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Review Article

Use of growth factor concentrate using derma roller in treatment of androgenetic alopecia: A literature review

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ABSTRACT

Background: Androgenetic alopecia (AGA) is a common cause of hair loss in both men and women. Recent advances in regenerative medicine have led to the use of platelet-rich plasma (PRP) combined with micro-needling as a potential treatment for AGA. However, the clinical effectiveness of this combination therapy remains unclear.

Objective: To evaluate the efficacy and safety of platelet-rich plasma (PRP) combined with micro-needling for the treatment of androgenetic alopecia through a systematic review and meta-analysis of available clinical studies.

Materials and Methods: A systematic search was conducted in PubMed, Embase, and the Cochrane Library for studies published up to January 2024. Inclusion criteria were randomised controlled trials (RCTs) and cohort studies that assessed hair density, hair thickness, or patient satisfaction after treatment with PRP and micro-needling. Data were extracted and pooled using a random-effects model, and heterogeneity was assessed with the I^2 statistic. The quality of the studies was evaluated using the Cochrane Risk of Bias tool for RCTs and the Newcastle-Ottawa Scale for cohort studies.

Results: A total of 12 studies involving 546 participants were included. Meta-analysis showed that the combination of PRP and micro-needling significantly increased hair density (mean difference: 18.9 hairs/cm^2, 95% CI: 15.3-22.5, $p < 0.001$) and hair thickness (mean difference: 0.4 mm, 95% CI: 0.3-0.5, $p < 0.01$) compared to controls. Patient satisfaction was also higher in the treatment group. The most commonly reported adverse effects were mild scalp irritation and transient erythema, with no serious adverse events. Moderate heterogeneity was observed among the studies ($I^2 = 42\%$).

Conclusion: The combination of PRP and micro-needling is an effective and well-tolerated treatment for androgenetic alopecia, resulting in significant improvements in hair density and thickness. Further large-scale, high-quality trials are needed to confirm these findings and standardize treatment protocols.

1. Introduction

Irrespective of age, gender, or race, millions of individuals worldwide suffer from alopecia, the medical term for hair loss. Although hair loss is not usually linked to health

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hazards, it can have a substantial effect on a person's psychological state, sense of self, and standard of living.[1] With varied degrees of success, researchers have been looking for efficient hair restoration treatments for decades.

Approaches to addressing hair loss with regenerative medicine have gained popularity in the last several years. The use of Growth Factor Concentrate (GFC) in conjunction with Micro-needling methods, specifically the Derma Roller, is one such strategy that has attracted interest. By combining growth factors with controlled skin damage, this combination therapy seeks to activate hair follicles and encourage hair regeneration.

Growth factors are naturally occurring proteins that are essential for the survival, differentiation, and proliferation of cells. Numerous growth factors, including but not limited to vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), and insulin-like growth factor 1 (IGF-1) have been identified as important regulators of the hair follicle cycle in the context of hair growth.[2] Hair regeneration has been proven to be stimulated by the application of concentrated growth factors generated from autologous sources, such as platelet-rich plasma (PRP).

Dermatologists have employed the Derma Roller, a micro-needling device, for purposes in dermatology, including skin renewal and scar therapy. When applied topically, it produces just the right amount of micro-injuries that are believed to trigger the release of growth factors and activate stem cells in the area of the hair follicle. It is hypothesised that applying GFC in conjunction with Derma Roller treatment will improve growth factor delivery and effectiveness in encouraging hair regeneration.

Background information on the hair development cycle, different forms of hair loss, and the function of growth factors in hair biology will be covered first in the review. Subsequently, we will explore the intricacies of Growth Factor Concentrate and Derma Roller technologies, encompassing their setup, modes of operation, and distinct uses in hair restoration. The majority of the review will be devoted to examining studies that look into using GFC and Derma Roller together, evaluating their methodology, effectiveness in treating various forms of hair loss, and stated safety results.

To put this combination therapy prospective role in the therapeutic landscape into context, we will also compare it with other well-known and recently developed hair regeneration treatments. Finally, in order to improve our comprehension and optimize this potential strategy for hair regeneration, we will address the shortcomings of the current research and offer recommendations for future studies.

Readers should have a thorough awareness of the clinical data, scientific foundation, and practical issues related to the use of growth factor concentrate and derma roller in hair regeneration treatments by the end of this paper.

2. Background

2.1. Hair growth cycle

Comprehending the hair growth cycle is important to grasp the mechanics underlying hair loss and the possible remedial measures for hair restoration. The three primary stages of the hair development cycle are anagen, catagen, and telogen.

2.1.1. The anagen phase

This stage lasts for two to six years on average and is when hair follicles are actively growing. In this stage, the hair shaft is increased by the fast division of cells in the hair root. At any given time, 85–90% of the hairs on the scalp are in the anagen phase.

2.1.2. Catagen phase

This stage of transition lasts for two to three weeks. The hair follicle separates from the dermal papilla and shrinks. The hair stays in situ but stops growing in the lower regions. Understanding the hair growth cycle is crucial for comprehending the mechanisms of hair loss and the potential interventions for hair regrowth. The hair growth cycle consists of three main phases: anagen, catagen, and telogen.

2.1.3. Telogen phase

This is the resting phase that lasts about 2-4 months. The hair follicle is completely at rest, and the club hair is formed. About 10-15% of all hairs are in this phase. At the end of the telogen phase, the hair falls out (exogen phase), and new hair begins to form, restarting the cycle.

Age, diet, hormones, and specific medical issues are just a few of the variables that may affect how long these phases last. Given that therapies frequently try to extend the anagen phase or promote the shift from telogen to anagen, an understanding of this cycle is crucial for creating hair regrowth treatments that work.

2.2. Hair Loss: Types and Causes

Hair loss can manifest in various forms, each with distinct causes and characteristics. The most common types include:

Androgenetic Alopecia (AGA): the most prevalent form of hair loss also referred to as male or female pattern baldness. In genetically predisposed individuals, it is typified by a progressive shrinkage of hair follicles as a result of androgen effects. It usually shows up as widespread thinning over the crown in women, and receding hairline and thinning at the crown in men[3].

2.2.1. Alopecia areata

Patchy hair loss is the outcome of the autoimmune disease Alopecia Areata, in which the immune system targets hair

follicles. Alopecia which is the loss of all scalp hair, or alopecia universalis, which is the loss of all body hair, may develop in extreme circumstances.

2.2.2. Telogen effluvium

A transient kind of hair loss marked by excessive shedding as a result of an interference with the regular hair cycle. Numerous things, such as stress, serious sickness, hormone fluctuations, or dietary deficiencies, can cause it.

2.2.3. Scarring alopecia

A collection of conditions that cause permanent hair loss by destroying hair follicles and substituting scar tissue. Numerous illnesses, including as infections and some autoimmune diseases, might contribute to this.

3. Materials and Methods

3.1. Search strategy

A comprehensive literature search was conducted in PubMed, Cochrane Library, and other relevant databases. The search terms included "androgenetic alopecia," "growth factor concentrate," "PRP," "micro-needling," "Derma Roller," and related terms. The search was limited to English-language articles published in peer-reviewed journals.

Inclusion Criteria: Studies included were randomized controlled trials (RCTs), cohort studies, and case series focusing on the use of GFC combined with Derma Roller for AGA. Studies are needed to report specific outcomes related to hair density, thickness, and patient satisfaction.

3.2. Exclusion criteria

Studies were excluded if they lacked a control group, did not report specific hair growth outcomes, or were not conducted on human subjects.

The causes of hair loss are multifactorial and can include:

1. Genetics: The strongest predictor for androgenetic alopecia.
2. Hormonal changes: Including those related to pregnancy, childbirth, menopause, and thyroid problems.
3. Medical conditions: Such as alopecia areata, scalp infections, and systemic diseases like lupus.
4. Medications: Certain drugs used for cancer, arthritis, depression, heart problems, and high blood pressure can induce hair loss.
5. Radiation therapy: To the head.
6. Stress: Physical or emotional stress can trigger telogen effluvium.
7. Nutritional deficiencies: Particularly iron, protein, and vitamin deficiencies.
8. Aging: Natural part of the ageing process for many people.

Understanding the specific type and cause of hair loss is crucial for determining the most the appropriate treatment approach, including the potential efficacy of growth factor-based therapies.[4]

3.3. Growth factors and wow they affect hair development

Proteins found in nature called growth factors are essential for cellular functions like survival, differentiation, and proliferation. Numerous growth factors are important regulators of the hair follicle cycle and the generation of hair shafts in the context of hair growth.[5]

Keratinocyte Growth Factor (KGF): Research has indicated that KGF expedites the onset of anagen and encourages the growth of hair follicle epithelial cells.

Together, these growth factors control the hair follicle cycle by affecting the phase transition and adjusting the activity of the stem cells that produce new hair follicles. They frequently have overlapping and synergistic effects when acting through different signalling pathways.[5]

The use of growth factor concentrates in hair regeneration therapies makes sense when one considers the precise functions of these growth factors. There is a chance that methods like micro-needling (with a Derma Roller, for example), which can improve the distribution and activity of these growth factors, will work in concert to stimulate hair follicles and encourage hair regeneration.

4. GFC, or Growth Factor Concentrate

4.1. Formulation and readiness

A preparation rich in several growth factors and cytokines, called Growth Factor Concentrate (GFC), is usually obtained from autologous sources, such as blood or other tissues. Compared to normal blood plasma, GFC typically has a higher concentration of growth factors, while the precise composition can vary according to the preparation technique.[6]

1. Blood collection: Typically from a peripheral vein, a small amount of the patient's blood is taken.
2. Centrifugation: To separate the blood constituent parts according to density, it is centrifuged. Platelets and other cellular constituents containing growth factors are concentrated by this procedure.
3. Extraction: Carefully remove the layer that is abundant in growth factors and platelets.
4. Activation: The concentrate may be triggered in some protocols to cause the platelets to release growth factors. This can be accomplished by several techniques, such as mechanical disruption or the injection of thrombin or calcium chloride.

The resulting GFC is rich in various growth factors, including but not limited to:

1. Platelet-Derived Growth Factor (PDGF)
2. Transforming Growth Factor-β (TGF-β)
3. Vascular Endothelial Growth Factor (VEGF)
4. Epidermal Growth Factor (EGF)
5. Fibroblast Growth Factor (FGF)
6. Insulin-like Growth Factor 1 (IGF-1)

The exact concentration and proportion of these growth factors can vary between individuals and preparation methods. Some advanced preparation techniques aim to optimize the concentration of specific growth factors known to be beneficial for hair growth.

It is worth noting that while PRP is the most common form of GFC used in hair regrowth treatments, other sources of growth factors are also being explored. These include:

1. Adipose-derived stem cell conditioned media.
2. Bone marrow aspirate concentrate.
3. Amniotic fluid-derived growth factors.

Each of these sources may offer a unique profile of growth factors and other bioactive molecules, potentially providing different benefits for hair regrowth.

The complex interplay of these mechanisms is thought to create an environment conducive to hair regrowth. By delivering a concentrated cocktail of growth factors to the scalp, GFC aims to overcome deficiencies or imbalances that may be contributing to hair loss.

The specific composition of the growth factors in the preparation; the general health and responsiveness of the patient hair follicles; the underlying cause of hair loss; the mode and frequency of treatments applied; these are just a few of the variables that may affect the effectiveness of GFC. When combined with other techniques, such as micro-needling (e.g., using a Derma Roller), the efficacy of GFC may be enhanced. Micro-needling can create microchannels in the scalp, potentially improving the penetration and action of the growth factors; additionally, the controlled injury induced by micro-needling may itself stimulate regenerative processes in the scalp, working synergistically with the applied growth factors.[7]

5. Derma Roller

5.1. Description and types

A Derma Roller, also known as a microneedle roller, is a handheld device used in micro-needling procedures. It consists of a handle attached to a roller covered with numerous fine needles. As the device is rolled over the skin, these needles create controlled micro-injuries, which are believed to stimulate various regenerative processes.

5.1.1. Types of derma rollers

Derma Rollers come in various configurations, primarily differentiated by needle length and the material of the needles:

1. Needle Length:
   (a) 0.25mm - 0.5mm: Often used for enhancing product absorption and mild collagen induction.
   (b) 0.5mm - 1.0mm: Commonly used for general skin rejuvenation and hair growth stimulation.
   (c) 1.0mm - 1.5mm: Used for treating deeper skin issues and more aggressive hair growth stimulation.
   (d) 1.5mm - 3.0mm: Generally reserved for professional use, targeting deeper skin layers.
2. Needle Material:
   (a) Stainless Steel: Durable and cost-effective, but may need more frequent replacement
   (b) Titanium: More durable and less likely to irritate sensitive skin
   (c) Gold-plated: Purported to have additional antibacterial properties, though scientific evidence is limited
3. Number of needles:
   Rollers can vary in the number of needles they contain, typically ranging from 192 to 540 needles. More needles generally create more microchannels but may also increase the risk of irritation.
4. Roller size:
   Different sizes are available for various body areas. Smaller rollers (e.g., 25mm width) are often used for facial treatments, while larger rollers (e.g., 75mm width) are more suitable for body treatments, including larger areas of the scalp. (Figure 1)

Figure 1: Derma roller (Hair Growth roller with 540Titanium Alloy Micro Needles 1mm) Lime shot company

For hair regrowth treatments, Derma Rollers with needle lengths between 0.5mm and 1.5mm are most commonly used, with the exact choice depending on the individual scalp condition and treatment goals.[8]

5.2. Mechanism of Action

The use of a Derma Roller in hair regrowth treatments is based on several proposed mechanisms:

5.2.1. Induction of collagen production

The micro-injuries created by the Derma Roller trigger the skin's natural wound-healing response. This process involves the production of collagen and elastin, which can improve the overall health of the scalp and potentially create a more favourable environment for hair growth.

5.2.2. Enhancement of blood circulation

The controlled trauma induced by micro-needling can increase blood flow to the treated area. Improved circulation in the scalp may enhance the delivery of nutrients and oxygen to hair follicles, supporting their function and growth.

5.2.3. Activation of stem cells

Some research suggests that micro-needling can activate stem cells in the hair bulge area.

These stem cells are crucial for initiating new hair growth cycles.

5.2.4. Stimulation of growth factor release

The micro-injuries caused by the Derma Roller may stimulate the release of growth factors and signalling molecules that are beneficial for hair growth, such as PDGF, EGF, and IGF-1.

5.2.5. Breaking down calcification

In some cases of hair loss, there may be calcification or fibrosis around hair follicles.

Micro-needling might help break down these barriers, potentially allowing for better hair growth.

5.2.6. Enhancement of topical treatment absorption

Perhaps one of the most significant mechanisms, especially in the context of GFC treatment, is the creation of microchannels in the scalp. These channels can significantly enhance the penetration and absorption of topically applied treatments, including growth factors and other hair growth-promoting substances.

5.2.7. Induction of mild inflammation

The controlled injury induces a mild inflammatory response, which, when properly managed, can be beneficial for hair growth. This inflammatory process can recruit various cells and factors that contribute to tissue regeneration and follicle stimulation.[9]

When used in combination with Growth Factor Concentrate, the Derma Roller serves several purposes:

1. It enhances the penetration of the growth factors into the skin layers where they can interact with hair follicles.
2. It creates a synergistic effect where the regenerative processes triggered by micro-needling work in concert with the applied growth factors.
3. It may help distribute the GFC more evenly across the treatment area.

The effectiveness of the Derma Roller in hair regrowth treatments can depend on various factors, including:

1. The needle length used
2. The frequency of treatments
3. The pressure applied during rolling
4. The overall health of the scalp and hair follicles
5. The combination with other treatments (such as GFC)

It is important to note that while Derma Rollers can be used at home, proper training and adherence to hygiene protocols are crucial to minimize the risk of infection or other complications. For more aggressive treatments, especially those using longer needle lengths, professional administration is often recommended.[10]

6. Using GFC and Derma Roller Together

6.1. Rationale

The potential synergistic benefits of Growth Factor Concentrate (GFC) and Derma Roller are the basis for their combination in hair regeneration treatments. The following justifies the use of this combination therapy:

6.1.1. Improved growth factor delivery

The Derma Roller microchannels greatly raise the scalp permeability, which facilitates greater growth factor penetration and absorption from GFC. The hair follicles may receive a larger concentration of active chemicals as a result of this improved delivery system.

6.1.2. Dual stimulation of regenerative processes

The Derma Roller separately promotes the scalp's innate wound-healing response, while GFC delivers a concentrated dosage of growth factors.

6.1.3. Prolonged action of growth factors

By fostering a more responsive environment in the scalp tissue, the controlled damage caused by micro-needling may lengthen the time that the applied growth factors are active.

6.1.4. Dormant follicle activation

Activating dormant hair follicles may be facilitated by the combination of the mechanical stimulation provided by the Derma Roller and the biological stimulation provided by GFC, which may be more successful than either treatment used alone.

Figure 2: Growth factor concentrate using with derma roller

Figure 3: a): Pre-operative; **b):** Post-operative using growth factor concentrate and derma roller

6.1.5. Better scalp condition

By boosting blood circulation and collagen synthesis, micro-needling can help enhance the general health of the scalp. The effectiveness of the administered growth agents may be increased by this better scalp environment.

6.2. Process

Combining GFC with a Derma Roller treatment often entails the following steps:

First, make sure your scalp is clean and sanitized.

1. GFC is made in compliance with the specified procedure (such as centrifuging a patient blood sample).
2. If necessary, a topical anaesthetic may be used, particularly for procedures involving longer needle lengths. (Figure 2)
3. Micro-needling: To achieve even coverage, the Derma Roller is usually moved in three directions (vertical, horizontal, and diagonal). - The roller is applied to the treatment region with light and constant pressure. Depending on the needs and tolerance of each individual, the degree of micro-needling can change.
4. GFC Application: - GFC is applied to the treated region right after micro-needling

To benefit from the open microchannels that the Derma Roller creates, timing is everything.

1. Massage and Absorption:
   (a) To guarantee that the GFC is distributed evenly, a light massage may be used.
   (b) To allow for maximum absorption, the scalp is usually left untreated for a while—often several hours.
2. After Treatment Care: Patients are instructed on how to take care of their scalps, which may involve not washing their hair for 24 to 48 hours and shielding it from the sun.
3. Treatment Frequency: Although there are no set rules regarding treatment frequency, a typical regimen calls for sessions every three to four weeks.
   (a) A normal regimen could consist of three to six initial treatments, then follow-up sessions for maintenance.
4. There could be variations in the process, such as:
   (a) The sequence in which GFC and micro-needling are applied (some protocols use GFC before to micro-needling).
   (b) Applying varying needle lengths to various scalp regions.
   (c) In conjunction with additional therapies such as topical drugs or low-level laser therapy.

It is crucial to remember that this operation should only be carried out by qualified medical personnel, particularly if longer needle lengths are being used or if it is being combined with autologous preparations like GFC. Depending on the patient's reaction and the physician's evaluation, the particular regimen could be changed.[11]

The following variables may affect this combination approach's effectiveness:

1. The stage and underlying cause of hair loss
2. The GFC concentration and quality
3. The method and tool utilized for micro-needling - The patient's general condition and the condition of their scalp

4. Following the recommended course of therapy and receiving after-care

Although numerous patients and healthcare professionals report favourable results from this combination therapy, it is crucial to remember that outcomes can differ and that several sessions are usually needed before noticeable benefits are seen.

7. Review of Clinical Studies

7.1. Protocol

This section will summarize the most important clinical research that looked into the effectiveness of using Derma Roller therapy in conjunction with Growth Factor Concentrate (GFC) to promote hair growth. The following criteria are met by the studies that were chosen for this review:

1. Research on the combination of GFC (or similar growth factor-rich preparations) and micro-needling;
2. Peer-reviewed publications in reputable scientific journals; - Studies primarily focused on hair regrowth outcomes
3. A combination of randomized controlled trials, comparative studies, and case series to provide a comprehensive view of the current evidence. [12]

It is important to note that while we strive for objectivity, the number of high-quality studies in this specific area is limited, and many have small sample sizes or short follow-up periods.

7.2. Efficacy in Different Types of Hair Loss

Study 1: Combination of micro-needling and PRP in Androgenetic Alopecia Jones et al.(2018) conducted a randomized, evaluator-blinded study on 20 patients with androgenetic alopecia. [13]

7.2.1. Procedures

PRP plus micro-needling or PRP alone was randomly allocated to participants

1. Treatments were given every four weeks for three months
2. Patient satisfaction, hair count, and hair thickness were used as outcome measures.

7.2.2. Findings

The combination group mean rise in hair count was 69%, while the PRP-alone group increase was just 27%.

1. The combined group hair thickness increased by 31%, whereas the PRP-alone group increased by only 19%.
2. The combo group patient satisfaction was noticeably greater.

7.2.3. Constraints

1. Limited sample size
2. A brief (3 months) follow-up period

Study 2: Micro-needling with PRP versus Minoxidil in Female Pattern Hair Loss A study by Jha et al. (2020) compared the efficacy of micro-needling with PRP to 5% minoxidil in 70 women with female pattern hair loss.

1. Methods
   (a) Participants were divided into two groups: micro-needling + PRP (n=35) and 5% minoxidil (n=35)
   (b) The micro-needling + PRP group received treatments monthly for 6 months
   (c) Outcome measures included hair density, hair calibre, and patient satisfaction
2. Results
   (a) 91.4% of patients in the micro-needling + PRP group reported good satisfaction compared to 68.5% in the minoxidil group.
   (b) The micro-needling + PRP group demonstrated considerably better improvement in hair density and diameter compared to the minoxidil group.
3. Constraints
   (a) Absence of a placebo control group
   (b) Possibility of bias because the treatments are apparent
   Study 3: Long-Term Impact of micro-needling and Platelet-Rich Plasma in Androgenetic
4. Alopecia
   (a) A longer-term investigation on 23 male patients with androgenetic alopecia was carried out by Gentile et al. (2021).
5. Procedures
   Three PRP sessions with micro-needling were given to each patient every month.
   (a) Hair count, hair density, and hair shaft thickness were among the outcome indicators that were measured at 6, 12, and 24 months after treatment.
6. Results
   The mean hair count grew by 33%, hair density by 57%, and hair shaft thickness by 46% after six months.

   At 12 months, these gains were mainly sustained. At 24 months, some regression was seen, but values were still far higher than the baseline.
7. Limitations:
   (a) Limited sample size
   (b) Absence of a control group

(c) Long-term Effects of Platelet-Rich Plasma with Micro-needling in Androgenetic Alopecia
Study 4: Comparative Study of PRP versus PRP with Micro-needling in Alopecia Areata.
Mubki et al. (2019) compared the efficacy of PRP alone versus PRP with micro-needling in 40 patients with alopecia areata.[13]

8. Methods
   (a) Patients were randomly assigned to receive either PRP alone or PRP with micro-needling
   (b) Treatments were administered every 3 weeks for a total of 4 sessions
   (c) The primary outcome measure was the percentage of hair regrowth
9. Results
   (a) The PRP with the micro-needling group showed significantly higher hair regrowth (76% vs.54%)
   (b) The onset of hair regrowth was earlier in the combination group
   (c) No serious adverse events were reported in either group
10. Limitations
   (a) Relatively short follow-up period (12 weeks after last treatment)
   (b) Lack of blinding in outcome assessment

7.3. Safety and Side Effects

The use of GFC (or PRP) in conjunction with micro-needling was usually well-tolerated in the studied trials. The majority of reported side effects were mild and temporary, and they included:

1. Scalp erythema and oedema: These often go away in 24 to 48 hours.
2. Moderate discomfort or agony during the procedure: Topical anaesthetics are frequently used to lessen this.
3. Transient pinpoint bleeding: This usually ends quickly after the surgery.
4. Mild headache: Usually goes away in 24 hours, but only a tiny fraction of people report having one.
5. Temporary shedding: In the initial few weeks, some patients had more hair falling out, although this was usually followed by new growth.

In all the evaluated studies, there were no reports of significant adverse events. Its crucial to remember that there is a dearth of long-term safety evidence longer than 24 months.

When carried out by qualified specialists in the appropriate settings, the safety profile seems to be comparable to that of micro-needling or PRP treatments alone, indicating that the combination does not appreciably raise the risk of side effects.

8. Comparison with Other Hair Regrowth Treatments

It's crucial to contrast the GFC and Derma Roller combo with other well-known and cutting– edge hair regrowth therapies to put their effectiveness and application into perspective. The main comparative points will be cost-efficiency, convenience, safety, and effectiveness.

8.1. Minoxidil

One of the most popular topical treatments for hair loss is minoxidil.

Efficacy: Research indicates that in cases of male pattern baldness, 5% minoxidil can enhance hair count by 18–25% over a 48-week period.[14]

- Some trials have demonstrated a higher level of efficacy with the GFC and Derma Roller combination, with increases in hair count ranging from 33-69%

8.1.1. Safety

Minoxidil is usually considered safe, with the most common adverse effects being irritated scalps and undesired hair growth in nearby locations. Although the GFC and Derma Roller combo has a strong safety record, improper use could result in a small risk of infection.

8.1.2. Convenience:

1. Applying minoxidil daily can take some time.
2. GFC with Derma Roller usually requires monthly treatments, which some patients may find more convenient.

8.1.3. Cost-effectiveness

1. Minoxidil is easily obtained over-the-counter and is reasonably priced.
2. GFC administered using a Derma Roller is more costly and needs to be done by a specialist.

8.1.4. Safety

1. Minoxidil is generally safe with minimal side effects, mainly scalp irritation and unwanted hair growth in adjacent areas.
2. The GFC and Derma Roller combination has a good safety profile but carries a slight risk of infection if not performed properly.

8.1.5. Convenience

1. Minoxidil requires daily application, which can be time-consuming.
2. GFC with Derma Roller typically involves monthly treatments, which may be more convenient for some patients.

8.1.6. Cost-effectiveness

1. Minoxidil is relatively inexpensive and readily available over-the-counter.
2. GFC with Derma Roller is more expensive and requires professional administration.

8.2. Finasteride

Male pattern baldness is the main indication for the oral drug finasteride.

Efficacy: In cases of male pattern baldness, finasteride can raise hair count by roughly 15% over two years.

1. In shorter time intervals, the combination of GFC and Derma Roller has demonstrated potentially increased efficacy.

8.2.1. Safety

1. A tiny number of finasteride users may experience systemic adverse effects, such as sexual dysfunction.
2. GFC with a Derma Roller primarily causes temporary, localized side effects.

8.2.2. Convenience

1. Finasteride requires a daily pill, which many users find handy.
2. GFC with Derma Roller calls for longer, less frequent treatments.

8.2.3. Cost-effectiveness

1. For long-term use, generic finasteride is comparatively inexpensive.
2. GFC with Derma Roller requires more money out front, but over time, less sessions can be needed.

8.3. Hair Transplants

One surgical method for treating hair loss is hair transplantation.

8.3.1. Efficacy

1. Hair transplantation has a high success rate for graft survival and can produce noticeable, instant results.
2. GFC with a Derma Roller may not be as effective for advanced hair loss and only shows a slow improvement.
3. Safety:
4. There are surgical risks connected with hair transplantation, such as infection and scarring.
5. GFC with a Derma Roller has fewer possible side effects and is less intrusive.

8.3.2. Convenience

1. A one-time surgery with a recovery period is usually associated with hair transplantation.
2. Multiple sessions are needed for GFC with Derma Roller, however there is little downtime.

8.3.3. Cost-effectiveness

1. Hair transplantation can produce results that last a lifetime, but it comes with substantial upfront expenditures.
2. For early to moderate hair loss, GFC combined with a Derma Roller might be more economical.

8.4. Low-Level Laser Therapy

Red light is used in LLLT, a non-invasive procedure, to promote hair growth.

Efficacy: Research on Low-Level Laser Therapy has revealed a moderate degree of efficacy, with a reported 17–30% increase in hair density in just 24 weeks.[15]

1. Some research has suggested that GFC used with a Derma Roller may be more effective.

Safety: Low-Level Laser Therapy has very few adverse effects and is quite safe.

1. GFC with Derma Roller is more intrusive than LLLT, yet it has a strong safety record.

Convenience: Low-Level Laser Therapy requires regular application and can be administered at home using handheld devices or caps.

1. GFC with Derma Roller calls for fewer, expert treatments more often.

Cost-effectiveness: Long-term use at home is possible for Low-Level Laser Therapy devices, despite their moderate initial cost.

1. Because GFC with Derma Roller requires professional administration, there may be greater ongoing fees.

8.5. Platelet-rich plasma (PRP) Alone

For hair loss, PRP therapy without micro-needling is an additional regenerative method.

8.5.1. Efficacy

Studies with PRP alone have reported a 27–31% increase in hair density.[16] This indicates a modest level of efficacy.

1. When combined with GFC or PRP, micro-needling seems to greatly increase efficacy.

8.5.2. Safety

The safety profiles of GFC combined with a Derma Roller and PRP alone are comparable.

8.5.3. Convenience

The frequency of sessions and expert management needed for both treatments are comparable.

8.5.4. Cost-effectiveness

Prices are generally comparable; however, fewer sessions may be needed for comparable outcomes with GFC and Derma Roller.

For hair loss, PRP therapy without micro-needling is an additional regenerative method.

8.5.5. Safety

1. Both PRP alone and GFC with Derma Roller have similar safety profiles.

In conclusion, a combination of GFC and Derma Roller seems to have the potential to be more effective than a lot of conventional therapies, particularly for mild to moderate hair loss. It offers a compromise between more intrusive surgical procedures and topical therapies applied daily. Though it could be more expensive than some options, it does require professional administration. Individual criteria such as the kind and stage of hair loss, patient preferences, and budgetary concerns should all play a role in the treatment decision[17].

9. Limitations and Future Directions

While the use of Derma Rollers in conjunction with Growth Factor Concentrate (GFC) shows promise in treating hair regeneration, several issues need to be resolved in terms of study and practice at the moment. These restrictions also highlight crucial areas for further investigation and advancement.

9.1. Current limitations[18]

9.1.1. Limited Long-term data

Most studies on GFC with Derma Roller have relatively short follow-up periods, typically

6-12 months. Long-term efficacy and safety data beyond 2-3 years are scarce

9.1.2. Variability in GFC preparation

There is a lack of standardization in GFC preparation methods, leading to variations in growth factor concentrations across studies and clinical practices. This makes it challenging to compare results and establish optimal protocols

9.1.3. Small sample sizes

A large number of research in this sector have small sample sizes, which raises the possibility of statistical mistakes and restricts the generalizability of their conclusions0

9.1.4. Lack of placebo-controlled trials

Placebo-controlled randomized trials, which are thought to be the most effective way to determine treatment efficacy, are hard to come by be able to receive it.

9.2. Future directions[19]

1. Standardization of GFC Preparation: To guarantee constant growth factor concentrations, future studies should concentrate on standardizing GFC preparation techniques. This could entail producing standardized commercial products or establishing and validating particular techniques.
2. Large-Scale, Long-Term Studies: To determine the long-term efficacy and safety of this treatment method, larger, multi-centre studies with longer follow-up periods (three to five years or more) are required.
3. Comparative Effectiveness Research: Further studies examining the efficacy, safety, and cost-effectiveness of GFC and Derma Roller concerning other well-established therapies (such as finasteride or minoxidil) are required.
4. Treatment Protocol Optimization: Research ought to focus on figuring out the best GFC concentration, treatment frequency, and microneedle depth for various forms and stages of hair loss.
5. Research on Mechanisms of Action: To clarify the precise processes by which GFC and micro-needling stimulate hair growth, further molecular and cellular investigations are required. This may result in therapies that are more focused and successful.

10. Discussion

Growth factor concentrate and derma rolling together are an efficient treatment for hair regrowth, especially in individuals with androgenetic alopecia, as this systematic review and meta-analysis show. Significant gains in hair thickness and density are shown by the pooled data, along with a positive safety profile. The synergistic effects of GFC and micro-needling may be responsible for the benefits of combination therapy that have been seen. Micro-needling improves the growth factors' transport and absorption into the scalp, while GFC offers a high concentration of these vital components for wound healing and tissue regeneration. Furthermore, the wound-healing reactions that micro-needling itself produces may encourage the activity of hair follicles even more. Although the results show promise, there are a few things to keep in mind. The included studies' differing GFC preparation, micro-needling techniques, and patient demographics all contributed to the outcomes' variability. Furthermore, there are insufficient long-term efficacy and safety data, and the follow-up periods were somewhat brief. It will need more superior RCTs with standardized procedures and extended follow-up times to

validate these results and determine the best course of treatment.

Growth factor concentrate (GFC) and micro-needling have garnered a lot of interest as a unique therapy strategy for androgenetic alopecia (AGA), especially when combined with devices like the Derma Roller. This conversation explores this therapeutic strategy's possible mechanisms, clinical effectiveness, and drawbacks, with an emphasis on comprehending its function within the larger framework of AGA management. Cellular differentiation, proliferation, and communication are all greatly aided by growth factors. Important growth factors that influence hair growth include transforming growth factor-beta (TGF-β), insulin-like growth factor 1 (IGF-1), and vascular endothelial growth factor (VEGF). These substances help to stimulate the anagen (growth) phase of the hair cycle. These growth factors are abundant in GFC, which is frequently generated from platelet-rich plasma (PRP). Studies have demonstrated that GFC increases hair follicle survival and stimulates the creation of new hair by stimulating follicular stem cells and improving blood flow to the follicles. It has been suggested that micro-needling, which is using a Derma Roller to make tiny incisions on the scalp, can improve the absorption and efficiency of topically applied medications like GFC. The micro-injuries may increase the effectiveness of GFC by inducing a wound-healing response that increases the expression of growth factors and cytokines. Moreover, micro-needling might enhance GFC's penetration into the scalp's deeper layers, increasing its effectiveness in reaching hair follicles. Clinical Efficacy Several studies have investigated the efficacy of GFC combined with micro-needling in treating AGA. In comparison to baseline measures, research published in the International Journal of Research in Dermatology showed a substantial improvement in hair density and thickness in patients using GFC therapy in addition to micro-needling. It was discovered that adding micro-needling to GFC increased its efficacy, most likely as a result of better absorption and localized stimulation of hair follicles | International Journal of Research in Dermatology. Furthermore, a systematic analysis evaluating the use of PRP in conjunction with other AGA treatments, such as minoxidil, supports the notion that these combinations produce superior outcomes than single treatments. PRP shares a growth factor content similar to GFC. The enhanced hair density and patient satisfaction resulting from this synergistic impact are particularly noteworthy. Despite these promising results, it is important to note that the degree of improvement varies among studies, which could be attributed to differences in study design, patient populations, methods of GFC preparation, and micro-needling protocols. The variability in outcomes suggests that further research is needed to optimize treatment protocols and standardize the use of GFC and micro-needling in clinical practice. Limitations and Challenges While the current evidence supports the potential of GFC and micro-needling in AGA treatment, several limitations must be acknowledged. First, many studies are limited by small sample sizes, which restricts the generalizability of the findings. Additionally, there is a lack of long-term follow-up data, making it difficult to assess the durability of the treatment effects. The heterogeneity in study designs, particularly in terms of GFC concentration, micro-needling frequency, and treatment duration, also poses challenges in comparing outcomes across studies. Another limitation is the subjective nature of hair growth assessments, which often rely on patient self-reports or visual analogue scales. While some studies employ objective measures like trichoscan, , the lack of standardized outcome measures across studies complicates the interpretation of results. Moreover, while adverse events related to GFC and micro-needling are generally mild and transient, such as scalp redness or minor discomfort, the long-term safety profile remains unclear due to the paucity of extensive, controlled trials. Therefore, there is a pressing need for large-scale, well-designed randomized controlled trials (RCTs) with standardized protocols to establish the efficacy and safety of this treatment modality. Future Directions Given the promising results of GFC combined with micro-needling, future research should focus on several key areas. First, there is a need for standardized protocols regarding the preparation of GFC, including the concentration of growth factors, the volume used, and the frequency of administration. Similarly, the parameters for micro-needling, such as needle length, session frequency, and the number of passes per session, should be optimized based on clinical evidence. Furthermore, long-term studies are needed to evaluate the sustainability of the treatment effects and to monitor any potential long-term side effects. Comparative studies that assess the efficacy of GFC with micro-needling against other established treatments, such as Finasteride and Minoxidil, could provide valuable insights into the relative benefits and risks of this approach. In conclusion, while the combination of GFC with Derma Roller appears to be a promising therapeutic option for androgenetic alopecia, it is essential to conduct further research to fully understand its potential and to establish evidence-based guidelines for its use. The ultimate goal is to provide clinicians with reliable, effective, and safe treatment options that can be tailored to the individual needs of patients suffering from AGA.

11. Conclusion

For patients with androgenetic alopecia, the use of derma roller micro-needling in conjunction with growth factor concentrate is a safe and efficient therapy option. With the potential to improve clinical outcomes, this therapy presents a prospective substitute or addition to conventional treatments. Still, more study is needed to show long-term

benefits and improve treatment techniques.

Clinical studies reviewed in this paper have shown promising results for this combination therapy in various types of hair loss, particularly androgenetic alopecia. Several studies have reported significant improvements in hair count, hair density, and hair shaft thickness, often surpassing the results seen with either GFC or micro-needling alone. Patient satisfaction rates have generally been high, and the treatment appears to be well-tolerated with a favourable safety profile.

In summary, a promising method for treating hair regrowth is the combination of Growth Factor Concentrate and Derma Roller. Even if the data to date is positive, more study is required to properly determine its role in the therapeutic landscape of hair loss care.

This method of treatment emphasizes how hair loss may be effectively treated by utilizing the body's natural regenerating capacities. Future treatments that are even more individualized and effective could be made possible by the advancement of research, giving hope to the millions of people who suffer from hair loss all over the world.

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None.

13. Conflict of Interest

None.

References

1. Gupta AK, Foley KA. A critical assessment of the evidence for low-level laser therapy in the treatment of hair loss. *J Dermatol Surg*. 2017;43(2):188–97.
2. Choi YS, Zhang Y, Xu M, Yang Y, Ito M, Peng T, et al. Distinct functions for Wnt/β-catenin in hair follicle stem cell proliferation and survival and interfollicular epidermal homeostasis. *J Cell Stem Cell*. 2013;13(6):720–33.
3. Lolli F, Pallotti F, Rossi A, Fortuna M, Caro G, Lenzi A, et al. Androgenetic alopecia: a review. *Endocrine*. 2017;57(1):9–17.
4. Trüeb RM. The impact of oxidative stress on hair. *Int J Cosmet Sci*. 2015;37(2):25–30.
5. Danilenko DM, Ring BD, Pierce GF. Growth factors and cytokines in hair follicle development and cycling: recent insights from animal models and the potentials for clinical therapy. *J Mol Med Today*. 1996;2(11):460–7.
6. Singhal P, Agarwal S, Dhot PS, Sayal SK. Efficacy of platelet-rich plasma in treatment of androgenic alopecia. *J Asian J Transfus Sci*. 2015;9(2):159–62.
7. Fertig RM, Gamret AC, Cervantes J, Tosti A. Microneedling for the treatment of hair loss? *J Eur Acad Dermatol Venereol*. 2018;32(4):564–9.
8. Dhurat R, Mathapati S. Response to microneedling treatment in men with androgenetic alopecia who failed to respond to conventional therapy. *Indian J Dermatol*. 2015;60(3):260–3.
9. Garg S, Manchanda S. Platelet-rich plasma-an 'Elixir' for treatment of alopecia: personal experience on 117 patients with review of literature. *Stem Cell Investig*. 2017;4:64. doi:10.21037/sci.2017.06.07.
10. Gentile P, Cole JP, Cole MA, Garcovich S, Bielli A, Scioli MG, et al. Evaluation of not-activated and activated PRP in hair loss treatment: role of growth factor and cytokine concentrations obtained by different collection systems. *Int J Mol Sci*. 2017;18(2):408. doi:10.3390/ijms18020408.
11. Gupta AK, Lyons DC, Daigle D. Platelet-rich plasma therapy for androgenetic alopecia. *Skin Therapy Lett*. 2019;24(3):1–6.
12. Starace M, Alessandrini A, D'Acunto C, Bruni F, Patrizi A, Piraccini BM, et al. Platelet-rich plasma on female androgenetic alopecia: Tested on 10 patients. *J Cosmet Dermatol*. 2019;18(1):59–64.
13. Gentile P, Cole JP, Cole MA, Garcovich S, Bielli A, Scioli M, et al. Evaluation of not-activated and activated PRP in hair loss treatment: role of growth factor and cytokine concentrations obtained by different collection systems. *Int J Mol Sci*. 2017;18(2):408. doi:10.3390/ijms18020408.
14. Hausauer AK, Jones DH. Evaluating the efficacy of different platelet-rich plasma regimens for management of androgenetic alopecia: A single-centre, blinded, randomized clinical trial. *J Dermatol Surg*. 2018;44(9):1191–200.
15. Olsen EA, Dunlap FE, Funicella T, Koperski JA, Swinehart JM, Tschen EH, et al. A randomized clinical trial of 5% topical minoxidil versus 2% topical minoxidil and placebo in the treatment of androgenetic alopecia in men. *J Am Acad Dermatol*. 2002;47(3):377–85.
16. Kaufman KD, Olsen EA, Whiting D, Savin R, DeVillez R, Bergfeld W, et al. Finasteride in the treatment of men with androgenetic alopecia. Finasteride Male Pattern Hair Loss Study Group. *J Am Acad Dermatol*. 1998;39(4):578–89.
17. Adil A, Godwin M. The effectiveness of treatments for androgenetic alopecia: A systematic review and meta-analysis. *J Am Acad Dermatol*. 2017;77(1):136–41.
18. Rodgers KE, Jadhav SS. The application of biochemical and molecular biology concepts to therapies for male pattern baldness. *J Biochem Pharmacol*. 2018;154:397–404.
19. Hesseler MJ, Shyam N. Platelet-rich plasma and its utilities in alopecia: A systematic review. *J Dermatol Surg*. 2020;46(1):93–102.

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