

# CLINICAL SYNOPSIS & SUMMARY

## HAIRMAX® LASER DEVICES

LASER PHOTOTHERAPY DEVICES FOR  
THE TREATMENT OF ANDROGENETIC ALOPECIA



AND THE PROMOTION OF HAIR GROWTH  
IN MEN AND WOMEN

**HAIRMAX®**  
The science of hair growth.™

LAST UPDATED MARCH 2015

**HairMax LaserComb Synopsis  
and Clinical Summary**

## Table of Contents

---

Executive Summary – Introduction and Device Design.....	3
Benefits.....	4
Mono, Concomitant, and Adjunctive Use.....	4
Current HairMax LaserComb Models.....	5
Medical Advisory Board.....	6
HairMax LaserComb Clinical Timeline.....	7
Safety Standards & Medical Device Certifications.....	9
Overview of Androgenetic Alopecia.....	10
The HairMax LaserComb and Androgenetic Alopecia.....	11
Hypothesized Mechanisms of Action.....	13
Published Clinical Studies on Efficacy and Safety.....	15
Summation of Hair Counts – All Clinical Studies.....	20
Other Clinical Studies.....	24
Mechanistic Studies – Completed.....	25
Clinical Research Projects.....	27
Un-Retouched Before and After Photos.....	28
References.....	33
Model Features.....	34

## Executive Summary

### INTRODUCTION

The HairMax LaserComb® is a home-use low level laser therapy (LLLT) device that has been clinically proven and FDA Cleared to treat androgenetic alopecia and promote hair growth in men and women. Initial development of the HairMax LaserComb began in the 1980's in Sydney, Australia where our CEO, Henry Pearl pioneered the use of laser phototherapy in a clinical setting to activate hair growth. The results were dramatic with men and women experiencing substantial improvement in hair growth, hair regrowth and overall quality of hair. David Michaels joined Henry Pearl to start development of a home use laser system that was safe, efficacious and provided strong customer benefits. David and Henry moved to Boca Raton, Florida and formed Lexington International LLC. The HairMax was introduced in 2000 and has helped hundreds of thousands of individuals around the world to re-grow their hair. Lexington is dedicated to the research and development of laser therapy and the treatment of hair loss with a strong emphasis on customer satisfaction.

### INDICATIONS OF USE

Official FDA indication *"All models of the HairMax are indicated to treat Androgenetic Alopecia and Promote Hair Growth in **males** who have Norwood Hamilton Classifications of IIa thru V and **females** who have Ludwig-Savin I-4, II-1, II-2 or Frontal patterns of hair loss."* Further international indications include, *Strengthening of scalp hair and reduction of further hair loss.*

It should be noted that HairMax maintains superior 'Indications for Use' over minoxidil and finasteride. The FDA 'indication of use' for HairMax allows for broader claims to be made than those that can be made by minoxidil or finasteride. HairMax is indicated to both "Treat Hair Loss" and "Promote Hair Growth", in men and women, in both vertex and temporal regions. The indication for minoxidil is limited to 'Hair regrowth treatment for the vertex'. Finasteride is only 'indicated for the treatment of male pattern hair loss'.

### FDA CLEARED, CLINICALLY PROVEN DEVICES

The HairMax LaserComb consists of a family of home-use laser therapy medical devices. The Advanced 7 model features 7 laser modules and replaceable AA batteries. The Lux 9 and Professional 12 feature 9 or 12 laser modules and a rechargeable lithium polymer battery.

### LASER SPECIFICATIONS

All HairMax LaserCombs are internationally classified as 3R laser products, safe for consumer use. Each laser module is 5mW at 655nm. Lexington fabricates each module using high grade medical diodes and specialized focused lenses to output a high concentration of laser speckles for maximum efficacy. Laser speckles are important, as it helps transfer laser energy to ATP.

Most other laser devices on the market do not use medical grade diodes or lenses in their device. You can easily tell the difference by the quantity, intensity and appearance of the laser speckles.

### **PATENTED HAIR PARTING TEETH**

The laser treatment is only effective when the laser energy reaches the scalp. Hair is a photo-protectant and therefore blocks a majority of the laser energy from reaching the scalp. Therefore, the HairMax employs a hair parting teeth mechanism to plow and part the hair allowing an unobstructed path for the laser to reach the scalp. The hair parting teeth allow maximum laser delivery and maximum effectiveness.



View of the HairMax LaserComb's patented hair parting teeth and laser delivery system which enables maximum efficacy.

### **BENEFITS**

- New hair re-growth
- A substantial decrease in hair fallout.
- Reduction in inflammation
- Increased speed of hair growth.
- Better manageability of hair
- Overall better quality and condition of hair
- Normalize scalp conditions
- Consistent positive results demonstrated in both vertex and frontal regions

### **MONO, CONCOMITANT AND ADJUNCTIVE USE**

- The HairMax LaserComb is clinically proven to be effective as mono-therapy
- The HairMax LaserComb can be used concomitantly with other modalities such as minoxidil or finasteride. Significant improvements in benefits have been observed when used in combination with other modalities.
- When used adjunctively, the HairMax LaserComb has been reported to decrease healing time and contribute to graft patency after hair transplant surgery.

There are no contraindications to use of the HairMax LaserComb.

## MEET OUR MEDICAL ADVISORY TEAM

We proudly introduce our Medical Advisory Board, a further extension of our dedication to quality and research. Each member represents a commitment to the advancement of the hair care industry through ethical, credible practices and is individually responsible for great contributions to the community. As a whole, the Medical Advisory Board can apply its expertise and credentials to support Lexington as we continue our efforts in providing a quality product to our customers. The board consists of many established Key Opinion Leaders in the hair loss field who can attest first-hand to the efficacy of low level laser therapy in the treatment of problem hair. In fact, these respected professionals have chosen to support our product based upon their experiences and belief that the HairMax LaserComb® provides beneficial results.



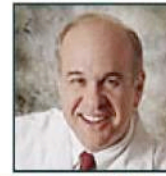
**Dr. Matt Leavitt**  
Advanced Cosmetic  
Dermatology  
Orlando, FL



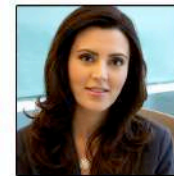
**Dr. Pierre Bouhanna**  
Dermatologist, Scalp Surgeon  
Paris, France



**Prof. Ralph Trüeb MD**  
Center for Dermatology  
and Hair Diseases  
Wallisellen-Zürich



**Dr. Lawrence A. Schachner**  
Senior Associate Dean and Executive  
Director for Development  
Professor, Chair Emeritus and  
Stiefel Laboratories Chair - Dermatology  
Director of the Division of  
Pediatric Dermatology



**Dr. Zakia Rahman**  
Clinical Assistant Prof. of  
Dermatology at  
Stanford University



**Dr. Joaquin J. Jimenez**  
Research Associate Professor  
University of Miami,  
Miller School of Medicine  
Department of Dermatology  
and Cutaneous Surgery



**Dr. Daniel Man**  
Board-Certified  
Plastic Surgeon  
Boca Raton, Florida



**Dr. M.H. Mohmand**  
H.T.I. Islamabad  
Islamabad, Pakistan



**Dr. Jennifer Martinick**  
New Skin/Hair Clinic  
Perth, Western Australia



**René Rodríguez**  
Medical  
Bogotá, Colombia



**Dr. Maria Muricy**  
Muricy Clinic Curitiba  
Parana, Brazil



**Dr. David H. Kingsley**  
British Science Corporation  
Staten Island, NY, USA



**Dr. Michael Markou**  
Markou Hair Restoration  
Clearwater, Florida



**John Satino**  
Laser Hair & Scalp Clinic  
Clearwater, Florida



**Dr. Craig Ziering**  
Ziering Medical  
Beverly Hills, CA, USA



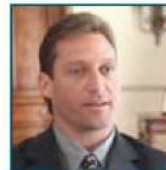
**Dr. Leila Bloch**  
Tykocinski Medical Group  
San Paulo, Brazil



**Dr. Melike Külahçı**  
Transmed  
Istanbul, Turkey



**Dr. med. Conradin  
von Albertini**  
Riverside Center  
Zurich, Switzerland



**Dr. Glenn Charles**  
Charles Medical  
Boca Raton, FL, USA



**Dr. Mark DiStefano**  
DiStefano Hair  
Restoration Center  
Worcester, MA USA



**Dr. Marwan Saifi**  
American Aesthetic  
Medicine & Hair Transplant Center  
Warsaw, Poland



**Dr. Marco Barusco**  
Tempus Hair Restoratio, P.A.  
Port Orange, FL



**Dr. John Kahen**  
Beverly Hills Hair  
Restoration  
Beverly Hills, USA



**Christina Chikaher**  
Senior Pharmacist  
The Belgravia Centre  
London, UK



**Vetta Thompson**  
New Vision Salon & Spa  
Jacksonville, FL, USA

## HairMax LaserComb® Clinical Timeline

- **1993** - First efficacy study conducted at the University of South Wales (Sydney) of laser irradiation and high-frequency electrotherapy of 15 months duration. Results showed that 80% of the actively treated group showed a mean increase in hair density at the end of first phase vs. – 4.5% with the control group and change was maintained for the duration of the study. After cessation of therapy, actively treated subjects experienced a significant loss of hair density.
- **2001** – HairMax LaserComb introduced
- **2002** - Clinical evaluation conducted via independent research by Dr. Michael Markou (Florida) and published in ***International Journal of Cosmetic Surgery and Aesthetic Dermatology***, a peer review medical journal.
- **2002** – IRB approved clinical study conducted by Dr. Roy Geronemus and Dr. Macrene Alexiades-Armenakas at the Laser and Skin Surgery Center of New York. Study involved 44 males and females and demonstrated that 97.2% of participants received some benefit in hair loss prevention and 81.9% experienced hair regrowth greater than 11%.
- **2005** - Multi-center, double blind, sham-device controlled clinical study proving efficacy of the HairMax LaserComb in males with androgenetic alopecia began.
- **2006** - Multi-center double blind, sham device controlled clinical study on efficacy and safety of the HairMax in females with androgenetic alopecia began.
- **2007** - HairMax LaserComb receives FDA 510(k) Marketing Clearance as an OTC (non prescription) Class II medical device for the treatment of androgenetic alopecia and promotion of hair growth in males.
- **2008** – HairMax study conducted in Brazil by Dr. Maria Muricy to evaluate hair growth with the HairMax alone and in combination with minoxidil. Biopsies were obtained and the results of the study demonstrated a reversal of follicular apoptosis using BCL2 markers. Results were presented at 2008 Annual Meeting of the ISHRS.
- **2009** – Pilot study completed by Dr. Adyta Gupta, Canada on the efficacy of the HairMax in treating mild to moderate seborrheic dermatitis on 10 subjects. Results showed positive effect of the HairMax on the condition.
- **2009** – Ex-vivo study conducted by Bio-Ec, France to evaluate the effect of two laser doses and one reference dose on ex-vivo hair growth. Micro-dissected hair follicles were placed in Philpott medium and pre-cultured for 4 days. Laser energy was administered daily for 4 minutes/day for 10 days. Findings were that all laser devices induced increased hair growth elongation on day 3 of evaluation.
- **2009** - Multi center clinical study published in peer reviewed medical journal ***Clinical Drug Investigation*** Volume 29,

- **2009** - A cordless model of the HairMax LaserComb receives FDA Clearance and is introduced to market.
- **2010** – Alopecia Areata Study conducted at University of Miami evaluating effects of the HairMax LaserComb in 14 C3H/HeJ mice with localized alopecia areata from heat shock induction.
- **2009/2010** - Three additional clinical studies completed on males and females with androgenic alopecia. These studies provide further proof that the HairMax is safe and effective in promoting hair growth, reducing hair loss and treating androgenetic alopecia.
- **2011** – Post-Chemotherapy Study conducted at University of Miami evaluating effects of the HairMax LaserComb to assess accelerated regrowth of hair in young rat model.
- **2011** – FDA Marketing Clearance granted for 3 new devices for the treatment of AGA in males.
- **2011** – FDA Marketing Clearance granted for the treatment of AGA in females.
- **2011** – Completion of clinical trial on the HairMax Dual Beam 12 for the treatment of AGA in females. FDA Clearance for Marketing granted.
- **2011** – FDA Clearance for marketing granted for the HairMax Advanced 7 and the HairMax Professional 12 for the treatment of AGA in females.
- **2011** - Clinical research program in AGA completed – All HairMax LaserComb models indicated for treating AGA and for promotion of hair growth in men and women
- **To date** - 460 subjects have been involved in seven clinical studies on the safety and efficacy of the HairMax.
- **2014** – Landmark clinical study with 4 LaserComb models published in the peer review journal, The American Journal of Clinical Practice April 2014, Volume 15, Issue 2, pp 115-127,

## **Safety Standards & Medical Device Certifications**

- The HairMax LaserComb® meets or exceeds all international laser safety requirements as described by FDA-21CFR-1040 Laser Safety 50 and ISO60825
- The HairMax is manufactured in an ISO certified facility adhering to the quality requirements of ISO9001:2008 and ISO13485;2003
- CE Compliant for electrical safety to ISO60601-1 and ISO60601-1-2
- The HairMax is registered as a medical device in the following countries:
  - USFDA – K060305, K093499, K110233, K103368, K112524, K111714
  - Health Canada – Medical Device License #61237
  - Australia TGA – ARTG 162142 Class IIa, GMDN 47417
  - Brazil ANVISA – 25351.246282/2006-34
  - Korean KFDA – A37020(3)
  - Saudi Arabian Medical Device License - MDNR100608340001
  - Egypt – Ministry of Health
  - Singapore – Health Sciences Authority – MD11535930S
  - Russia – POCC US.AN29.A02083
  - Columbia – INVIMA 2012DM-0009190
  - Kuwait – Ministry of Health
  - Thailand – Thai FDA – 5501729
  - Israel – Ministry of Health
  - United Kingdom – ASA Acceptance of Efficacy Claims
  - In process –Taiwan, Mexico

## Overview of Androgenetic Alopecia

Male and female pattern hair loss is a common, chronic dermatologic disorder. Androgenetic Alopecia affects an estimated 50 million men and 30 million women in the United States with Male pattern hair loss (AGA) affecting 50% of men by 50 years of age. The frequency and severity of female pattern hair loss (FPHL) also increases with age, with a prevalence of over 50% in women over the age of 80 years and is also characterized with miniaturization. By age 40, approximately forty percent of men and women have visible symptoms of hereditary hair loss. By age 50, approximately 50 percent of both genders show signs of the condition.

MPHL is characterized by a dihydrotestosterone-dependent process with miniaturization of terminal hair follicles (HF's) into vellus HRs. The process of miniaturization is a gradual process brought on by androgenic hormones. Miniaturization leads to thinning, a decrease in density, and ultimately balding of the hair on the scalp. The goal of hair loss treatments is to increase hair coverage of the scalp and retard and reverse the miniaturization process. If thinning is minimal, the main perceived response may be retardation of further thinning<sup>5</sup>.

The typical pattern of AGA in men begins at the hairline, the existing hair may become finer and shorter. The hair at the crown also begins to thin, and eventually the top of the hairline meets the thinned crown, leaving a pattern of hair around the sides of the head.

The typical pattern of AGA in women is different from that in men. AGA in women causes diffuse thinning of the hair at and behind the hairline with thinning all over the head. There may be moderate loss of hair on the crown, but this rarely progresses to total or near baldness as it may in men.<sup>3</sup>

Genetic predisposition to hereditary hair loss can be inherited from either side of a person's family or from both parents. It is found in men and women of virtually all races and ethnicities. Hair loss is a common and distressing condition. Americans spend about one billion dollars annually for treatments to combat and cover up hair loss.<sup>1,2</sup>

## **The HairMax LaserComb and Androgenetic Alopecia**

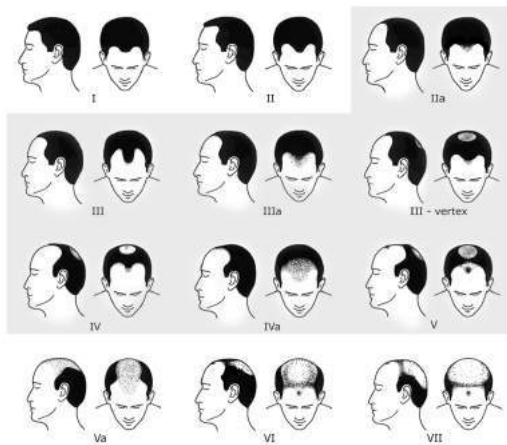
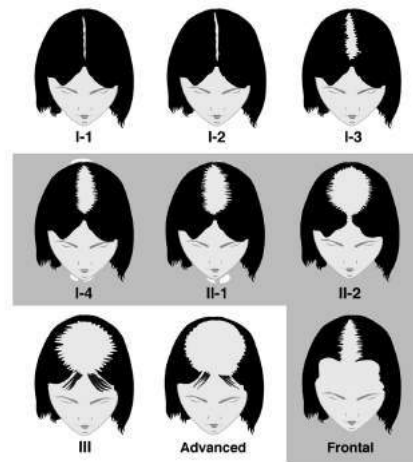
Most men and women with androgenetic alopecia (AGA) are concerned enough about their hair loss to seek remedies to regrow their hair. Although there are surgical options available, many patients would rather use non-surgical procedures to effect change. While there are a plethora of products available that claim efficacy in treating hair loss, the majority of them do not have any scientific proof as to the value of their claims. In fact, there are only two medicinal products/ingredients with proof of efficacy and FDA approval for use in promoting hair growth, minoxidil and finasteride. Finasteride is only indicated for the treatment of AGA in males, leaving minoxidil as the only drug proven useful in treating AGE in females. Since hair loss is a cosmetic problem in generally healthy individuals, treatment options should have little if any side effects from use. With the clearance of the HairMax LaserComb in 2007, an effective non-drug alternative became available for stimulating hair growth in those with AGA.

The HairMax also has an excellent safety profile, with only minor side effects reported in the ten years the device has been on the market. The HairMax LaserComb offers an effective alternative to minoxidil for the treatment of females with AGA.

### **EFFECTIVENESS**

Studies involving 460 subjects demonstrate that the HairMax LaserComb is an effective treatment for hair loss in men and women with certain classes of AGA. Subjects in the clinical studies demonstrated increases in hair counts on an average of 19 to 22 hairs per centimeter<sup>2</sup>. The HairMax is indicated for the promotion of hair growth in males with Norwood Hamilton hair loss classifications of IIa to V and females with Ludwig (Savin) I-4, II-1, II-2, or frontal. Subjects in the clinical studies were limited to Fitzpatrick Skin Types I-IV (in order to facilitate hair counting methods as it is difficult to count a dark hair on darker skin tones). Field experience has demonstrated significant benefits in all Fitzpatrick skin types.

The HairMax LaserComb has been clinically proven to be effective in men with the Norwood Hamilton Classifications and in females with the Ludwig (Savin) Classifications represented by the shaded classes in the pictures on the next page:

**Norwood Hamilton Classification****Ludwig (Savin) Classification**

Response to the HairMax LaserComb varies, but generally those using the HairMax will start to see results in 12 weeks. In clinical studies over 90% of subjects on the HairMax device experienced hair growth. The HairMax has to be used continuously or hair will revert to the stage it was in prior to treatment.

Since the HairMax LaserComb is an anagen inductor, many patients will experience shedding of the miniaturized telogen hairs in the beginning stages of treatment. This shedding is only temporary and is an indication that the HairMax is beginning to exert its effect.

## **Hypothesized Mechanisms of Action**

The HairMax LaserComb is proven to stimulate hair regrowth for individuals with androgenetic alopecia.

The HairMax LaserComb is hypothesized to be an anagen inductor by reducing inflammation, increasing vascularization and promoting the production of ATP, which in turn increases cellular metabolism, cellular activity and reduces oxidative stress. The hair follicle now has the building blocks and energy to transform a weakened follicle to one that is healthy. The enhanced environment then in turn invigorates the hair follicle which promotes hair growth and normalizes scalp conditions.

The following theories of the mechanisms of action of LLLT have been published.

### **ANAGEN INDUCTION HYPOTHESIS VIA BULGE ACTIVATION**

Utilizing the mechanism of action of Photo-Bio Stimulation (LLLT) by furthering activation of the bulge-localization stem cell population by follicular papilla. The bulge activation hypothesis states that the initial event of anagen is the direct activation of a bulge-localized stem cell population by follicular papilla signaling. The resultant proliferation of bulge cells is the source of all hair follicle layers and of both the downward growth of the hair follicle and the upward growth of the hair shaft and inner root sheath.

### **EFFECTS ON ATP SYNTHESIS**

Absorption of photons by cytochrome C oxidase (COX) molecules leads to stimulated state and consequently can lead to acceleration of transfer reactions. LLLT is hypothesized to release nitric oxide (NO) bound to COX receptors which allows the progression of the respiratory chain, leading to increased production of ATP. Increases in ATP synthesis and increases in proton gradient lead to an increasing activity of the Na<sup>+</sup>/H<sup>+</sup> and Ca<sup>2+</sup>/Na<sup>+</sup> antiporters and of all the ATP driven carriers for ions, such as Na<sup>+</sup>/K ATPase and Ca<sup>2+</sup> pumps<sup>8</sup>.

### **PROLIFERATION OF CELLS OF THE FOLLICULAR EPITHELIAL MATRIX**

The analysis of biopsies using Ki67 and Beta Catenin markers show evidence that LLLT interacts with the cells of the epithelial matrix causing multiplication of those cells responsible for hair growth. Alternately, LLLT may stimulate the derma papilla which in turn stimulates cell proliferation of the matrix cells (indirect stimulation). Increased telogen shedding at the onset of treatment may be evidence of this process occurring.

### **REDUCTION OF INFLAMMATION**

Biopsy examination has demonstrated a reduction in follicular inflammation following the application of LLLT.

### **FOLLICULAR APOPTOSIS**

Significant apoptosis occurs when follicles are in catagen and they are committed to exit anagen. It is hypothesized that LLLT delays catagen onset, thus extending the growth phase of the cycle (anagen). Studies using BCL-2 and PTEN markers support this hypothesis. Delaying catagen would allow hairs to grow longer and reduce miniaturized hair.

### **INCREASED VASCULARIZATION**

Confocal microscopic evidence that vellus follicles were described as "being surrounded by a very simple capillary system whereas resting follicles are surrounded by a palisade of capillaries

connected by short, transverse vessels”<sup>6</sup> provides further evidence that increasing blood circulation to vellus follicles may directly correlate with anagen induction in AGA.

LLLT can release NO bound to hemoglobin resulting in vasodilation around the localized hair follicle.

### **OXIDATIVE CHANGES**

LLLT has been reported to produce a shift in overall cell redox potential, regulating reactive oxidation species and super oxides resulting in a reduction of oxidative stress.<sup>9,10</sup>

### **REVERSES MINIATURIZATION**

The HairMax LaserComb<sup>®</sup> has been proven by macro photography to reverse the process of miniaturization.

## Published Clinical Studies on Efficacy and Safety

The efficacy and safety of the HairMax LaserComb in the treatment of androgenetic alopecia (AGA) in males and females has been demonstrated in a seven clinical trials involving 460 subjects. Further, the excellent safety profile has been proven in these studies and there has never been a report of serious adverse effects occurring.

The results of 5 clinical studies have been published in peer review journals.

**April 2014** - The Americal Journal of Clinical Dermatology, a peer reviewed article was published entitled: **Efficacy and Safety of a Low-level Laser Device in the Treatment of Male and Female Pattern Hair Loss: A Multicenter, Randomized, Sham Device-controlled, Double-blind Study**

Joaquin J. Jimenez , Tongyu C. Wikramanayake, Wilma Bergfeld, Maria Hordinsky, Janet G. Hickman, Michael R. Hamblin and Lawrence A. Schachner

[Am J Clin Dermatol. 2014 Apr;15(2):115-27]

The results of 4 studies are described in the article and below is a description of the studies:

### OBJECTIVE

To determine whether treatment with a low-level laser device, the US FDA-cleared HairMax Lasercomb<sup>®</sup>, increases terminal hair density in both men and women with pattern hair loss.

### METHODS

Randomized, sham device-controlled, double-blind clinical trials were conducted at multiple institutional and private practices. A total of 146 male and 188 female subjects with pattern hair loss were screened. A total of 128 male and 141 female subjects were randomized to receive either a lasercomb (one of three models) or a sham device in concealed sealed packets, and were treated on the whole scalp three times a week for 26 weeks. Terminal hair density of the target area was evaluated at baseline and at 16- and 26-week follow-ups, and analyzed to determine whether the hypothesis formulated prior to data collection, that lasercomb treatment would increase terminal hair density, was correct. The site investigators and the subjects remained blinded to the type of device they dispensed/received throughout the study. The evaluator of masked digital photographs was blinded to which trial arm the subject belonged.

### RESULTS

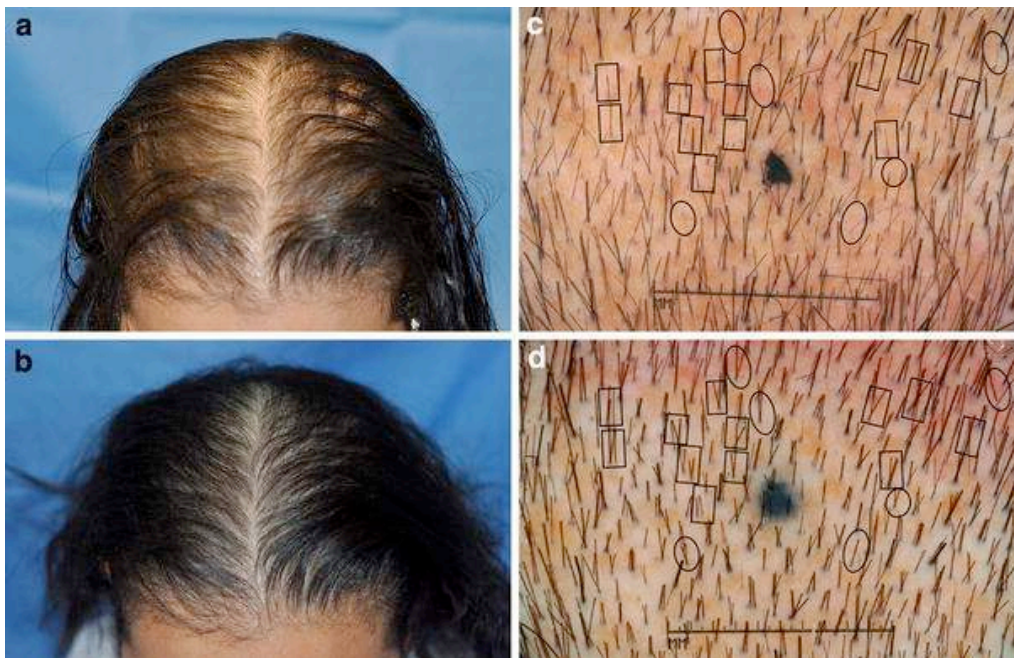
Seventy-eight, 63, 49, and 79 subjects were randomized in four trials of 9-beam lasercomb treatment in female subjects, 12-beam lasercomb treatment in female subjects, 7-beam lasercomb treatment in male subjects, and 9- and 12-beam lasercomb treatment in male subjects, compared with the sham device, respectively. Nineteen female and 25 male subjects were lost to follow-up. Among the remaining 122 female and 103 male subjects in the efficacy analysis, the mean terminal hair count at 26 weeks increased from baseline by 20.2, 20.6, 18.4, 20.9, and 25.7 per cm<sup>2</sup> in 9-beam lasercomb-treated female subjects, 12-beam lasercomb-treated female subjects, 7-beam lasercomb-treated male subjects, and 9- and 12-beam lasercomb-treated male

subjects, respectively, compared with 2.8 ( $p < 0.0001$ ), 3.0 ( $p < 0.0001$ ), 1.6 ( $p = 0.0017$ ), 9.4 ( $p = 0.0249$ ), and 9.4 ( $p = 0.0028$ ) in sham-treated subjects (95 % confidence interval). The increase in terminal hair density was independent of the age and sex of the subject and the lasercomb model. Additionally, a higher percentage of lasercomb-treated subjects reported overall improvement of hair loss condition and thickness and fullness of hair in self-assessment, compared with sham-treated subjects. No serious adverse events were reported in any subject receiving the lasercomb in any of the four trials.

## CONCLUSIONS AND RELEVANCE

We observed a statistically significant difference in the increase in terminal hair density between lasercomb- and sham-treated subjects. No serious adverse events were reported. Our results suggest that low-level laser treatment may be an effective option to treat pattern hair loss in both men and women. Additional studies should be considered to determine the long-term effects of low-level laser treatment on hair growth and maintenance, and to optimize laser modality.

Before and after global photographs (Fig. 3a, b) and macrophotographs (Fig. 3c, d) demonstrated increases in terminal hair density, most likely through the conversion of vellus or intermediate follicles to terminal follicles or from resting telogen follicles to active anagen follicles.



**Fig. 3**

Male and female pattern hair loss before and after lasercomb treatment. Global photographs of a female subject, at baseline (a) and after 26 weeks (b) of the 12-beam lasercomb treatment. Macro photographs of a male subject, at baseline (c) and after 26 weeks (d) of the 9-beam lasercomb treatment. **Increased hair count through conversion of vellus or intermediate follicles to active follicles producing terminal hair (ovals) or resting telogen to active anagen follicles (rectangles) is highlighted**

**April 2014** -The International Journal of Trichology, entitled: **Use of Low-Level Laser Therapy as Monotherapy or Concomitant Therapy for Male and Female Androgenetic Alopecia**

Andréia Munck, Maria Fernanda Gavazzoni, Ralph Trüeb  
*Int J Trichology*. 2014 Apr;6(2):45-9

## **OBJECTIVE**

The aim was to evaluate the efficacy and safety of low-level therapy (LLLT) for AGA, either as monotherapy or as concomitant therapy with minoxidil or finasteride, in an office-based setting.

## **MATERIALS AND METHODS**

Retrospective observational study of male and female patients with AGA treated with the 655 nm-HairMas LaserComb, in an office-based setting. Efficacy was assessed with global photographic imaging.

## **RESULTS**

Of 32 patients (21 female, 11 male), 8 showed significant, 20 moderate, and 4 no improvement. Improvement was seen both with monotherapy and with concomitant therapy. Improvement was observed as early as 3 months and was sustained up to a maximum observation time of 24 months. No adverse reactions were reported.

## **CONCLUSIONS:**

LLLT represents a potentially effective treatment for both male and female AGA, either as monotherapy or concomitant therapy. Combination treatments with minoxidil, finasteride, and LLLT may act synergistically to enhance hair growth.

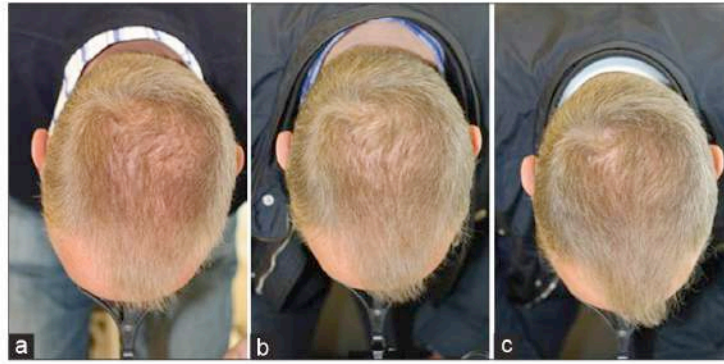
## **NOTES**

Patients had to have had at least 9 months treatment with drugs, and 26 were not responding well so the HairMax LaserComb was added to the drug treatment regimen. The balance of 6 patients were intolerant to drug therapy, so the drugs were discontinued and the HairMax LaserComb was used alone.

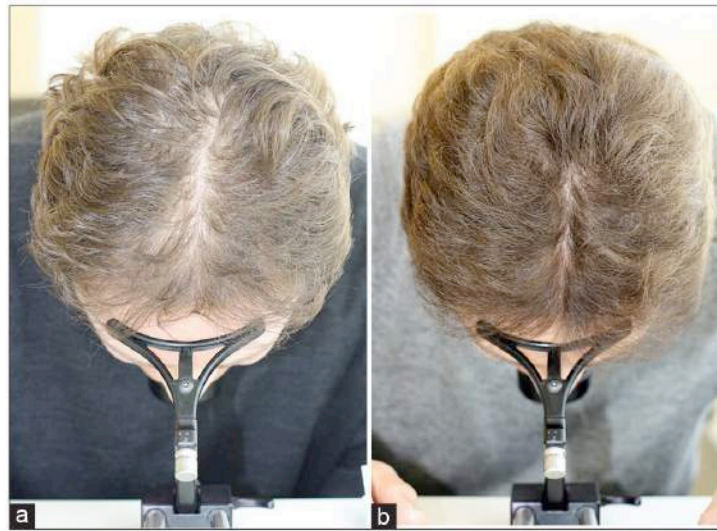
The results of the analysis after 3 months showed that 88% of all patients who were responding poorly or intolerant of drug therapy and had the the HairMax LaserComb added to the regimen, demonstrated significant improvement. Of equal importance, 100% of patients treated with the HairMax LaserComb alone, showed significant improvement. (These global results correlate with hair count results found in all other published HairMax LaserComb clinical studies).

## **PHOTOGRAPHY**

Below are pictures showing the effects of the addition or substitution of the HairMax LaserComb to treatment regimens.



**Figure 2:** Monotherapy in a 54-year-old male (a) Before treatment, and improvement after (b) 6 months, and (c) 12 months of low-level laser therapy



**Figure 3:** Concomitant treatment with topical 5% minoxidil in a 55-year-old male adding on low-level laser therapy (LLLT) to 4 year pretreatment with 5% topical minoxidil solution (a) Before, and (b) After 3 months of added LLLT



**Figure 4:** Concomitant treatment with topical 5% minoxidil and 1 mg oral finasteride in a 34-year-old male (a) Before, (b) After 9 months treatment with 1 mg oral finasteride and topical 5% minoxidil solution bid, and (c) After 3 months after adding on low-level laser therapy

**May 2009** -. This article described the clinical results of a trial which led to the first FDA Clearance of the HairMax LaserComb for treatment of AGA in males was published in in the peer review journal, Clinical Drug Investigation, entitled, **HairMax LaserComb Laser Phototherapy Device in the Treatment of Male Androgenetic Alopecia, A Randomized, Double-Blind, Sham Device-Controlled, Multicentre Trial**

Leavitt M, Charles G, Heyman E, Michaels D  
*Clin Drug Investig.* 2009;29(5):283-92

## **OBJECTIVE**

To assess the safety and effectiveness of the HairMax LaserComb laser phototherapy device in the promotion of hair growth and in the cessation of hair loss in males diagnosed with androgenetic alopecia (AGA).

## **MATERIALS AND METHODS**

The double-blind, sham device-controlled, multicenter, 26-week trial randomized male patients with Norwood-Hamilton classes IIa-V AGA to treatment with the HairMax LaserComb or the sham device (2:1). The sham device used in the study was identical to the active device except that the laser light was replaced by a non-active incandescent light source.

## **RESULTS**

Of the 110 patients who completed the study, subjects in the HairMax LaserComb treatment group exhibited a significantly greater increase in mean terminal hair density than subjects in the sham device group ( $p < 0.0001$ ). Consistent with this evidence for primary effectiveness, significant improvements in overall hair regrowth were demonstrated in terms of patients' subjective assessment ( $p < 0.015$ ) at 26 weeks over baseline. The HairMax LaserComb was well tolerated with no serious adverse events reported and no statistical difference in adverse effects between the study groups.

## **CONCLUSIONS**

The current study has accomplished an important goal. This is the first study demonstrating efficacy in hair growth with a laser phototherapy device, the HairMax LaserComb.

## SUMMATION OF HAIR COUNT CHANGES FROM ALL CLINICAL STUDIES CONDUCTED TO DATE

### 2003 STUDY - MALES AND FEMALES

Investigators - Roy Geronemus, MD, Macrene Alexiades-Armenakas, MD

	Treatment Area	
Summary	Frontal	Vertex
Number of Subjects	26	50
<b>Week 16</b>		
Mean	26.1 (25.9)	28.6 (29.8)
Change(SD)hairs/cm <sup>2</sup>	38.4%	31.0%
% change		
P-value	<0.0001	<0.0001
<b>Week 26</b>		
Mean	37.9 (34.8)	43.0 (30.7)
Change(SD)hairs/cm <sup>2</sup>	54.6%	48.1%
% change		
P-value	<0.0001	<0.0001

**Results:** 97.7% of study participants showed successful benefits with an average hair count increase of 37.9 hairs/cm<sup>2</sup> (frontal) and 43.0 hairs/cm<sup>2</sup> (vertex) at 26 Weeks.

### 2005 STUDY - MALES

Investigators- Irwin Kantor, MD, Elyse Rafal, MD, Harlan Bieleley, MD, Toni Funicella, MD

	Hair Max LaserComb Number of Subjects = 72	Placebo Number of Subjects =40
<b>Baseline – Hair Counts</b>		
Mean (SD) hairs/cm <sup>2</sup>	124.1 (52.1)	124.7 (54.3)
Range hairs/cm <sup>2</sup>	21.6, 252.1	25.5, 281.4
<b>Change from baseline</b>		
Mean (SD) hairs/cm <sup>2</sup>	16.3 (14.6)	-12.3 (24.5)
Range hairs/cm <sup>2</sup>	-56.0, 52.2	-145.1, 7.6
Adjusted mean hairs/cm <sup>2</sup>	18.8	-10.6
P-Value	<0.0001	

**Results:** 84.2% of study participants showed successful new hair growth with an average hair count increase of 18.8 hairs/ cm<sup>2</sup> at 26 Weeks.

**2005 STUDY - FEMALES**

**Investigators – Marco Barusco, MD, Toni Funicella, MD, Daniel Rowe, MD, Irwin Kantor, MD, Elyse Rafal, MD**

	<b>Hair Max LaserComb® Number of Subjects = 29</b>	<b>Placebo Number of Subjects = 20</b>
<b>Baseline – Hair Counts</b>		
Mean	128.6 (SD) 31.7	130.6 (SD) 39.1
Change(SD)hairs/cm <sup>2</sup>		
Range hairs/cm <sup>2</sup>	44.6, 183.3	38.2,192.3
<b>Change from baseline</b>		
Mean Change SD hairs/cm <sup>2</sup>	18.6 (SD) 12.4)	-4.9 (SD) 8.5
Range hairs/cm <sup>2</sup>	-1.3, 44.6	-20.4, 10.2
Adj. mean change hairs/cm <sup>2</sup>	18.5	-6.0
P-Value	<0.0001	

**Results:** 93.1% of study participants showed successful new hair growth with an average hair count increase of 18.5 hairs/ cm<sup>2</sup> at 26 Weeks

**2009-2010 STUDY - MALES 7 BEAM**

**Investigators– Michael Jarrett, MD, Abe Marcadis, MD**

**Terminal Hair Count Change from Baseline Summary**

Summary	Treatment	
	LaserComb 7	Control
Week 16		
Subjects Completing	24	14
<b>Mean Change (SD) hairs/cm<sup>2</sup></b>	<b>17.7 (12.83)</b>	<b>2.8 (6.89)</b>
Median hairs/cm <sup>2</sup>	17.8	3.2
Min, Max hairs/cm <sup>2</sup>	-16.6, 49.7	-15.3, 11.5
P-value	0.0019	
Week 26		
Subjects Completing	24	14
<b>Mean Change (SD) hairs/cm<sup>2</sup></b>	<b>18.4 (13.78)</b>	<b>1.6 (8.60)</b>
Median hairs/cm <sup>2</sup>	16.6	3.2
Min, Max hairs/cm <sup>2</sup>	-5.1, 48.4	-16.6, 16.6
P-value	0.0017	

**Results:** 91.7% of study participants showed successful new hair growth with an average hair count increase of 18.4 hairs/cm<sup>2</sup> at 26 Weeks.

**2009-2010 STUDY - MALES 9 & 12 BEAM****Investigators - Zoe Draelos, MD, David Goldberg, MD, Abe Marcadis, MD****Terminal Hair Count Change from Baseline Summary**

	Treatment		
	LaserComb 9	LaserComb 12	Control
Baseline Mean (SD) Hair Count	163.3 (69.35)	151.5 (42.37)	171.4 (62.30)
Week 16 Subjects Completing	21	22	22
Mean Change (SD) hairs/cm <sup>2</sup>	<b>20.4 (14.52)</b>	<b>23.5 (17.67)</b>	<b>4.4 (8.38)</b>
Median hairs/cm <sup>2</sup>	19.1	21.0	4.5
Min, Max hairs/cm <sup>2</sup>	-1.3, 57.3	-5.1, 56.0	-7.6, 31.8
P-value	0.0007	0.0002	
Week 26 Subjects Completing	21	22	22
Mean Change (SD) hairs/cm <sup>2</sup>	<b>20.9 (14.08)</b>	<b>25.7 (16.92)</b>	<b>9.4 (12.94)</b>
Median hairs/cm <sup>2</sup>	17.8	25.5	5.7
Min, Max hairs/cm <sup>2</sup>	2.5, 57.3	-3.8, 56.0	-3.8, 53.5
P-value	0.0249	0.0028	

**Results:** 95% of study subjects demonstrated new hair growth with an average hair count increase of 20.9 and 25.7 hairs/cm<sup>2</sup> for 9 & 12 beam devices respectively –Wk. 26

**2009-2010 STUDY FEMALES 9 BEAM**

**Investigators – Janet Hickman, MD, David Goldberg, MD, Michael Jarrett, MD, Abe Marcadis, MD, Jose Mendez, DO**

**Observed Terminal Hair Count Change from Baseline Summary**

Summary	Treatment	
	LaserComb 9	Control
Baseline		
Mean (SD) Hair Count	162.6 (46.17)	155.7 (43.51)
Week 16		
Subjects Completing	43	22
<b>Mean Change (SD) hairs/cm<sup>2</sup></b>	<b>14.8 (9.70)</b>	<b>1.3 (14.67)</b>
Median hairs/cm <sup>2</sup>	12.7	1.3
Min, Max hairs/cm <sup>2</sup>	0.0, 47.1	-16.6, 59.8
P-value <sup>1</sup>	<.0001	
Week 26		
Subjects Completing	42	21
<b>Mean Change (SD) hairs/cm<sup>2</sup></b>	<b>20.5 (11.11)</b>	<b>2.7 (16.88)</b>
Median hairs/cm <sup>2</sup>	17.8	0.0
Min, Max hairs/cm <sup>2</sup>	2.5, 48.4	-14.0, 67.5
P-value	<.0001	

**Results:** 95.2% of study participants showed successful new hair growth with an average hair count increase of 20.5 hairs/cm<sup>2</sup> at 26 Weeks.

**2010 STUDY – FEMALES DUAL 12 BEAM**

Investigators - Wilma Bergfeld MD, Lawrence Schachner MD, Maria Hordinsky MD.

**Observed Terminal Hair Count Change from Baseline Summary**

Summary	Treatment	
	LaserComb 12	Control
Baseline		
Mean (SD) Hair count	162.6 (46.17)	155.7 (43.51)
Week 16		
Subjects Completing	39	18
<b>Mean Change (SD) hairs/cm<sup>2</sup></b>	<b>11.9 (11.40)</b>	<b>-0.8 (7.87)</b>
Median hairs/cm <sup>2</sup>	11.5	0.0
Min, Max hairs/cm <sup>2</sup>	-5.1, 57.3	-14.0, 11.5
P-value [1]	0.0002	
Week 26		
Subjects Completing	39	18
<b>Mean Change (SD) hairs/cm<sup>2</sup></b>	<b>20.6 (11.55)</b>	<b>3.0 (9.33)</b>
Median hairs/cm <sup>2</sup>	17.8	2.5
Min, Max hairs/cm <sup>2</sup>	0.0, 68.8	-8.9, 26.7
P-value [1]	<.0001	

**Results:** 94.8% of study participants showed successful new hair growth with an average hair count increase of 20.6 hairs/cm<sup>2</sup> at 26 Weeks.

**Other Clinical Studies****SEBORRHEIC DERMATITIS**

HairMax LaserComb Open Label Pilot Study to Treat Seborrheic Dermatitis – Aditya Gupta, M.D., Ph.D. - Data on File

**Objective:** To test whether the stimulation of vascularization and cellular metabolism on the scalp by use of the HairMax LaserComb would produce improvement in the condition of scalp seborrheic dermatitis.

**Methods:** LaserComb used 3 times weekly on non-consecutive days. GOS measurement of 0, 1 or 2 at week 12.

**Results:** Of 9 patients completing the trial and receiving a GOS (Global Outcome Score)

- 60% (6) markedly or moderately improved
- 20% (2) slightly improved
- 1 unchanged.

Secondarily, all subjects demonstrated a TDSS (Total Dandruff Sum Score) reduction at week 12 compared to baseline.

## Mechanistic Studies - Completed

### I. EVALUATION OF ACTIVITY OF LASER DOSES ON EX-VIVO HAIR GROWTH- Data on file.

**Objective:** To compare 2 laser doses and 1 reference dose on ex-vivo hair growth.

**Methods:** Micro-dissected hair follicles were isolated and placed in 48-well plates and maintained in Philpott hair culture medium. Follicles were pre-cultured for 4 days and cultured for additional 10 days. Laser energy administered daily for 4 minutes/day.

**Results:** All laser devices induced increased hair growth elongation on day 3 of hair fiber measurement. One laser device induced statistically significant

### II. EFFECTS OF THE LEXINGTON LASERCOMB ON HAIR REGROWTH IN THE C3H/HeJ MOUSE MODEL OF ALOPECIA AREATA

**Lasers Med Sci. 2011 Jul 9:953-7 – Conducted at University of Miami**

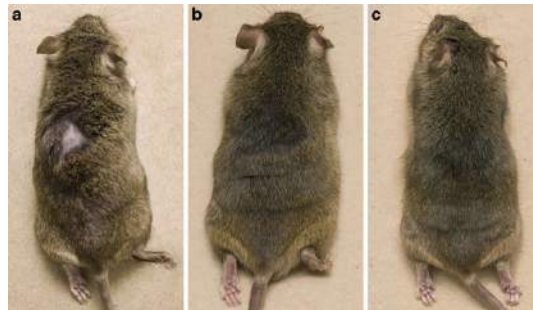
**Objective:** To ascertain the effect of the LaserComb on hair regrowth in a mouse model of alopecia areata.

**Methods:** Fourteen 8 month female C3H/HeJ mice had AA induced by heat treatment. Histology from skin biopsies were confirmed in two mice. The remaining twelve mice were randomized into two groups:

Group 1 was treated with the HairMax LaserComb for 20 s daily, three times per week for a total of 6 weeks; group II was treated similarly, but with the laser off (sham-treated). Skin samples were collected from the dorsum of the mice, and fixed in 10% formalin. Paraffin embedded section (5µm) were stained with hematoxylin and eosin (H&E), and evaluated under a microscope.

**Results:** After 6 weeks of the LaserComb treatment (group 1), an increase in the number of hair follicles was observed in the subcutaneous layer, the majority of which were in the anagen phase, though some had entered the catagen phase. The anagen hair bulbs were larger compared to the sham-treated mice (group II in whom the majority of the hair follicles were in telogen. In the sham-treated mice in group II after 6 weeks, the disruption of normal hair growth was apparent in the form of follicles without hair shafts, and the majority of the follicles were in the telogen phase, with the entire hair follicles located in the dermis. The sham-treated skin demonstrated reduced skin thickness and significantly reduced number of hair follicles.

Fig. 1 Effects of the Lexington HairMax LaserComb on hair regrowth in C3H/HeJ mice with alopecia areata. Shown are C3H/ HeJ mice with heat-induced alopecia before (a) and after 2 weeks (b) or 6 weeks (c) of laser treatment.



**Conclusion:** Using a mouse model with hair loss previously shown to mimic AA both clinically and histologically, marked hair regrowth was observed in the LaserComb treated mice compared with sham-treated mice. While hair regrowth was first observed 2 weeks later, the follicles were either still in anagen or in catagen, indicating that there is a much longer growth phase.

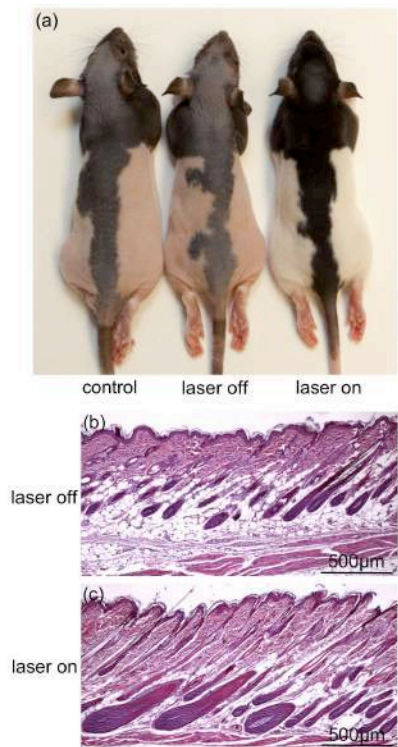
### III. EFFECTS OF THE HAIRMAX LASERCOMB ON POST-CHEMOTHERAPY INDUCED ALOPECIA IN YOUNG RAT MODEL

**Lasers Med Sci. 2012 Jun 14, 2012. Conducted at University of Miami.**

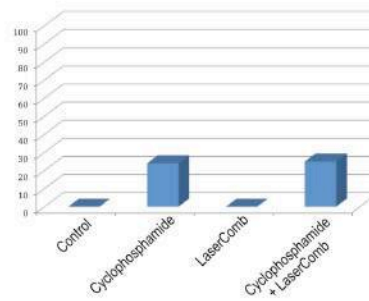
**Objective:** To ascertain if the HairMax LaserComb accelerated regrowth of hair in an animal model of Post-Chemotherapy Alopecia (PCA).

**Methods:** A young rat model of CIA was used and administered per the following groups: group1, either cyclophosphamide, group 2, etoposide, and a group 3 a combination of cyclophosphamide and doxorubicin. Rats were randomized into three groups, one receiving chemotherapy, the other received immediate treatment with the HairMax LaserComb daily for 10 days, turned off and the third was treated with the LaserComb turned on. Seven to ten days later, full body alopecia was observed in all groups.

**Results:** The group receiving treatment with the HairMax LaserComb regrew the hair 5 days earlier than the untreated and sham groups.



**Figure 1.** Effects of the HairMax LaserComb treatment on hair regrowth in rats after chemotherapy-induced alopecia. (a) Representative rats treated with cyclophosphamide chemotherapy alone (control, Group 1), chemotherapy and sham LaserComb treatment (with the laser turned off, Group 3) and chemotherapy and LaserComb treatment (laser on, Group 2) 15 days after chemotherapy. Notice the regrown hair coat in rat with laser on, while the other two rats remain alopecic. (b, c) Histology of dorsal skin biopsies from rats 15 days after treatment with cyclophosphamide and the HairMax LaserComb, with the laser turned off (b) or on (c). Brackets indicate the thickness of the skin.



**Figure 2.** Percentage of leukemia-free rats at 25 days after Shay chloroleukemia cell injection, with or without cyclophosphamide chemotherapy or HairMax LaserComb treatment.

**Conclusion:** Treatment with the HairMax LaserComb may provide a means of accelerating hair growth in PCA. Our results should be extrapolated to the treatment of PCA because the HairMax LaserComb provides a user friendly and non-invasive approach which could be translated to increased patient compliance and improved efficacy.

## Clinical Research Projects

### I. TREATMENT OF MILD TO MODERATE SEBORRHEIC DERMATITIS

Protocol already drafted, received FDA comments back on clinical study plan

### II. CHEMOTHERAPY INDUCED ALOPECIA CLINICAL STUDY

Protocol under development

**Un-Retouched Before and After Photos from Clinical  
Studies on Hair Growth- Baseline/26 Weeks**







Orlando (01-001)



11/28/2005



6/5/2006



## References

- 1 Norwood, O. and Lehr, B. Female Androgenetic Alopecia: A Separate Entity. Dermatology Surgery, 2000.
- 2 Hamilton, J.B. Patterned Baldness in Man: Types and Incidence. NY Acad Sci 1951; 53; 707028
- 3 Price V. Treatment of Hair Loss. New England Journal of Medicine, 1999: Sept 23 9664-973.
- 4 Biphasic Dose Response in Low Level Light Therapy, Huang YY, Chen AC, Carroll JD, Hamblin MR.; Dose Response.;7(4):358-83.
- 5 HairMax LaserComb Laser Phototherapy Device in the Treatment of Male Androgenetic Alopecia, Leavitt M, Charles G, Heyman E, Michaels D; Clin Drug Invest:29(5)283-292
- 6 Sakita S, et al: Three-Dimensional Microvascular Architecture of Hair Follicle by Electron Microscopy (1994) Electron Microscopy in Dermatology – Basic and Clinical Research. Es. Y Ishibashi, et al. Elsevier Science BV Amsterdam
- 7 Hair follicle predetermination, **Panteleyev<sup>1</sup>, A et al**, Journal of Cell Science 114, 3419-3431 (2001)
- 8 Hamblin, R, Mechanisms of Laser Induced Hair Regrowth, Aesthetic Buyers Guide, 4/4/2006
- 9 Karu T.1999. Primary and Secondary Mechanisms of Action of visible to Near-IR Radiation on Cells. J Photochem Photobiol B 49:1-17
- 10 Alexandratou E, et al, Human Fibroblast Alterations Induced by Low Power Laser Irradiation at the Single Cell Level Using Confocal Microscopy. Photochem Photobiol Sci 1:547-52