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Case Report

Impacts of Personalized Multimodal Treatment in the Clinical Management of Androgenetic Alopecia: A Case Report

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Abstract

Introduction: Androgenetic alopecia (AGA) is one of the most common forms of hair loss, characterized by the progressive miniaturization of hair follicles. The condition affects both men and women and has a significant impact on patients' self-esteem and psychological well-being. The treatment of AGA remains challenging, with available therapeutic options that do not always result in satisfactory outcomes.

Methodology: This case study investigated the efficacy of a multimodal treatment for AGA, combining oral therapy, at-home topical care, microinfusion of specific active ingredients, and photobiomodulation. The patient was treated with Actrisave, Saw Palmetto, Trichoxidil, and microinfusion of growth factors such as KGF and copper peptide. The treatment was carried out over a determined period, with clinical and photographic follow-up throughout the sessions.

Results and Conclusion: The patient showed a significant improvement in hair density and scalp coverage. The treatment resulted in an increase in the anagen phase of the hair cycle, a reduction in the telogen phase, and greater formation of hair follicle units. Additionally, no adverse effects were reported, and the patient expressed satisfaction with the results achieved. The combination of oral, topical treatments, and microinfusion of active ingredients, along with photobiomodulation technologies, proved effective in the treatment of androgenetic alopecia, promoting hair regeneration and increased hair density. The personalized approach, which considers the specific needs of each patient, was crucial for the success of the treatment. However, further studies are needed to confirm the efficacy of these treatments on a larger scale and in the long term.

Keywords: Androgenetic Alopecia, Multimodal Treatment, Photobiomodulation, Microinfusion of Active Ingredients, Personalized Treatment.

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1. Introduction

Androgenetic alopecia (AGA), also known as male pattern baldness, is characterized by progressive hair loss and miniaturization of hair follicles (HF)[1]. There is a specific alteration in the hair growth cycle, where follicles remain in the anagen phase (active hair growth phase)

for a reduced period. In this context, the new hair shafts present as abnormally short and fine vellus hairs. This alteration occurs in response to the activation of androgen receptors. The pathophysiology of AGA involves genetically predisposed factors, leading to an excessive response to androgens, associated with local microinflammation in the scalp[2]. AGA is the most common form of hair loss, with its incidence increasing with age, affecting about 50% of men at 50 years old and up to 80% at 70 years old[3]. Although it is a benign condition, hair loss, as a physical attribute related to self-image, is associated with psychosocial impacts such as low self-esteem, anxiety, and depression[4].

In AGA, there is a gradual thinning of the hair, mainly in the crown and frontal regions of the scalp. This clinical characteristic is the result of the distribution of androgen receptors in the scalp, which respond to the presence of dihydrotestosterone (DHT), converted from testosterone by the enzyme 5-α-reductase[5]. Despite its high incidence, there is still no definitive treatment for AGA due to its chronic nature, the genetic factors involved in its pathophysiology, and the epigenetic factors that contribute to the progression of the condition. Currently, there are two medications approved by the Food and Drug Administration (FDA) for the treatment of AGA: oral finasteride and topical minoxidil. However, both drug therapies are associated with adverse effects. Finasteride may cause sexual and reproductive side effects such as erectile dysfunction, decreased libido, ejaculatory dysfunction, and post-finasteride syndrome. Minoxidil is associated with side effects such as contact dermatitis, headaches, and hypertrichosis[6–8]. These limitations necessitate the development of alternative and combined therapeutic approaches.

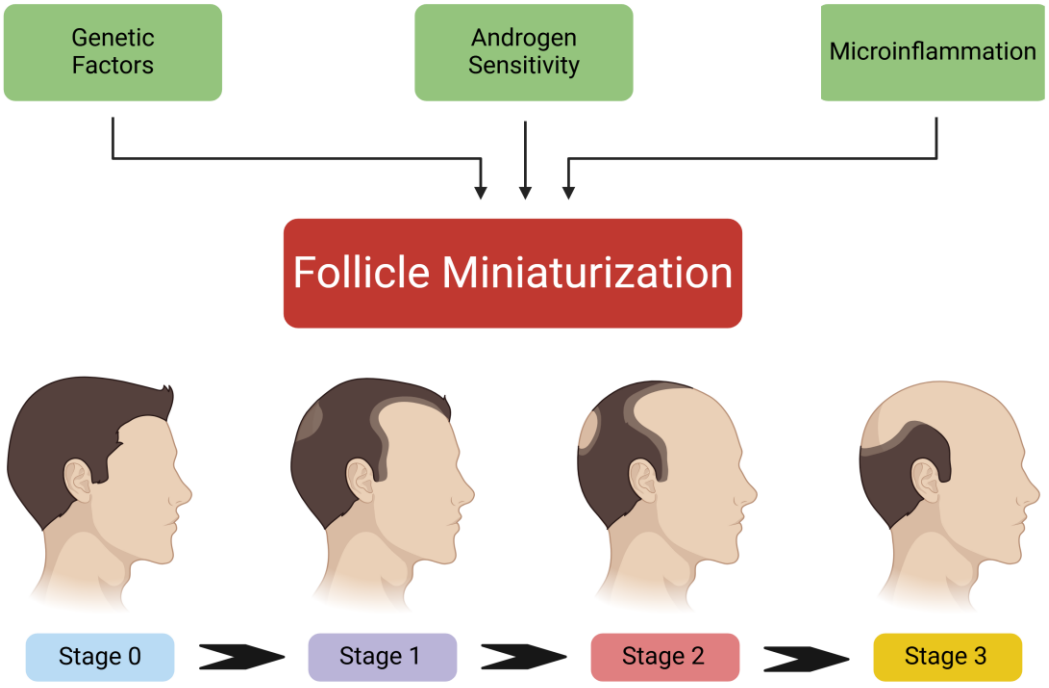

Figure 1. The pathophysiology of androgenetic alopecia involves genetic factors, the sensitivity of hair follicles to androgens, and local microinflammation in the scalp.

Due to the complexity of AGA, effective treatment requires a multimodal approach that considers not only the biological aspects but also the psychological issues associated with the condition[9]. Personalization of the treatment, considering clinical variability and the individual patient's response, is essential for successful management. The case study is particularly relevant for evaluating complex situations, such as the treatment of AGA. The variability in the clinical presentation of AGA requires an integrative and personalized approach. In this context, the present case study aims to assess the effectiveness of a multimodal protocol, which includes oral treatments, at-home topical care, and microinfusion of specific active ingredients, tailored to the individual patient's needs. This case study provides new insights to improve the clinical management of AGA, particularly in patients who do not respond

satisfactorily to conventional treatments. Furthermore, it contributes to the advancement of trichology and the understanding of the impact of a personalized approach in treating the condition.

2. Case Report

A 35-year-old man presented with hair thinning, visible areas of the scalp, and low hair density. The trichoscopy, along with the clinical evaluation, suggests a diagnosis of androgenetic alopecia (Figure 2). The degree of hair loss is advanced, corresponding to stage VI-VII on the Hamilton-Norwood scale. Cases of androgenetic alopecia in advanced stages represent a major therapeutic challenge, as the hair follicles are in an advanced stage of atrophy, which hinders regeneration. In these cases, treatment options show limited clinical response, requiring more aggressive therapeutic approaches and often combinations of therapies, such as medications, topical treatments, and even surgical procedures like hair transplants. Additionally, the results can be unpredictable and variable, depending on the extent of the hair loss and the quality of the remaining follicles. The patient did not report any associated comorbidities.

Figure 2. Tricoscopy before treatment, showing hair miniaturization, empty follicles, increased spacing between hairs, and reduced hair density, typical characteristics of androgenetic alopecia.

The treatment consisted of oral use of Actrisave 250 mg, Saw Palmetto 350 mg, and methionine 200 mg. The at-home care included the topical application of Trichoxidil 5%. In the clinic, ten microneedling sessions were performed, with the first six sessions occurring at 30-day intervals and the last four at 60-day intervals. Before each microneedling session, red light therapy was applied, and after the procedure, blue LED light was used. During the microneedling sessions, the following active ingredients were used: keratinocyte growth factor (KGF), copper peptide, and Trichoxidil. Additionally, the patient underwent three sessions of intradermotherapy with biotin and silicon. The results obtained with the proposed multimodal protocol are described in Figures 3, 4, 5, and 6.

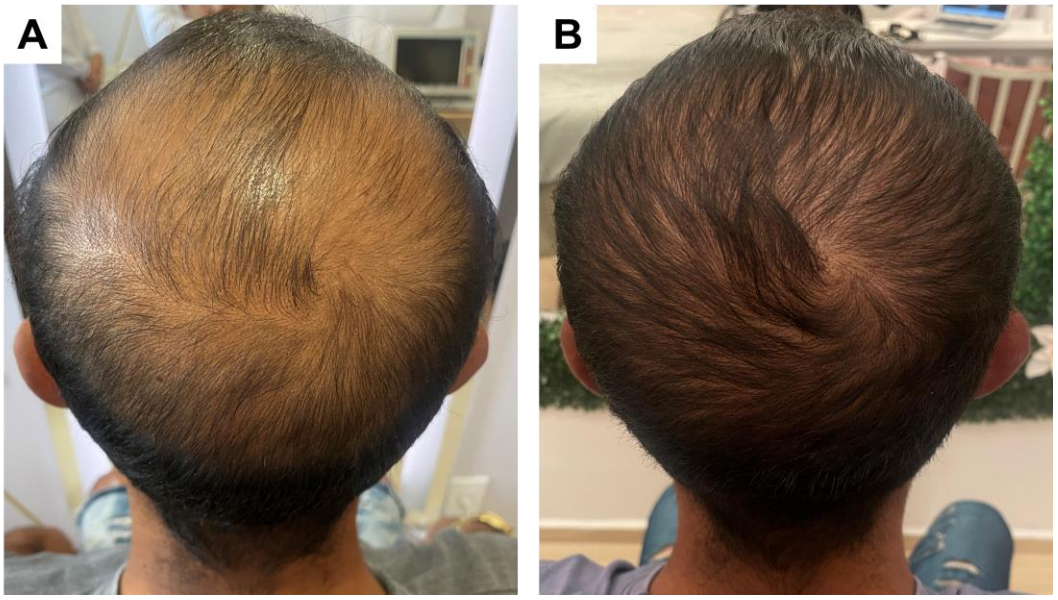

Figure 3. Images of the patient's vertex and posterior scalp with androgenetic alopecia (AGA) before (A) and after treatment (B)

Figure 4. Images of the upper scalp region of the patient with androgenetic alopecia (AGA) before (A) and after treatment (B).

Figure 5. Image of the **l**eft parietal area of the patient with androgenetic alopecia (AGA) before (A) and after treatment (B).

Figure 6. Images of the right parietal area of the patient with androgenetic alopecia (AGA) before (A) and after treatment (B).

After completing the ten sessions of microinfusion of specific active ingredients tailored to the patient's needs, a noticeable improvement in hair density and scalp coverage was observed. The improvement was evident in all areas evaluated, including the vertex, upper region, and both left and right parietal areas, indicating a globally positive response across the entire scalp. No hair loss was observed throughout the treatment, reinforcing the effectiveness of the therapeutic approach. The patient also reported a substantial perception of improvement, with satisfaction regarding the results, highlighting an increase in confidence and well-being. It is important to mention that no adverse effects were identified during the treatment follow-up, suggesting good tolerance to the protocol. These results indicate that the multimodal treatment was successful not only in improving hair density but also in providing a therapeutic experience without complications.

3. Discussion

The combination of oral treatment, at-home topical care, and microinfusion of active ingredients proved to be highly effective in restoring hair growth, particularly in areas of the scalp where follicles were previously inactive. However, it is important to emphasize that, while each of these modalities played its part, the success of the treatment cannot be attributed solely to a single approach. The determining factor for the exceptional results was the personal selection of active ingredients, which was tailored to the specific needs of the patient, considering their clinical condition and individual response to treatment. This integrative and personalized approach was crucial in stimulating robust and lasting hair regeneration.

The oral treatment included the use of Actrisave, a dietary supplement composed of extracts from *Oryza sativa* L. (black rice) and *Opuntia ficus-indica* L. (prickly pear). This supplement has antioxidant and anti-inflammatory properties that positively contribute to hair health. Black rice, rich in anthocyanins, plays an important role in protecting against oxidative stress, one of the primary factors responsible for hair loss and weakening[10]. The anthocyanins in this extract improve blood circulation in the scalp, facilitating the proper delivery of nutrients to hair follicles and stimulating hair growth. Additionally, black rice may exert an anti-inflammatory effect, alleviating possible inflammatory processes that could harm the health of hair follicles[11]. The extract of *Opuntia ficus-indica* L., in turn, is valued for its regenerative and antioxidant properties, playing a key role in scalp health. The compounds found in prickly pear, such as flavonoids and polyphenols, help protect hair cells from damage caused by oxidative stress and inflammation[12,13]. Both factors are closely related to the development of alopecia, and therefore, the use of Actrisave may be an important complementary option in the treatment of hair loss, promoting the strengthening of hair follicles and improving hair quality over time.

Trichoxidil, used as a topical home care treatment, is a phyto-complex derived from specific fractions of essential oils, which has shown the ability to activate fibroblasts and positively regulate genes related to hair growth. Among the growth factor mRNAs regulated by this active ingredient, insulin-like growth factor 1 (IGF-1), keratinocyte growth factor (KGF), and vascular endothelial growth factor (VEGF) stand out. These factors play crucial roles in the regeneration of hair follicles and the stimulation of the anagen phase. The use of Trichoxidil has been associated with a significant increase in the anagen phase, a reduction in the telogen phase, and greater follicular unit formation, when compared to conventional treatment with minoxidil[14]. These effects suggest that Trichoxidil could be a promising therapeutic option, either as a complement or an alternative, for the treatment of alopecia, promoting hair growth and increasing hair density.

In addition to its topical application, Trichoxidil was also used in the microinfusion of active ingredients, enhancing its effects on hair growth stimulation. This expanded approach allows for the synergistic action of the active ingredient, further improving its efficacy in the treatment of alopecia by providing a more direct and controlled release of active ingredients into the deeper layers of the scalp. When combined with other therapies, Trichoxidil, both topically and in microinfusion, can offer more consistent and satisfactory results in stimulating hair growth.

The microinfusion of active ingredients also included the administration of KGF and copper peptide. KGF belongs to the fibroblast growth factor family and plays an important role in the proliferation of various epithelial cells, including keratinocytes of the hair follicle. Studies indicate that KGF plays a crucial role in the hair cycle, particularly in the induction of the anagen phase, by stimulating the proliferation of matrix cells. Additionally, KGF activation contributes to the increase in hair density and the recovery of hair follicle function in cases of AGA. This factor also exerts a cytoprotective effect, protecting keratinocytes against damage induced by oxidative stress and local inflammation, which are frequently observed in AGA. Literature suggests that KGF could provide a therapeutic target in the treatment of AGA by improving hair follicle regeneration and promoting healthier and more durable hair growth[15]. On the other hand, copper peptide, with its regenerative properties, primarily works by stimulating cellular renewal and promoting the proliferation of dermal fibroblasts. It is also known

for its ability to increase the production of vascular endothelial growth factors (VEGF), which activates microcirculation in the scalp, favoring the supply of essential nutrients to the hair follicles. Additionally, copper peptide contributes to the proliferation of dermal papilla cells — a region crucial for hair follicle health — and helps reduce the number of apoptotic cells in this area, promoting hair regeneration. Its anti-inflammatory properties are particularly important in androgenetic alopecia, as chronic inflammation compromises the function of hair follicles.[16]. Thus, copper peptide emerges as a valuable tool in the treatment of alopecia, assisting in the revitalization of the scalp and promoting the growth of new hair follicles.

The use of red laser, a low-level laser, is employed to stimulate hair follicles and improve scalp health, in addition to having an anti-inflammatory effect. It promotes a significant increase in the expression of mRNAs of molecules involved in the Wnt/β-catenin signaling pathway, which are responsible for cell proliferation, migration, and organization in the hair growth cycle. Studies show that the use of red laser contributes to an average increase in hair density, hair thickness, and hair count[17].

Blue light photobiomodulation has been shown to be effective in stimulating hair growth and maintaining scalp health. This technique works through its interaction with photoreceptive molecules, opsins, present in dermal papilla cells, activating a cascade of biochemical signals that can modulate hair growth by regulating crucial processes such as cell proliferation and differentiation[18]. Furthermore, blue light induces an intrafollicular accumulation of the protein CRY1, which is predominantly expressed during the anagen phase. This process favors the prolongation of the anagen phase, resulting in a more effective stimulation of hair growth.

In summary, the multimodal treatments used in this study demonstrated significant potential in improving hair density and regenerating hair follicles, offering a promising approach for managing androgenetic alopecia. Although further studies are needed to confirm the long-term benefits, the observed results indicate that the combination of topical, oral, and microinfusion therapies can represent an effective and personalized alternative for the treatment of androgenetic alopecia.

4. Conclusion

Throughout this study, it was possible to observe that the multimodal treatment, combining oral, topical, and microinfusion therapies, showed promising results in the management of AGA. The personalized choice of active ingredients such as Trichoxidil, KGF, copper peptide, together with the use of technologies like red laser and blue LED, proved to be effective in stimulating hair growth, regenerating hair follicles, and improving hair density. Additionally, the integrative approach, which takes into account the individual needs of patients, has been shown to be essential for achieving positive and sustainable results. However, it is important to highlight that, despite the progress made, further studies with larger sample sizes and extended clinical follow-up are needed to confirm the long-term efficacy of these interventions. This study contributes to the field of trichology, offering new perspectives for more effective and personalized treatments in the fight against androgenetic alopecia.

5. Patient Consent and Anonymity

A written Informed Consent Form was signed by the patient, authorizing the publication of data and images in this article. Approval from an Ethics Committee was neither sought nor required due to the retrospective nature of the clinical outcomes in the routine treatment of the patient.

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