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# Hair Regrowth and Increased Hair Tensile Strength Using the HairMax LaserComb for Low-Level Laser Therapy

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## ABSTRACT

**The authors wished to confirm the efficacy of low level laser therapy (LLLT) using a HairMax LaserComb for the stimulation of hair growth and also to determine what effect LLLT with this device had on the tensile strength of hair. Thirty-five patients, 28 males and 7 females, with androgenetic alopecia (AGA) underwent treatment for a six-month period. Both the hair counts and tensile strength of the hair were affected very beneficially in both sexes in the temporal and vertex regions, with the males and vertex areas showing the most improvement.**

## INTRODUCTION

ALTHOUGH LOW-LEVEL LASER THERAPY (LLLT), the therapeutic application of low-energy lasers to medicine, has been used for photobiostimulation for more than thirty years now, in the past it has primarily been used to accelerate the healing of burns or wounds, or alternatively, to ease or relieve pain. Furthermore, LLLT has gained credibility and common usage in some parts of the world, such as Japan, the Scandinavian countries, and Australia, while in other parts of the world, such as North America, a lack of recognition of its efficacy has remained.

Even though there are more than 2,500 papers related to LLLT in the scientific literature,[1] only one printed reference, Professor Pekka Pontinen's text, was found which actually discussed the use of LLLT "to stimulate hair growth."[2] Even in this source, the information was limited to one paragraph, which refers to one paper given in Sorrento in 1982 which reported increased hair growth after LLLT in animals,[3] and a foreign language publication in 1983 which reported favorable results with LLLT in the treatment of Alopecia areata.[4] The authors heard about Dr. Martin Unger's paper in Puerto Vallarta, Mexico, discussing the use of LLLT for hair biostimulation,[5] and around this same time period, the fall of 2001, became interested in the HairMax LaserComb (Lexington International, Boca Raton, FL), secondary to several anecdotal reports that they had heard about this device. It was at this time that the authors decided to carry out their own study to determine whether the HairMax LaserComb was effective with regard to stimulating hair growth. The authors also wished to determine what affect LLLT had on the tensile strength of hair and undertook to determine this during the same study.

## MATERIALS AND METHODS

The HairMax LaserComb (Figs. 1, 2) was selected as the LLLT device for many important reasons. As noted above, the authors had heard several favorable anecdotal reports about its ef-

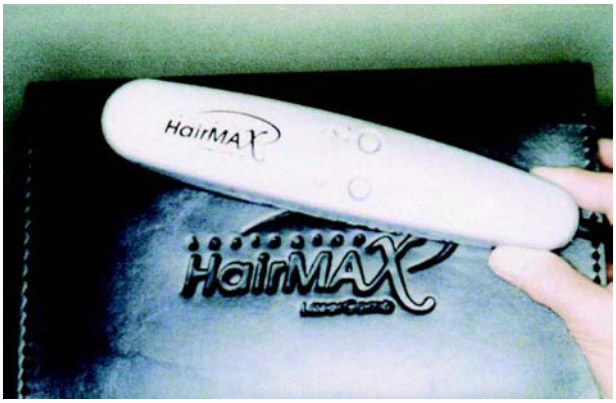


**FIG. 1.** Dorsal view of the HairMax LaserComb and its leather storage case.

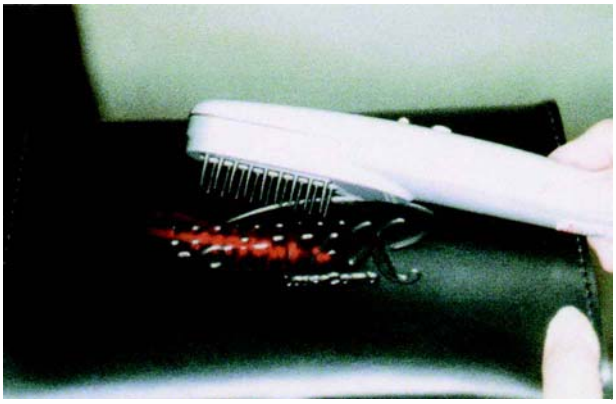

**FIG. 2.** Lateral view of the HairMax LaserComb, demonstrating the nine laser beams on the case and the comblike teeth extending from its ventral surface.

ficacy. Secondly, the cost of the device was affordable , and thirdly, the device was simple enough for the patient to use at home, avoiding repeated visits to the clinic. The facts that the device was completely safe, and that no adverse side effects had ever occurred, were also important considerations. In addition, the comblike teeth of the device separates the hair so that the nine laser beams emitted can easily reach the scalp without absorption or interference from existing hair, and the laser beams themselves are visible light energy allowing the patients to see for themselves that the device is operating.

In total, 35 patients with androgenetic alopecia (AGA) were involved in the study, of which 28 were males, aged 28 to 72, and 7 were females, aged 46 to 76. Each patient was given a HairMax LaserComb to use at home for six full months and was instructed to comb his/her entire scalp hair slowly (advancing one-quarter of an inch per second) for five to ten minutes every other day. The treatment was to be carried out when the hair and scalp were clean and the hair was dry. A hair count in the greatest area of alopecia and a determination of the tensile strength of the hair was carried out before treatment was started and again after six months of treatment.

As each patient was troubled by AGA to start with, the authors did not want to clip additional

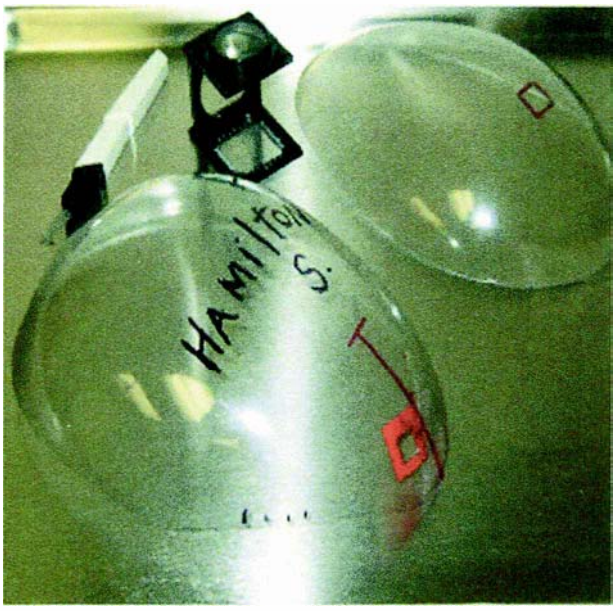

**FIG. 3.** Clear acrylic head mold with the one-square-centimeter opening noted in the vertex area, and outlined in red.

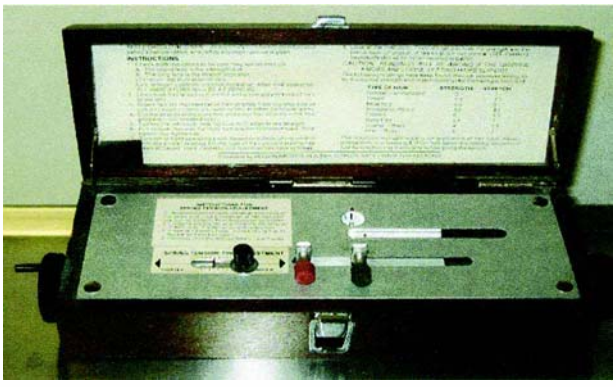

**FIG. 4.** A frontal view of the VIP HairOScope used for measuring the hair tensile strength.

hair for the hair counts. Accordingly, they created a clear acrylic mold of each patient's head, with the front of the mold positioned at the hairline, and a one-centimeter square removed from the mold in the area of greatest alopecia in either the temporal or vertex region (Fig. 3). For the hair count, the hairs within the one square centimeter space were pulled through the opening, and then counted using a surgical skin hook and a lens with five times magnification. Hair counts were carried out by both authors to confirm the accuracy of the data.

To test the tensile strength of the hair before treatment and after six months of treatment, three typical terminal hairs were removed from the one square centimeter area and a VIP HairOScope (Belson Imports, Hialeah, FL) used to determine the tensile strength (Fig. 4).

Table 1. HairMax LaserComb Hair Count Data

| | | | | | Hair Count | | | |
|---|---|---|---|---|---|---|---|---|
| *Number* | *Patient* | *Age* | *Sex* | *Area* | *Baseline* | *6 months after* | *Difference* | *Change(%)* |
| 1 | RC | 47 | M | T | 23 | 45 | 22 | 95.7 |
| 2 | CP | 34 | M | T | 33 | 51 | 18 | 54.5 |
| 3 | DL | 28 | M | T | 22 | 31 | 9 | 40.9 |
| 4 | SH | 56 | M | T | 6 | 11 | 5 | 83.3 |
| 5 | WG | 35 | M | T | 16 | 28 | 12 | 75.0 |
| 6 | JC | 29 | M | T | 38 | 56 | 18 | 47.4 |
| 7 | TM | 34 | M | T | 12 | 46 | 34 | 283.3 |
| 8 | JH | 51 | M | T | 18 | 27 | 9 | 50.0 |
| 9 | LM | 63 | M | T | 16 | 16 | 0 | 0.0 |
| 10 | JT | 29 | M | T | 15 | 23 | 8 | 53.3 |
| 11 | AT | 36 | M | T | 28 | 37 | 9 | 32.1 |
| | Average (T) | 40.2 | | | 20.6 | 33.7 | 13.1 | 74.1 |
| 12 | DB | 55 | M | V | 8 | 22 | 14 | 175.0 |
| 13 | RK | 37 | M | V | 36 | 41 | 5 | 13.9 |
| 14 | PP | 29 | M | V | 22 | 61 | 39 | 177.3 |
| 15 | EL | 34 | M | V | 19 | 36 | 17 | 89.5 |
| 16 | JI | 51 | M | V | 18 | 27 | 9 | 50.0 |
| 17 | BG | 48 | M | V | 14 | 64 | 50 | 357.1 |
| 18 | SA | 59 | M | V | 12 | 23 | 11 | 91.7 |
| 19 | DB | 29 | M | V | 18 | 26 | 8 | 44.4 |
| 20 | EW | 38 | M | V | 22 | 28 | 6 | 27.3 |
| 21 | JS | 56 | M | V | 18 | 31 | 13 | 72.2 |
| 22 | MB | 35 | M | V | 22 | 39 | 17 | 77.3 |
| 23 | PL | 46 | M | V | 12 | 23 | 11 | 91.7 |
| 24 | JL | 72 | M | V | 12 | 33 | 21 | 175.0 |
| 25 | CR | 42 | M | V | 12 | 23 | 11 | 91.7 |
| 26 | PH | 60 | M | V | 12 | 27 | 15 | 125.0 |
| 27 | RH | 42 | M | V | 24 | 38 | 14 | 58.3 |
| 28 | JB | 30 | M | V | 4 | 17 | 13 | 325.0 |
| | Average (V) | 44.9 | | | 16.8 | 32.9 | 16.1 | 120.1 |
| | Average (V + T) | 43.1 | | | 18.2 | 33.2 | 15.0 | 102.7 |
| 29 | JL | 56 | F | T | 32 | 51 | 19 | 59.4 |
| 30 | FP | 66 | F | T | 19 | 27 | 8 | 42.1 |
| 31 | EL | 71 | F | T | 22 | 29 | 7 | 31.8 |
| 32 | LW | 46 | F | T | 8 | 15 | 7 | 87.5 |
| | Average (T) | 59.8 | | | 20.3 | 30.5 | 10.3 | 55.2 |
| 33 | NC | 64 | F | V | 19 | 29 | 10 | 52.6 |
| 34 | PJ | 76 | F | V | 18 | 36 | 18 | 100.0 |
| 35 | RM | 49 | F | V | 19 | 27 | 8 | 42.1 |
| | Average (V) | 63.0 | | | 18.7 | 30.7 | 12.0 | 64.9 |
| | Average (T + V) | 59.8 | | | 20.3 | 30.5 | 10.3 | 55.2 |
| | Average (T, M + F) | 45.4 | | | 20.5 | 32.9 | 12.3 | 69.1 |
| | Average (V, M + F) | 47.6 | | | 17.1 | 32.6 | 15.5 | 111.9 |
| | Average (T + V, M + F) | 46.7 | | | 18.5 | 32.7 | 14.1 | 93.5 |

M, male; F, female; T, temporal; V, vertex.

## RESULTS

The scientific data for the hair counts is demonstrated in Table 1, and the data for the tensile strength of the hair recorded in Table 2. One-third of the patients did report some temporary slightly increased hair shedding during the first one or two months of treatment, but after two months, this no longer occurred.

In summary, Table 1 shows that the hair counts increased in the temporal area an average of 55.2% in women, 74.1% in men, and 69.1% for all patients. In the vertex area, the corresponding percentages were 64.9% for women, 120.1% for men, and 111.9% for all patients. There was a hair count increase of 93.5% when all temporal and vertex patients were combined. In general, males and the vertex area did the best, but both sexes and all areas did demonstrate significant improvement.

Table 2. HairMax LaserComb Hair Tensile Strength Data

| | | | | | *Hair tensile* | | | |
|---|---|---|---|---|---|---|---|---|
| *Number* | *Patient* | *Age* | *Sex* | *Area* | *Baseline* | *6 months after* | *Difference* | *Change(%)* |
| 1 | RC | 47 | M | T | 4.5 | 5.9 | 1.4 | 31.1 |
| 2 | CP | 34 | M | T | 3.8 | 6.1 | 2.3 | 60.5 |
| 3 | DL | 28 | M | T | 3.7 | 4.2 | 0.5 | 13.5 |
| 4 | SH | 56 | M | T | 2.1 | 3.5 | 1.4 | 66.7 |
| 5 | WG | 35 | M | T | 2.3 | 3.6 | 1.3 | 56.5 |
| 6 | JC | 29 | M | T | 2.4 | 4.1 | 1.7 | 70.8 |
| 7 | TM | 34 | M | T | 1.2 | 5.2 | 4.0 | 333.3 |
| 8 | JH | 51 | M | T | 5.5 | 6.3 | 0.8 | 14.5 |
| 9 | LM | 63 | M | T | 2.4 | 2.9 | 0.5 | 20.8 |
| 10 | JT | 29 | M | T | 4.2 | 4.9 | 0.7 | 16.7 |
| 11 | AT | 36 | M | T | 4.6 | 5.7 | 1.1 | 23.9 |
| | Average (T) | 40.2 | | | 3.3 | 4.8 | 1.4 | 64.4 |
| 12 | DB | 55 | M | V | 1.6 | 3.7 | 2.1 | 131.3 |
| 13 | RK | 37 | M | V | 4.0 | 5.8 | 1.8 | 45.0 |
| 14 | PP | 29 | M | V | 2.9 | 5.8 | 2.9 | 100.0 |
| 15 | EL | 34 | M | V | 4.1 | 5.4 | 1.3 | 31.7 |
| 16 | JI | 51 | M | V | 1.9 | 3.1 | 1.2 | 63.2 |
| 17 | BG | 48 | M | V | 3.5 | 4.7 | 1.2 | 34.3 |
| 18 | SA | 59 | M | V | 2.3 | 5.0 | 2.7 | 117.4 |
| 19 | DB | 29 | M | V | too short | | N/A | N/A |
| 20 | EW | 38 | M | V | 2.9 | 3.1 | 0.2 | 6.9 |
| 21 | JS | 56 | M | V | 1.1 | 3.1 | 2.0 | 181.8 |
| 22 | MB | 35 | M | V | 0.8 | 2.3 | 1.5 | 187.5 |
| 23 | PL | 46 | M | V | 1.7 | 4.0 | 2.3 | 135.3 |
| 24 | JL | 72 | M | V | 2.9 | 4.6 | 1.7 | 58.6 |
| 25 | CR | 42 | M | V | 2.8 | 4.3 | 1.5 | 53.6 |
| 26 | PH | 60 | M | V | 2.4 | 4.3 | 1.9 | 79.2 |
| 27 | RH | 42 | M | V | 1.3 | 3.5 | 2.2 | 169.2 |
| 28 | JB | 30 | M | V | 3.8 | 5.1 | 1.3 | 34.2 |
| | Average (V) | 44.9 | | | 2.5 | 4.2 | 1.7 | 89.3 |
| | Average (V + T) | 43.1 | | | 2.8 | 4.4 | 1.6 | 79.5 |
| 29 | JL | 56 | F | T | 2.0 | 4.6 | 2.6 | 130.0 |
| 30 | FP | 66 | F | T | 3.2 | 3.8 | 0.6 | 18.8 |
| 31 | EL | 71 | F | T | 2.2 | 4.0 | 1.8 | 81.8 |
| 32 | LW | 46 | F | T | 2.7 | 5.4 | 2.7 | 100.0 |
| | Average (T) | 59.8 | | | 2.5 | 4.5 | 1.9 | 82.6 |
| 33 | NC | 64 | F | V | 1.7 | 2.9 | 1.2 | 70.6 |
| 34 | PJ | 76 | F | V | 2.1 | 3.4 | 1.3 | 61.9 |
| 35 | RM | 49 | F | V | 2.1 | 3.8 | 1.7 | 81.0 |
| | Average (V) | 63.0 | | | 2.0 | 3.4 | 1.4 | 71.1 |
| | Average (T + V) | 59.8 | | | 2.5 | 4.5 | 1.9 | 82.6 |
| | Average (T, M + F) | 45.4 | | | 3.1 | 4.7 | 1.6 | 69.3 |
| | Average (V, M + F) | 47.6 | | | 2.4 | 4.1 | 1.7 | 86.4 |
| | Average (T + V, M + F) | 46.7 | | | 2.7 | 4.4 | 1.6 | 78.9 |

M, male; F, female; T, temporal; V, vertex.

Similarly, in Table 2, the hair tensile strength increased in the temporal area 82.6% in women, 64.4% in men, and 69.3% in both sexes. In the vertex area, the percentages were 71.1% for women, 89.3% for men, and 86.4% for both sexes. The hair tensile strength was increased 78.9% when all temporal and vertex patients were considered. There was greater improvement in the vertex area in males, but more improvement in the temporal area in females. Both sexes and all areas did benefit significantly.

## DISCUSSION

In general, the results far exceeded the expectations of the authors, and they were pleased to be able to document the benefits that LLLT with the HairMax LaserComb can achieve for both men and women in both the temporal and vertex regions. Although there were four times as many men as women patients in the study, each sex did demonstrate significant benefits from the LLLT.

The mechanism or mechanisms of action of LLLT are unknown with regard to the stimulation of hair growth or how the hair tensile strength is increased so greatly. From wound healing studies, it is known that LLLT causes an increase in the microcirculation of tissue and a reduction in inflammation.[2] The amount of cellular energy in the form of adenosine triphosphatase (ATP) is also increased following LLLT.[2] Perhaps one or more of these beneficial effects are responsible for the results that we were able to achieve. The authors hypothesized that the early temporary hair shedding experienced by some patients was most likely related to an accelerated hair cycle in general. Obviously, more research is required if we are to fully understand the scientific findings noted in this paper.

## CONCLUSION

LLLT with the HairMax LaserComb is an effective treatment for stimulating hair growth and increasing the tensile **strength** of hair in both sexes in both the temporal and vertex regions. In the authors' opinion, LLLT should be given serious consideration as an option in the treatment of AGA in view of its safety, ease of patient home administration, and the benefits documented in this study.

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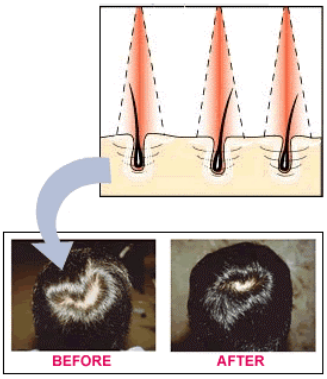
**Note: DermaLogix Cosmedics Pte Ltd inserts this part of the report**

# The HairMAX LaserComb

The HairMAX LaserComb is the one and only home laser device in the world. Designed and developed in Sydney, Australia from 13 years of clinical experience. Manufactured in USA and patent pending in 104 countries. It is a smart way to thicker and healthier hair. Complies with USA FDA laser safety regulations. It is safe, effective and without side effects.

The HairMAX LaserComb is effective for both Male pattern hair loss and Female pattern hair loss. The HairMAX LaserComb uses "Cold Beam" or Low Level Laser to stimulate thicker hair growth through the process of photo-biological stimulation. Clinical studies have shown that bio-stimulation of "cold-beam" or Low Level Laser Therapy (LLLT) gives numerous positive effects to the skin and hair.

- No need to pay again and again for expensive and unnecessary treatments at hair centers or hair clinics - no need to be held ransom by hair centers.
- Only 10 minutes twice a week, done at home or while traveling. Share it with family members and your love ones.
- Complies with US Food & Drug Administration (FDA) CDRH laser safety standards (section 21) - completely safe, effective and absolutely no side effects.
- Certified by the Canadian Government as a Class 2 medical device for claims on the prevention of hair loss and stimulate hair growth for man and woman.
- Registered as a Class 2A medical device with HSA Singapore.
- European CE certification for conformity with essential health and safety requirements set out in the European Directives.



# How the HairMAX LaserComb Works

The laser energy produced by the HairMAX LaserComb is within the accepted level of LLLT. The HairMAX LaserComb uses a laser diode operating in the red portion of the visible colour spectrum. Laser energy is different from natural light in several ways. It is monochromatic, which means all the energy is essentially one wavelength or colour whereas a light bulb produces a broad spectrum of light and energy waves.

Laser energy is also collimated which means it is a tight beam of light energy that spreads or diverges only a little at great distances while a light bulb loses its brightness very quickly with distance.

And laser energy is also coherent.

All energy consists of waves of energy and in the light bulb these waves are not organized or in sync with each other. The waves of light energy produced by a laser are synched or in phase with each other. These characteristics make laser energy a truly unique form of light energy.

The LaserComb bathes your hair root with the nourishing light and is designed to energize your hair light energy. All cells love light. When hair cells are exposed to low level laser light the cells responded through the process of photo-bio stimulation. Just like cells in plants produce positive energy and food through photosynthesis.

The monochromatic light waves produced by laser light are the crucial factor in photo-biostimulation. Light and all electromagnetic energy travels as bundles of energy called photons. The center (nucleus) of an atom contains neutrons and protons. Electrons moving in specific orbits surround the nucleus. Energy, in the form of photons, is released when the electrons change orbits.

It is these bundles of energy called photons that trigger biological changes within the body. Photon energy is absorbed by the DNA, thus activating it. The cell's DNA then transmits this new energy to the cell walls by means of a protein and calcium transfer. Then the cell walls transform themselves into healthy shapes, allowing the cell to function again at full capacity.

The tissues exposed to light increase blood flow, thus helping to carry vitamins and nutrients into the area where they are needed most, with no damage to surrounding tissues. As a result of increased blood flow, toxins and waste bi -products including harmful DHT are taken away from the hair cells.

In summary, within weeks you will experience lesser hair loss and within 2 to 3 months better thicker hair growth.

# Effects of Laser on Cell Frequency

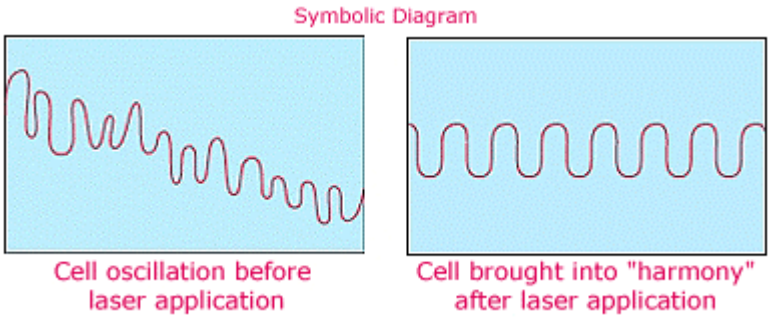
Scientific studies on cell cultures have shown that laser penetrates into soft tissue and increases the action of adenosine triphosphate (ATP), a molecule that is a major carrier of energy from one reaction site to another in all living cells. According to the eminent scientist **Popp***. in his article On the coherence of ultraweak photon emission from living tissues living cells actually give out ultra-weak photons (light) with a coherence characteristic to laser.

Popp theorised that soft tissue and fluids in our bodies actually vibrate! And they do this within a frequency range similar to that of low-level laser. Popp postulated that "sick" cells are "light-starved" and when irradiated with low level laser in the correct frequency range they become "light-restored" and healthy.

* Popp FA. On the coherence of ultraweak photon emission from living tissues. Kilmister CW (ed), Disequilibrium and Self-Organisation, 207-230. 1986 Reidel

Another of many scientific theories* is that cells are largely dependant for healthy function on an exchange of energy and 'information' with surrounding cells. This is achieved via individual wave systems by which cells 'communicate' through inter-connective plasma – which is affected by low level laser working at quantum level.

*Wolbarsht ML. Ed: Clinical aspects of laser research. Plenum Press New York p116 1977



# Biological Effects of Low Level Laser Therapy**

Professor Pöntinen PJ, one of the pioneers of laser therapy in Scandinavia in his book Low Level Laser as a treatment modality documented that Low Level Laser Therapy can have very positive impact on skin and hair cells, namely:

(1)Increased Arterial Micro-Circulation: Both vasodilation and regeneration of blood vessels.

(2.) Increased Venous and Lymphatic Flow: Results in reduced edema clinically.

(3.) Decreased Inflammation in Tissue: Marked increase in the number of leucocytes that participate in phagocytosis.

(4) Faster Rate of Cell Division

(5) Faster Regrowth of Epithelium

(6) Faster Rate of Collagen Formation

(6) Faster Rate of Wound Healing

(7) Minimal Scar Formation

(8) Decreased Keloid Formation

(9) Increased Energy of the Tissue

- Increased ATP in the cellular mitochondria.

- There is activation of RNA- and DNA production

(10) Stimulation of Hair Growth

** Pötinen, PJ. Low Level Laser Therapy as a Medical Treatment Modality, Art Urpo LTD., Tampere, Finland, 99-101, 1992.

# What is Low Level Laser Therapy

The term LASER is an acronym for:
**L**ight **A**mplification by **S**timulated **E**mission of **R**adiation.

Radiation, in this case, refers to the coherent light energy released, which produces the light beam. There are two types of lasers: High power laser or "hot laser" and Low power laser or "cold lasers". The thing that determines whether a machine is hot or cold is the amount of energy that comes from the machine.

Hot lasers cause thermal (heat) changes and destroy tissues. They are only used in the medical field. Cold lasers don't cause thermal changes in the tissues therefore it is allowed and in recent years have been approved by US FDA to be used in salons and spas by Aestheticians.

Toady "Cold Laser" are sometimes called Low Level laser Therapy (LLLT) , or Low Light Laser Therapy some doctors refer it as "Cold Beam" therapy. For our purposes we shall simply refer this technology as LLLT.

# History of Lasers

Many of the required scientific principles for the advent of lasers were set in place by the 19th and early 20th centuries. Descriptions of wave theory by Maxwell in 1864, quantum theory by Planck in 1905 and atomic structure by Bohr in 1913 paved the way for the future development of this technology.

The true father of lasers was Einstein, who theorized on the stimulated emission of radiation in 1917 as part of his paper on quantum theory. His theories evolved into practice with the development of masers (Microwave Amplification of the Stimulated Emission of Radiation) by Gordon in 1955 and lasers by Maiman in 1960. Mainman's initial work with the ruby wavelength ushered in a tide of new lasers over the next few years. These included the HeNe and Nd:Yag lasers in 1961, the argon laser in 1962 and the CO2 laser in 1964. They were employed as dermatological systems from the time of their introduction.

## Laser Light vs. Day Light

A laser is a device that emits a special form of light. The light is special because it consists of light waves of a single wavelength, in which all the waves reinforce one another. (It is like a heavy surf with large waves breaking on a beach instead of many small waves.) It is also called coherent light, where the waves reinforce one another.

Normal daylight is incoherent light and consists of varying wavelengths of all the colors of the rainbow, from blue (400 nanometers in length) to red (750 nanometers in length).

Professor Mester of Budapest University has made many experiments with animal and human cells to be able to explain the function of light on cells. The monochromatic light influences the DNA to use the lipoproteins in the treated area, so the cell has better function, as well as to produce collagen and elastin.

According to Dr. Mesters' experiments, it was the monochromatic light and not the coherence of the light that had more positive effect on cells. Since Professor Mester's studies, and companies started manufacturing Low Level Laser Therapy machines, their experiments showed that this monochromatic light has significant positive improvement on the biological function on cells.

## Clinical Research on Low Level Laser Therapy

For the last 30 years, scientists in the United States and Europe have been researching the clinical uses of lasers. The research has partly focused on the use of low-level lasers in a process called photobiostimulation - their ability to stimulate a variety of cellular functions in a non-thermal (heat), non-destructive manner. Cold lasers, as they are called, are now available for use.

Monochromatic light waves produced by laser light are the crucial factor in photo-biostimulation. Light and all electromagnetic energy travels as bundles of energy called photons. The center (nucleus) of an atom contains neutrons and protons. Electrons moving in specific orbits surround the nucleus. Energy, in the form of photons, is released when the electrons change orbits.

It is these bundles of energy called photons that trigger biological changes within the body. We are constantly bombarded by random photons from ordinary light sources including sunlight. Light created by a laser or an LED device, have the ability to 'concentrate' these photons.

## Photo - Bio Therapy (Light therapy)

When photons are introduced onto the skin, they are absorbed by the skin and underlying tissue, triggering biological changes within the body in this photo biostimulation process. Photon energy is absorbed by the DNA, thus activating it. The cell's DNA then transmits this new energy to the cell walls by means of a protein and calcium transfer. Then the cell walls transform themselves into healthy shapes, allowing the cell to function again at full capacity.

The tissues exposed to light increase blood flow, thus helping to carry vitamins and nutrients into the area where they are needed most, with no damage to surrounding tissues. As a result of increased blood flow, toxins and waste bi increased blood flow, toxins and waste bi-products products are taken away from the tissues.

Light therapy is also called "photo therapy". For instance, visible red light has been shown to effect positive changes at a cellular level on living tissues. It is very beneficial in treating problems close to the surface. Skin layers, because of their high blood and water content, absorb red light very readily.

Red light can be created by a laser or by an LED-type machine.

## Scientific Medical Presentations

1. LLLT for Hair Stimulation, the 9th annual meeting of the International Society for Hair Restoration Surgery, Puerto Vallarta, Mexico, Oct. 20th, 2001.

2. LLLT for Hair Loss Prevention and Hair Regrowth, the 18thy annual meeting of the American Acadamy of Cosmetic Surgery, Fort Lauderdale, FL, Feb. 3rd, 2002.

3. Hair Loss Prevention and Hair Regrowth with LLLT, the 7th annual congress of the Italian Society of Hair Resotartion Surgery, Florence, Italy, June 5th, 2002.

4. Hair Loss Prevention and Hair Regrowth with LLLT, the 5th annual congress of the European Society of Hair Restoration Surgery, London, England, June 9th, 2002.

Hair Loss Prevention and Hair Regrowth with LLLT, The 19th annual meeting of the American Academy of Cosmetic Surgery, Palm Springs, CA, Jan. 26th, 2002.

# Reported Studies of LLLT in Hair Loss (Man & Woman)

**NOTE:** These medical studies are Extracts of reports submitted . Various light sources, including lasers, have been used in attempt's to grow hair and stop hair loss since the 1950's. Some of these studies have included light sensitive drugs. These studies are not presented here.

### Professor Andre Mester (1964)

In 1964, Professor Andre Mester began experimenting with the use of low-power laser energy in Budapest, Hungary. He observed that low energy laser exposure has a stimulating effect on the biological system, while high-energy laser exposure had an inhibiting effect. In his experiments with wound treatment on mice, he noticed rapid healing due to microcirculation of blood supply.

This healing was also obvious in laser light treatment of diabetic patients suffering with dystrophic sores. He was amazed to find sores that would not otherwise heal were healed, and he also observed accelerated hair growth and thickening of hair in the treated areas. This theory through its evolution has since been refined and is widely becoming one of the most popular non-invasive hair loss treatments.

Laser researcher Dr. J. Layton Wright states: … **"Laser Hair Therapy increases microcirculation of the hair follicle, which allows nutrients and freshly oxygenated blood to access the hair follicle with the results being a stimulation of the natural hair growth cycle."**

### Dr. Trelles (1984)

In 1984, Dr. Trelles showed in one study that patients with alopecia areata who were treated with He-Ne laser 632,8 nm showed a good response. Dr. Trelles reported that most of the patients with alopecia areata responded well after only 6 to 8 treatments administered twice a week for a couple of weeks.

The He-Ne laser was placed 30 centimeters from the alopecia areata with dosages ranging from 3-4 Joule per sq. cm. No fibres or lenses were used. In the same study, microscopic evaluation of the hair shaft structure on the alopecia areata irradiated areas showed a clear medulla rich in keratin after treatment. Daily treatments appeared to prevent regrowth, causing irritation with probable increase in hair loss.

### Japan Laser Therapy Association (1992)

At the 4th annual Meeting of the Japan Laser Therapy Association in 1992, success was reported with an increase in both hair growth and the density of the hair follicles in the laser treated areas of both male and female stress alopecia and alopecia areata with only one failure out of 40 cases reported in two papers.

### Laser Conference, Helsinki Finland (1993)

An unpublished study presented at Laser Conference, Helsinki, Finland 1993 shows the effect of LLLT on Androgenetic Alopecia. A double-blind comparative study with placebo laser for treatment of Hereditary Androgenetic Alopecia in young males was presented in Helsinki 1993 describing the positive effect of LLLT treatments on hair growth, stop of hair loss and hair shaft tensile strength.

At the Helsinki Laser Conference research results demonstrating the effect of LLLT compared to a placebo group was presented. It was found that hair re-growth was clearly shown in the laser group. In addition all patients, with the exception of one, in the laser-treated group showed a complete stop of hair loss. All patients, except 3, showed a clear hair re-growth of hair with a reduction of at least one category in the Hamilton classification.

Post-treatment showed the dermis with almost the same amount of hair follicles as pre-treatment, although a number of new follicles could be seen with clearly noticeable hair growth. 50% of the follicles are now in the anagen phase (growth).

When comparing the histological findings, transformation into anagen hair follicles could be observed in 83% of the patients on laser treatment but in none of the placebo patients. Out of 18 patients, 14 showed an increase in hair thickness, and all 18 showed improvement in general hair shaft quality measured with the hair stretcher.

The results showed no improvement in the placebo group or any adverse effects of the treatment.

### Prof. Pekka J. Pöntinen (1996)

Professor Pöntinen is one of the pioneers of LLLT in Scandinavia thorough theoretical and practical studies on how to apply low level laser therapy in the treatment of chronic, especially musculoskeletal and myofascial pain and dysfunction, vascular disturbances, wound and ulcer treatment etc.

Prof. Pekka J. Pöntinen established the beneficial effect of Laser Hair Care® on scalp blood flow and published his results in 1996.

The effects of hair lasers on skin blood flow were measured on three different devices to establish the effect of scalp blood flow. The hair lasers used were Laser Hair Care (670 nm ), a He-Ne (632.8 nm ) laser containing one laser transferring light via fibres and lenses to the patient and a laser identical to the Laser Hair Care where the lasers were replaced (placebo).

The differences in the laser systems are illustrated by the fact that Laser Hair Care increased scalp blood flow by 54%. The He-Ne hair laser had no effect while the Placebo decreased flow rate by 36%. In addition, the skin temperatures measured before and after the treatment showed little change.

### European Studies (1997)

In 1997 a European group of scientist's published their work on LLLT in the treatment of alopecia of the scalp. The authors tried to verify the efficacy of low energy laser (LLLT) in scalp alopecia. Sixty patients were divided in two groups: A) laser group, 33 patients treated with both LLLT and classical therapy; B) control group, 27 patients treated only with classical therapy, Before, during and after treatment, historical samples were done.

For the group A the results were rather superior but in a twice shorter time shorter time than group B. The maintenance of the good results needed classical therapy for a long period. They conclude that LLLT therapy could have a useful complementary method for the treatment of scalp alopecia.

The same European group of scientist's published their findings on LLLT use in the treatment of alopecia and crural ulcers in 1998. The authors tried to verify the efficacy of LLLT in scalp alopecia and crural ulcers of different causes. Laser used was (red diode, continuous emission, 8 mW power, wave length 670 nm spot size about 5 mm diameter on some points. They also use as control classical therapy. Before, during and after treatment, histological samples were taken from alopecia regions. For the laser groups (alopecia and ulcers) the results were rather superior and in a three or twice time shorter than the control group. They conclude that LLLT therapy is a very useful complementary method for the treatment of scalp alopecia and crural ulcers.

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