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# Fractional non-ablative laser-assisted drug delivery leads to improvement in male and female pattern hair loss

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## ABSTRACT

Androgenetic alopecia, also known as male and female pattern hair loss, is a very prevalent condition; however, approved therapeutic options are limited. Fractionated laser has been proposed to assist in penetration of topical medications to the cutaneous tissue. We present four cases of androgenetic alopecia that underwent treatment with a non-ablative erbium glass fractional laser followed by the application of topical finasteride 0,05% and growth factors including basic fibroblast growth factor, insulin-like growth factor, vascular endothelial growth factor, and copper peptide 1%. During all laser treatment sessions, eight passes were performed, at 7 mJ, 3–9% of coverage and density of 120 mzt/cm<sup>2</sup>. A positive response was observed in all of the four patients. Photographs taken 2 weeks after the last session showed improvement in hair regrowth and density. No significant side effects were observed.

## ARTICLE HISTORY

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## KEYWORDS

Androgenetic alopecia;  
fractional laser; finasteride;  
growth factors

## Introduction

Laser-assisted drug delivery is a modality of dermatological therapy that has gained popularity in the past few years. It has been shown to be an effective and safe means of enhancing penetration of topical agents to the skin (1). Fractional photothermolysis is a laser technique introduced by Manstein and Anderson in 2004, which consists in the generation of microscopic thermal injury zones (MTZ) to the skin (2). It creates numerous “fractional” microscopic columns of controlled width, depth, and density, sparing the epidermal and dermal tissue surrounding each MTZ. The small wounds formed and the short path for keratinocytes migration allow a rapid epidermal repair (2).

Recently, non-ablative fractional lasers (NAFLs) applied alone have been shown to be effective in the treatment of hair diseases, such as alopecia areata, female and male pattern hair loss (3–6). The authors postulate that fractionated laser acts as a wounding source, increasing blood flow, cytokines, and growth factors expression, as well as on stem cell and/or dermal papilla cell stimulation (4,5).

Another modality of treatment that has long been used for male pattern hair loss is finasteride, a type II 5 $\alpha$ -reductase enzyme inhibitor. More recently, finasteride has also been used for the treatment of female pattern hair loss (7). Although clinical improvement has been demonstrated with this medication, finasteride is associated with important systemic side effects, such as sexual dysfunction, anhedonia, and lack of mental concentration (7–9).

Growth factors are protein molecules that act in tissue angiogenesis, matrix deposition, and, consequently, stimulate healing and growth of new organic structures. Previous studies

demonstrated improvement in male and female pattern hair loss after treatment with platelet-rich plasma, a preparation of autologous blood with a high concentration of platelets that releases several growth factors (10–12). Growth factors and interleukins are also known as key factors of the hair cycle and, consequently, for the hair growth (13,14).

In this study, we report on four patients with male or female pattern hair loss that underwent treatment of NAFL-assisted drug delivery of topical finasteride and topical growth factors.

## Case reports

A non-ablative 1550 nm fractional erbium glass laser (Fraxel, Solta Medical, Hayward, CA) was used. During all laser treatment sessions, eight passes were performed, at 7 mJ, 3–9% of coverage, and density of 120 mzt/cm<sup>2</sup>. No anesthesia was administered and an epidermal cooling device (Zimmer Medizin System, Irvine, CA) was used during the procedure to reduce the pain. Immediately after laser treatment, all patients received 2 mL of topical finasteride solution 0.05% compounded with distilled water as the vehicle. A 2 mL compounded solution of growth factors, including vascular endothelial growth factor, basic fibroblast growth factor, insulin-like growth factor, and copper peptide 1.2%, was also applied topically after laser treatment.

## Case 1

A 34-year-old male with a history of 3 years of hair loss of the frontotemporal areas and thinning of the vertex area of the



**Figure 1.** (A) Before treatment; (B) After five treatment sessions.

scalp underwent five sessions of NAFL (Figure 1A, B). Immediately after each laser application, the patient received topical finasteride and growth factors. The interval between sessions was 15 days. The patient was already taking dutasteride for more than 6 months when started the laser-assisted drug delivery treatment, without any improvement. He was advised to continue his regimen.

### Case 2

A 66-year-old female with a history of 5 years of thinning on the frontal scalp region underwent treatment with NAFL drug delivery of finasteride and growth factors (Figure 2A, B). She received 10 treatments with an interval of 15 days and 5 treatments with an interval of 30 days.

### Case 3

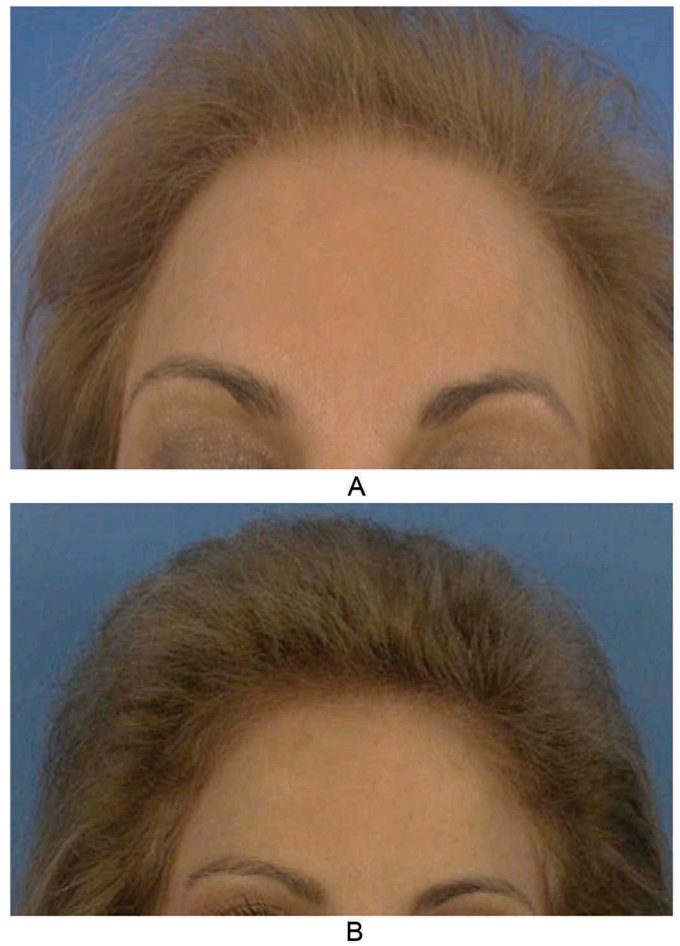
A 26-year-old male with a 1-year history of hair loss of the frontotemporal areas and thinning of the vertex area of the scalp underwent treatment with NAFL drug delivery of finasteride and growth factors (Figure 3A–D). He received 5 treatments with an interval of 15 days and 10 treatments with an interval of 30 days.

### Case 4

A 43-year-old male with a 6-year history of hair loss of the frontotemporal areas and thinning of the vertex area of the scalp underwent treatment with NAFL drug delivery of finasteride and growth factors (Figure 4A, B). He received five treatments with an interval of 30 days between sessions.

After each treatment, all the patients were advised to not apply any other topical medication to their scalp, neither to start any new systemic drug during the treatment course. Patients who were already taking an oral medication for more than 6 months were instructed to continue their regimen.

Photographs were taken at baseline and 2 weeks after the last treatment session.



**Figure 2.** (A) Before treatment; (B) After fifteen treatment sessions.

At each visit, medical examination was performed and any possible adverse effects were assessed and recorded, including erythema, edema, dryness, bleeding, scaling, and progressive hair loss. Two weeks after the final treatment, side effects were reassessed.

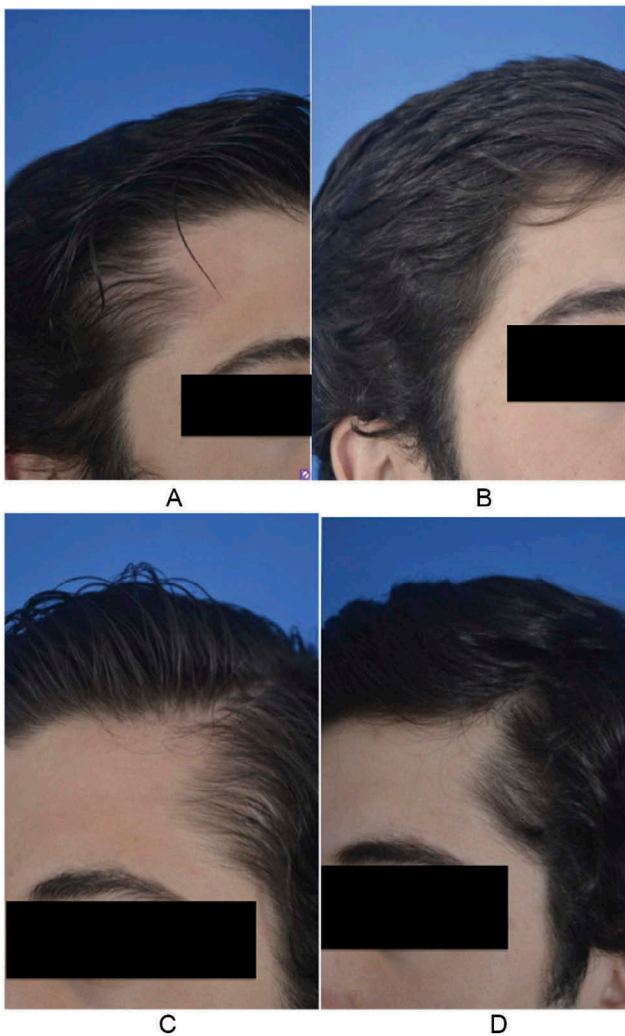
## Results

All cases reported here underwent treatment with NAFL-assisted drug delivery of finasteride and growth factors. A positive response was observed in all of the four patients. Global photographs taken 2 weeks after the last session when compared to baseline photos showed improvement in hair regrowth and density. The minimal number of sessions performed before any noticeable improvement was 5. None of the patients reported that their condition had worsened after the first treatment session.

A patient was already taking an oral 5 $\alpha$ -reductase inhibitor (dutasteride) for more than 6 months prior to the beginning of laser treatment. He was instructed to continue his regimen.

No significant side effects were observed. Two patients reported mild pain during the laser procedure and transient post-treatment erythema. These symptoms self-resolved within 2 h.





**Figure 3.** (A) Right frontotemporal area before treatment; (B) Right frontotemporal area after fifteen treatment sessions; (C) Left frontotemporal area before treatment; (D) Left frontotemporal area after fifteen treatment sessions.

## Discussion

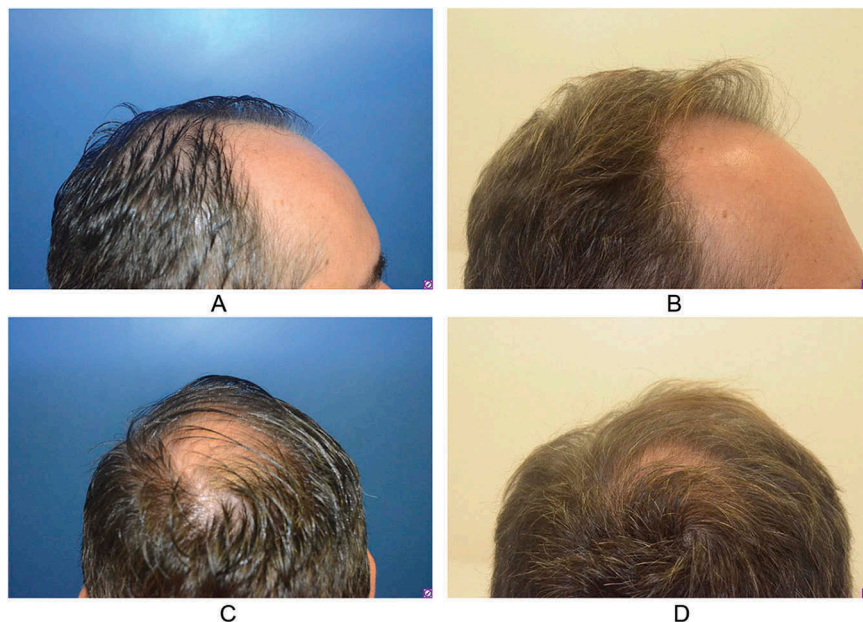
Male pattern hair loss (MPHL) and Female pattern hair loss (FPHL) have long been difficult diseases to treat. While minoxidil and finasteride have shown efficacy for hair growth, side effects are often a barrier for its use, and patients continue to look for additional treatments and more improvement.

Although oral finasteride was associated with a positive response when used to treat androgenetic alopecia (AGA), there is growing concern about its systemic side effects, especially on sexual function, such as erectile dysfunction and loss of libido (7). Therefore, a topical formulation of this drug may reduce systemic absorption and still act on target tissue, stimulating hair regrowth. All of the cases reported here demonstrated some degree of hair regrowth, and none of them presented side effects.

Growth factors and interleukins are known to play an important role in the hair cycle and, consequently, for the hair growth. It has been proposed that growth factors may act in the bulge area of the hair follicle, where stem cells are located. Germinative cells are found at the dermal papilla, in matrix. The interaction between these two types of cells may activate the proliferative phase of the hair and allow the development of a new follicular unit (11,15).

Fractionated lasers have been proposed to assist in penetration of topical medications to the cutaneous tissue. The cutaneous bioavailability of most topical medications ranges from only 1% to 5% (16) and some cannot penetrate deeply enough. Fractional technique creates an array of microscopic lesions across the surface of the skin that are surrounded by large areas of healthy tissue. These “channels” may enhance penetration of topical agents, such as finasteride and growth factors compound solutions used in these cases.

Fractional laser as a wounding source was found to increase blood flow, cytokines expression, and induce growth factors changes (4,5). We suggest that therapeutic effects seen in these cases may be a combination of the wound stimuli



**Figure 4.** (A) Right frontotemporal area before treatment; (B) Right frontotemporal area after five treatment sessions; (C) Vertex area before treatment; (D) Vertex area after five treatment sessions.

resulted from laser therapy, added to more optimal dispersion of growth factors and finasteride to the scalp. Controlled and large studies are required to further elucidate the mechanism of this improvement.

### Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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