

Method for quantitative evaluation of the efficacy of treatments for hair loss using image analysis: preliminary study

Método para avaliação quantitativa da eficácia de tratamentos para queda de cabelo mediante análise de imagens: estudo preliminar

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ABSTRACT

Introduction: The number of women seeking treatment for androgenetic alopecia has increased during the last decade. Likewise, a greater amount of therapeutic options and methods for evaluating treatment efficacy have also become available. In face of this, it is necessary to develop simple and objective methods to quantitatively evaluate the effectiveness of hair treatments.

Objective: To validate a quantitative method that evaluates the effectiveness of treatments for hair loss.

Methods: Comparison of standardized photographs obtained before and after the treatments, analyzed by a software that provides automatic calculation of the area of hair loss in square pixels. This calculation is based on the contrast perceived between bright (hair loss) and dark (normal amount of hair) regions of the scalp, and allows estimating the area that is not covered by hair, thus quantifying the effectiveness of the treatments.

Results: The method is effective for assessing the affected area in patients with both initial and advanced degrees of hair loss.

Conclusions: The proposed method allows evaluating the effectiveness of diverse types of treatments for telogen effluvium and androgenetic alopecia in a rapid, straightforward and cost effective manner.

Keywords: Alopecia; Hair; Methodology; Methods

RESUMO

Introdução: O número de mulheres que buscam tratamento para alopecia androgenética tem crescido na última década, bem como as opções terapêuticas e os métodos para avaliar a eficácia de tratamentos. Nesse contexto, é necessário o desenvolvimento de métodos simples e objetivos para avaliar quantitativamente a eficácia dos tratamentos capilares.

Objetivo: Validar um método quantitativo para avaliar a eficácia de tratamentos para a queda de cabelos.

Métodos: Comparação de fotos padronizadas, obtidas antes e depois dos tratamentos, analisadas com auxílio de um software, que fornece o cálculo automático da área de falha, em pixels quadrados, a partir do contraste entre claro (região com perda capilar) e escuro (região com quantidade normal de cabelos), possibilitando estimar a área de couro cabeludo que não apresenta cobertura capilar e, assim, quantificar a eficácia dos tratamentos.

Resultados: O método é eficaz para a avaliação da área afetada pela perda capilar tanto em pacientes com grau inicial (Savin I-1a) quanto em quadros mais avançados (Savin III e avançada).

Conclusões: O método proposto permite avaliar de forma rápida, simples e com baixo custo a eficácia de diversos tipos de tratamentos para eflúvio telógeno e alopecia androgenética.

Palavras-Chave: Alopecia; Cabelo; Metodologia; Métodos

Original Articles

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INTRODUCTION

Hair loss causes psychological and emotional distress, with a significant negative impact on the patients' self-esteem, confidence, and body self-image.¹

Physical, hormonal, and emotional factors, diseases and surgical interventions can be classified as triggering factors of telogen effluvium (TE).

The number of women seeking treatment for androgenetic alopecia (AGA) and TE has increased in the last decade, as well as therapeutic options and methods to evaluate their treatment efficacy.

Cosmetic products may have the function of just masking the appearance of hair loss by covering up the exposed scalp where there is visible hair loss, as is the case with some pigment sprays. Shampoos and other topical agents can deposit particles aimed at adding volume to the surface of the hair fibers and reduce the space between them, giving the sensation of a scalp with greater coverage. In AGA, the hair shaft's diameter is reduced, increasing the susceptibility to fracture (breaking of the threads). Lubrication for external protection – aimed at minimizing friction – combined with agents that provide temporary adhesion in order to prevent damage to the cuticles, helps to reduce hair breakage and consequently, their falling.² Also, there are some products containing active principles, in their formulations – such as Minoxidil –, that stimulate the cycle of capillary growth.³

With the growing market for products aimed at treating hair loss, it has become necessary to develop simple and objective methods to quantitatively evaluate their efficacy. This would allow the assessment of effectiveness before new products are released into the market and enable both physicians and patients to monitor the development of the treatments.

Traditional methods used to evaluate the effectiveness of treatments are normally based on manual counting of hair strands from an area marked and photographed with a common camera or on a phototrichogram. Both techniques are laborious, in addition to requiring specific technical training in order to be implemented, which adds additional costs for testing and evaluating the effectiveness of products and for controlling and treating hair loss.⁴

OBJECTIVE

The present study is aimed at proposing a quantitative method to evaluate the effectiveness of treatments against PCPF/AGA and TE, based on the analysis of an imaging software.

METHODOLOGY

The proposed method was based on the methodology described by Hung et al.⁵ Standardized photographs of the frontoparietal area, in the region of central hair loss, were obtained for the evaluation. The photographs were taken before and after topical treatments were performed.

The photographs were individually analyzed using the Image Pro Premier® software (Media Cybernetics, Rockville, USA). Correction of the exposure was performed in all pho-

tographs in order to emphasize the contrast between normal areas and hair failure areas. The analysis corresponded to the automatic calculation of the area with hair loss in square pixels, performed by the software based on the contrast between bright regions (hair loss region) and darker regions (area without hair loss), as shown in Figures 1 and 2. In this way, it was possible to estimate the area (in pixels²) of the scalp that was not covered by hair and, thus, to quantify the efficacy of the treatments used for AGA and TE, by comparing photographs obtained before and after its application.

RESULTS AND DISCUSSION

The Savin scale (Figure 1) was used as a parameter for classifying the degree of AGA.⁶ This scale distributes female androgenetic alopecia in eight degrees of hair loss intensity: I-1 to I-4 (mild loss), II-1 to II-2 (moderate loss), III and advanced (more intense stages of hair loss, as well as more rare frontal loss).

Women with AGA – associated or not to TE – who underwent topical treatment with minoxidil lotion associated with anti-dandruff shampoo were evaluated. Analysis of Figures 1 and 2 suggests that the method is effective for the evaluation of the area affected by hair loss both in patients with initial degrees of hair loss (Savin scale I-1-4) 6, and with more advanced cases of hair loss (Savin scale II-1-2 and advanced).⁶

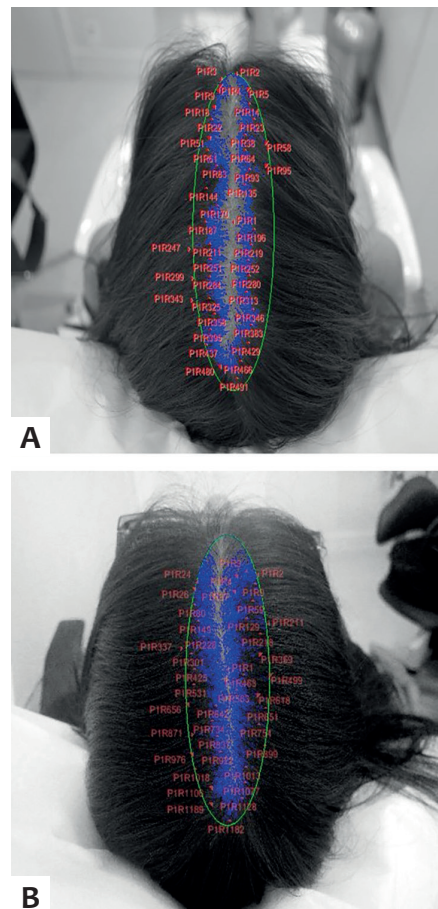


FIGURE 1: Female patient with hair loss (Savin scale I-3)
A - Before the treatment (Savin scale I-3)
B - After the treatment (Savin scale I-2)

Figure 1 depicts the effectiveness of a treatment for AGA (Savin scale I-3), with the area affected by hair loss measuring 31,564 pixel² before the treatment (Figure 2a) being reduced to 25,163 pixel² after the 2-year therapy (Figure 2.b), which would clinically correspond to AGA – Savin scale I-2.⁶

The efficacy of a treatment for an AGA – Savin scale II-2 can also be observed in Figure 2. In this more severe case, the first image (Figure 2a) shows the area affected by hair loss prior to the treatment (440,529 pixel²), with the second image (Figure 2.b) highlighting a reduction to 296,151 pixel² after 9 months of therapy, corresponding to the II-1 level in the Savin scale.

The proposed method stands out from those usually used for the straightforwardness of use, as it does not require specific technical training, yields results in a few minutes, is cost effective and allows to evaluate different degrees of hair loss. It is also possible to estimate the development of the AGA and worsening of the hair loss over time in percentage terms, as well as to evaluate the improvement caused by the treatment, rather than simply classifying patients according to scales.

On the other hand, it is not possible to evaluate the growth of hair strands or estimate the ratio of anagen to telogen fibers, as is the case with phototricograms.⁴ However, concerning the coverage effect, as is the case with many cosmetic

products that only mask the appearance of hair loss by filling or coloring the scalp, the proposed method is a better choice.

CONCLUSION

The proposed imaging software-assisted analysis method allows physicians and researchers to quantitatively evaluate the efficacy of products intended for the control and treatment of AGA and TE in a quick, efficient and cost-effective manner. It calculates the area of hair loss in the scalp caused by the decreased number and diameter of hair strands, which is more precise than just relying on visual observation, offering more accuracy and efficacy in the assessment of AGA severity. ●

REFERENCES

1. Ponnappakkam T, Katikaneni R, Gulati R, Gensure R. A new technique for quantitative analysis of hair loss in mice using grayscale analysis. *J Vis Exp*. 2015;(97). doi: 10.3791/1152185.
2. Davis MG, Thomas JH, van de Velde S, Boissy Y, Dawson TL, Iveson R, et al. A novel cosmetic approach to treat thinning hair. *Br J Dermatol*. 2011;165 Suppl 3:24-30.
3. Herman A, Herman AP. Topically used herbal products for the treatment of hair loss: preclinical and clinical studies. *Arch Dermatol Res*. 2017;309 (8):595-610.
4. Olsen EA. Current and novel methods for assessing efficacy of hair growth promoters in pattern hair loss. *J Am Acad Dermatol*. 2003;48 (2):253-62.
5. Hung PK, Chu TW, Tsai RY, Kung CW, Lin SJ, Chen CM. Quantitative assessment of female pattern hair loss. *Dermatologic Sinica*. 2015; 41(10): 1171-4.
6. Savin RC. A method for visually describing and quantitating hair loss in male pattern baldness. *J Invest Dermatol*. 1992;98(4):604.

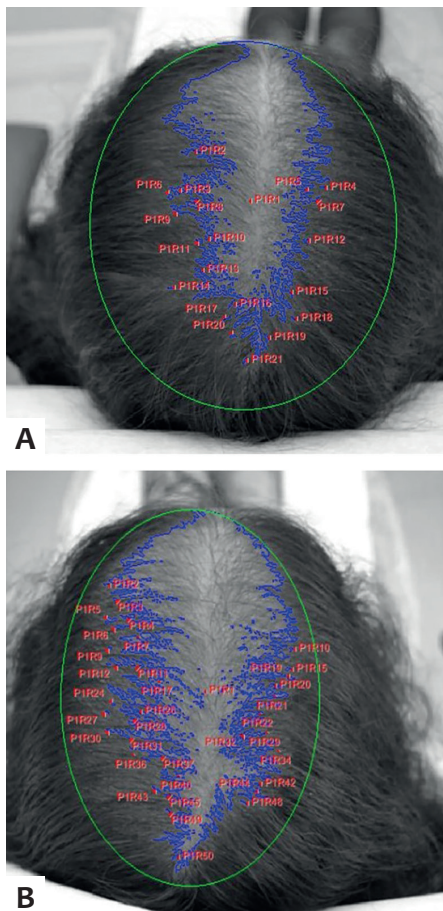




FIGURE 2: Female patient with hair loss (Savin scale II-2). **A** - Before the treatment. **B** - After the treatment (Savin scale II-1)

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