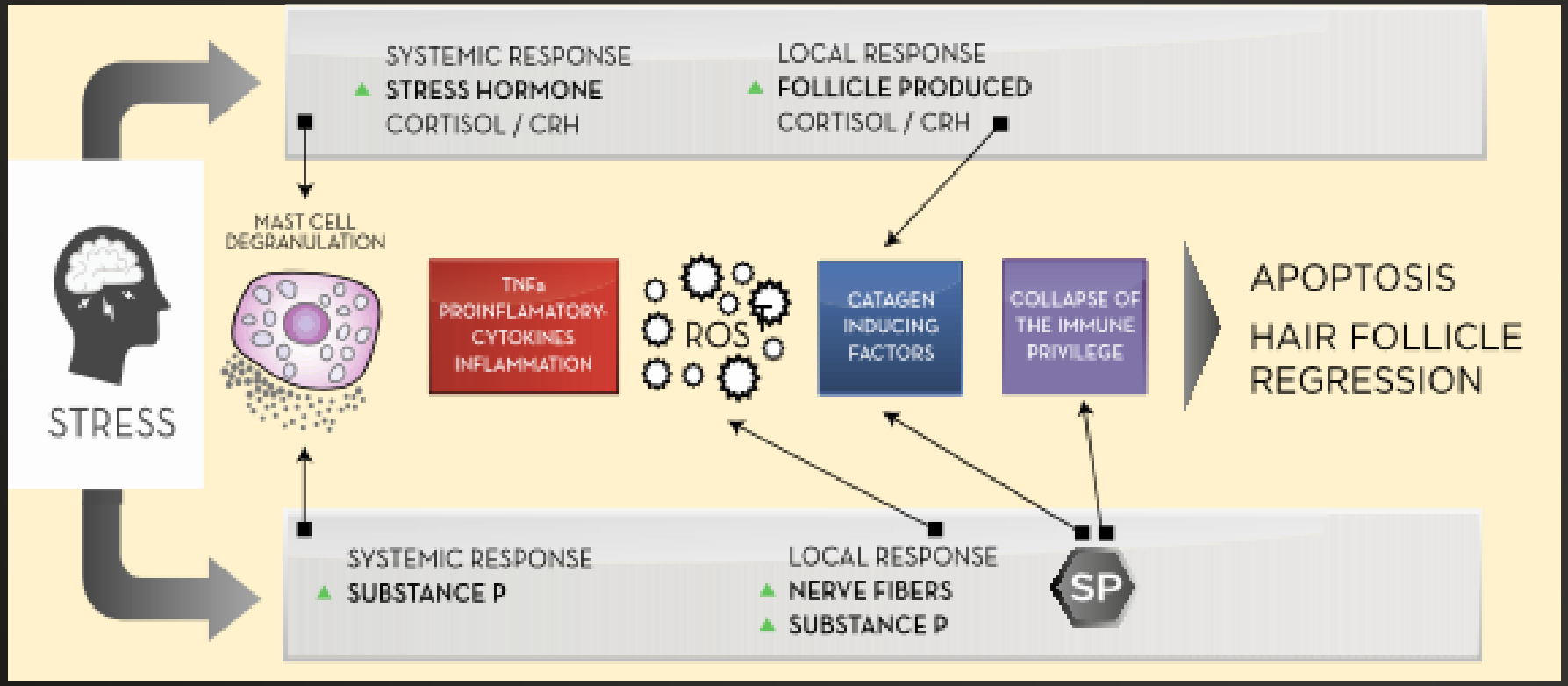
- **73% seeing more scalp coverage** by 6 months, increasing to **80% by 9 months**
- **73% seeing less shedding** by 6 months, increasing to **90% by 9 months**
- **80% seeing new hair growth** by 6 months, increasing to **93% by 9 months**
- **90% percent reporting improvement in texture by 9 months**

A 6-month, randomized, double-blind, placebo-controlled study ***evaluating the ability and safety of a nutraceutical supplement with standardized botanicals to promote hair growth in perimenopausal, menopausal and post-menopausal women with self-perceived thinning hair***; with 6-month open label extension:

- 70 women >45 years of age, with symptoms of peri-, during and post menopause + hair thinning
- New formulation with botanical rebalancing hormone-sensitizers
- *Interim (double-blind, placebo-controlled, randomized) 6-month results – currently underway*

Stress Directly Inhibits Hair Growth

Neuro-immunomodulatory Pathway



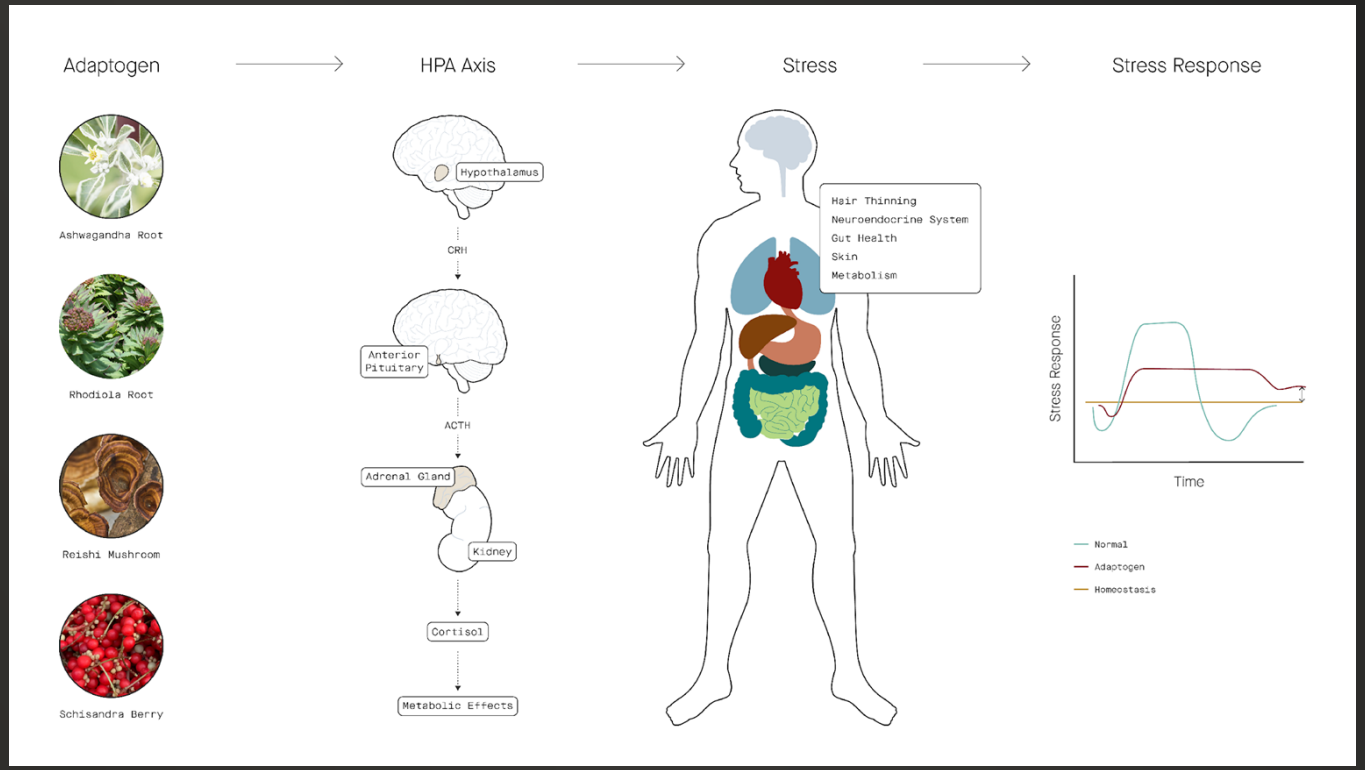
Neurogenic Pathway

Overall, cortisol, CRH, SP result in degranulation of local mast cells, release of pro-inflammatory mediators (TNF-α), inflammation, ROS injury and collapse of the follicle immune privilege – leading to early catagen, hair growth arrest, apoptosis and regression

Botanical Stress Adaptogens used to target stress as a cause of hair thinning

Definition

- Adaptogen (Latin & Greek) "adaptare", meaning to adjust or fit and "gen", meaning produced or generated by
- Class of natural substances derived from plants and mushrooms
- Increase organism's ability to adapt and build resilience to stress
- Recognized by the FDA



Mechanism of Action

- Enhanced resistance of human body against external stimuli
- Balance the HPA axis
- Maintain or recover homeostasis/allostasis
- Promote anabolic recovery
- Regulate energy by improving function of neuroendocrine system

Robin, K.P. et al. (2017). Biomed Pharmacother. 2017;95:1815-1829.
Winslow L.C., Kroll D.J. (1998) Arch Intern Med. 158(20):2192–2199.
Liao, L. et al. (2018) Chin Med. 13:57.
Chandrasekhar, K., et al (2012). Indian journal of psychological medicine, 34(3), 255

Stress Adaptogen Nutraceutical Booster for extra stress(ful times):

Indications:

For patients suffering from hair thinning or sudden shedding due to moderate to severe stress

To be paired with Patented Core Nutraceutical Complex with Standardized Botanical formulations for men, women and women in menopausal transition.

Key Ingredients

Rhodiola rosea

Clinically shown to balance cortisol by toning the HPA axis and modulating pathways involved in glucocorticoid resistance.[1-2]

Reishi mushroom

Clinically shown to increase antioxidants and lower stress induced reactive oxygen species (ROS).[3-4]

Schisandra chinensis

Has adrenal protective mechanisms that help target the negative effects of stress by balancing immune cytokines known to induce catagen. Shown to support anagen progression and hair fiber length in preclinical studies.[5]

Benefits

Targets root causes – This hair-focused adaptogenic formula supports the stress response, a key pathway that plays a role in compromised hair growth.[1]

Cortisol balance – Adaptogens tone the HPA axis to balance levels of cortisol secreted from the adrenal glands.[1]

Counters oxidative stress – Adaptogens have antioxidant properties that defend against oxidative damage caused by stress.[6]

Immune system-modulation – Adaptogens helps support the body's immune response to stress.[7]

1.Anghelescu I-G, Edwards D, Seifritz E, Kasper S. Stress Management and the Role of Rhodiola rosea: a review. International Journal of Psychiatry in Clinical Practice. 2018.

2.Panossian A, Wikman G, Sarris J. Rosenroot (Rhodiola rosea): traditional use, chemical composition, pharmacology and clinical efficacy. Phytomedicine. 2010;17(7):481-493.

3. Wang J, Cao B, Zhao H, Feng J. Emerging Roles of Ganoderma Lucidum in Anti-Aging. Aging and disease. 2017;8(6):691-707.

4.Bhardwaj N, Katyal P, Sharma AK. Suppression of inflammatory and allergic responses by pharmacologically potent fungus Ganoderma lucidum. Recent Pat Inflamm Allergy Drug Discov. 2014;8(2):104-117.

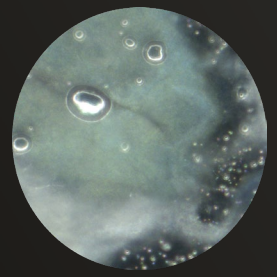
5.Kang JI, Kim SC, Hyun JH, et al. Promotion effect of Schisandra nigra on the growth of hair. Eur J Dermatol. 2009;19:119ß125.

6. Wang J, Cao B, Zhao H, Feng J. Emerging Roles of Ganoderma Lucidum in Anti-Aging. Aging and disease. 2017;8(6):691-707.

7. Robin, K.P., Mankanjuola, V.O., Arora, R., et al. (2017). Immunopotentiating significance of conventionally used plant adaptogens as modulators in biochemical and molecular signalling pathways in cell mediated processes Biomed Pharmacother. 2017;95:1815-1829

Professional-Strength Probiotic Formula for Hair

Bacteriophage Prebiotic



Probiotic Blend

Acid-Resistant Capsule

Formulated with clinically-tested probiotic strains, chosen to diversify the gut microbiome to support increased nutraceutical efficacy, help the body improve the gut lining and nutrient absorption, support a healthy immune response and strengthen the gut-hair axis.

Hair probiotic formulation contains 25 billion CFUs of 10 probiotic strains of three different types and one innovative bacteriophage prebiotic.

Lactobacillus strains
Needed for healthy pH levels in the gut

Balanced pH in the body is reflected in improved health, healthy scalp and proper growth

Bifidobacterium strains
Generate short chain fatty acids

Promote healthy gut immune function and nutrient absorption needed for healthy hair growth

Bacillus strains
High stability &are protective against stomach acid

Travel lower into the intestine where they support the colonization of beneficial bacteria

Bacteriophage works to target and destroy undesirable commensal bacteria which release their cellular components for beneficial bacteria to consume and grow

Professional-Strength Hair Booster Formulation for Extra Stress

Formulation contains four clinically effective standardized stress adaptogens that have been shown to improve the stress response, reduce oxidative damage and immune reactivity, which directly impact the hair growth cycle. The ingredients support stress-resilience for those with extra stress and excess shedding, countering mental, physical and metabolic stressors by holistically supporting adaptation in the HPA axis and its feedback loops.

Rhodiola

Bacopa

(***Upstream***)
Targets upstream receptors triggered during stress

Holy Basil

(***Midstream***)
Targets CRH and cortisol

Ashwagandha

(***Downstream***)
Targets Cortisol. Shown to have **dose-dependent decrease in cortisol and stress relieving benefits** when combined with Nutraceutical with Standardized Botanicals for Hair.

Standardized Nutraceutical Adaptogenic Ingredients have been shown to:

- Tone the HPA axis by balancing stress hormones
- Improve feelings of stress, including mental fatigue and general well-being
- Support the immune system triggered by stress

Auddy B. J ANA. 2008.
Spasov A. Phytomedicine. 2000.
Mondal S. J Ethnopharmacology. 2011.
Nemetchek. M. J. Ethnopharmacology. 2017.
Choudary G.. Int. J Parma &BioScience. 2010.

Surgical Hair Restoration - 2023

History of Hair Restoration

- The first documented hair restoration case dates back to 1822 in Germany with modern hair restoration, using skin grafts, starting in the late 1930's.
- The punch technique dominated the 1960's, resulting in the popular term "hair plugs" (groupings of 10-20 hairs).
- The problem with all the previous techniques is they frequently led to unnatural appearing results.
- Beginning in the late 1980's and early 1990's follicular unit harvesting from strip graft donor sites became the dominant technique. The major potential downside is donor site scarring.
- The game changer was the use of follicular units (1-3 grafts).
- Follicular units are how human hair naturally grows.
- FUE consists of harvesting grafts using miniaturized punches (.9 to 1.0 mm).

A Brief History

Aesthetic Impact

Hair restoration has a major impact on facial aesthetics.
For example…

Hair Loss - 2023

- Hair plays an important role in identity, self-perception, and psychological functioning
- Hair loss can be devastating experience that decreases self-esteem and feelings of personal attractiveness while also leading to depression and anxiety
- New treatments exist that are changing the landscape for both patients and providers alike