"All forms of matter are really light waves in motion." **- Albert Einstein**

AURA PTL II
WHITE PAPER

The AURA PTL II, represents the first true integration of functional, energetic and alternative medicine. The AURA PTL II represents the next step in accelerating recovery from tissue damage, disease and stress. The AURA PTL II Clinical System is the first technology of its kind that uniquely blends precision high frequency therapy, Low Level Light Therapy (LLLT), acupoint stimulation, homeopathy, nutrition and energetic substance specific frequencies to create integrated clinical protocols.

The AURA PTL II delivers 635nm, <5mW laser beams as carriers of both substance specific "information" and precision high frequency therapies. The ***AURA PTL II Clinical System*** is designed to support and enhance the integrated use of acupoint stimulation, homeopathy and nutrition to provide patient care for issues related to inflammation, pain, nerve and general biostimulation and cellular biomodulation.

At ***BioLight Technologies*** it is our belief that pain and suffering is not caused by the presence of disease, but the absence of one or more components of health. Light, frequency therapy, homeopathy, nutrition and the correct corresponding application can restore a number of the missing components – thereby restoring a segment of health that has previously been missed.

The ***AURA PTL II*** is being recognized worldwide by multiple health care disciplines as the finest quality, most user-friendly, technically advanced and ***ONLY Pulsed Induction LLLT unit on the market today***.

Defining Light Therapy

Light and the absence of light has profound and far-reaching effects on human physiology. As the sun's light patterns change with the seasons, the biological rhythms of the human body shift as well. This well-established necessity for light has led into this investigation and therapeutic use of light to treat a variety of conditions**.** Such treatments are generally described as light therapy.

In the 1950's and 1960's, Chicago banker turned photobiologist, Dr. John Nash Ott pioneered an investigation into the benefit of full spectrum lighting on plants and animals. He found that most plants and animals need full spectrum light to thrive. He also determined that limiting the spectrum of light would cause plants and animals to reproduce only one gender and that offspring would not grow to full maturation. Science now suggests that it is the absence of specific wavelengths and possibly the imbalance of other wavelengths of light found in common artificial light that can cause specific illness in plants, animals and humans. This is similar to the way an absence of specific nutrients or imbalanced food in your diet would cause illness.

The Application of Low Level Light Therapy

Lasers are a unique light source. They produce only one specific wavelength of light, not a full spectrum of light like the sun would produce. All of the light waves stream out of a laser in the same direction and phase. This is called a coherent beam of light. This coherent beam is what allows a laser pointer to produce a point of light across a room. This allows a specific spectrum of light to be focused on specific parts of the body.

In his book, Energy Medicine: The Scientific Basis (ISBN # 0-443-06261-7), James L. Oschman makes multiple references to the communication within the body - from cell to cell – as coherent light or laser light. This may further explain the enormous and sometimes surprising success with wound and bone healing, neurological rehabilitation, and illness reversal when using coherent LLLT. One researcher describes the effects of light therapy as follows:

> "The exact mechanism of action of low level laser therapy is still not completely understood. Its basic feature is to modulate cell behavior, without causing significant temperature increase. During irradiation of a tissue with a laser beam, an interaction between cells and photons takes place--photochemical reaction. After a cell absorbs the photon, the photon stops existing, and its energy is incorporated into the molecule which has absorbed it. Once this energy is transferred to different biomolecules, it can be transferred to other molecules as well. The energy transferred to the molecule can increase its kinetic energy, and activate or deactivate enzymes or alter physical or chemical properties of main macromolecules. Effects of low level laser therapy on wound healing process is one of the most fully studied aspects of this type of therapy. It affects all phases of this very complex process." [1]

[1] Low level laser irradiation and its effect on repair processes in the skin, Matic M, Lazetic B, Poljacki M, Duran V, Ivkov-Simic M.

Laser Light Therapy and Wound Healing

A brief review of literature reveals amazing effects of LLLT on wound healing. A study in Brussels, Belgium studied the influence of LLLT on the proliferation of fibroblasts and on the lymphatic regeneration. Four parameters were studied (Adhesion, local edema, regeneration of the vein and regeneration of the lymph vessel), with the following results:

> The adhesion of the scar with the under laying tissues disappeared after 10 days in the control group and after 4 days in the experimental group, a 60% improvement with LLLT therapy. The local edema disappeared in the test group after 8 days, while in the control group it lasted until 10 days, a 20% improvement.

A considerable acceleration of the regeneration of both vein and lymph vessel was also seen in the test group.[2]

In another study, the mean time required for complete closure of a sutured wound in the control group was 7 days while irradiated test wounds took only 5 days to heal. The mean breaking strength, as measured by the ability of the wound to resist rupture against force, was found to be significantly increased in the test group. Early neovascularization, epithelization, increased fibroblastic reaction, and leucocytic infiltration were seen in the laser-irradiated wounds.[3]

Wound healing on animals and humans with use of low level laser therapy following sport and traffic accident injuries resulted in a 25-35% acceleration of healing on 74 patients over control group.[4]
A very surprising finding of wound healing with LLLT is the systemic effect that it has on the body. Ten days after receiving an 8mm circular full thickness hole in both hips, the control group of rats averaged 26% closure, but irradiated rats averaged a closure of 65% on both left (irradiated) and right (non-irradiated) hips **- *a systemic effect on the right, as it received no irradiation*. *A similar study involved mice and rabbits receiving bilateral fractures where only one side was irradiated in the test group and no irradiation was performed on the control group. Both sides of the test group healed significantly faster than the control group.*[5]**

This systemic effect casts a whole new light on LLLT therapy. It is not just the illumination of a specific cell or group of cells that creates improved healing of that area alone, LLLT stimulates the entire organism's physiology and systemic healing is observed.

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2 Wound healing process: Influence of LLLT on the Proliferation of Fibroblasts and on Lymphatic Regeneration, Lievens P, van der Veen, PhD, Department of Rehabilitation Research, Vrije Universiteit Brussel, Brussels, Belgium.

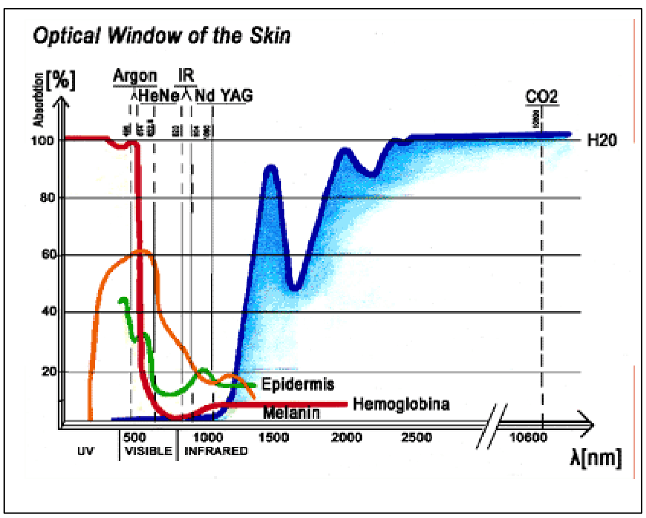
3 Effect of helium-neon laser on wound healing, Bisht D, Mehrotra R, Singh P A, Indian Journal of Experimental Biology. 1999; 37(2): 187-189

4 Wound Healing on Animal and Human Body with Use of Low Level Laser Therapy - Treatment of Operated Sport and Traffic Accident Injuries: A Randomized Clinical Study on 74 Patients with Control Group, Simunovic Z, Ivankovich A D, Depolo A.

5 Wound healing; US Food & Drug Administration: results from a preliminary wound healing trial. Waynant R, Notes from a presentation at the 2nd Congress of The World Assoc. for Laser Therapy, Kansas, MO, USA, Sept. 25, 1998.

Another aspect of LLLT is the ability to treat the wound without disturbing the wound. LLLT can be administered through the bandages as effectively as on the skin with only a minor increase in treatment time. This speeds the patient's recovery by not disturbing the wound, lessens the time to apply the therapy, and reduces the risk of infection by exposing the wound for prolonged periods of time.[6]
The overall effect of low-level light therapy was well summarized in a study on sutured wounds of the teat in dairy cattle. The LLLT affects various aspects of the healing process, including minimizing inflammation and formation of edema, improvement of skin regeneration and enhancement of collagen synthesis.[7]

635nm Light



Light is measured in wavelengths called nanometers (nm). One nanometer is one billionth of a meter. This can be represented by scientific notation as 10-9 meters or .000000001 meter = 1nm. The wavelength of visible light falls between 380nm to 760nm. Higher wavelengths are in the infrared realm where most heat is carried. The lower wavelengths, less than 380nm such as ultraviolet and x-rays are where most organic damage can occur. With today's technology a laser diode can be manufactured with almost any wavelength. ***What is the best wavelength of light to use? As evident in the following chart, the lower infrared wavelengths between 800nm to 1000nm, have the least absorption rate frequency by the skin. This allows for deeper penetration of light but it is less-absorbable and does not stimulate the physiology of the body as well as the visible red, 635nm wavelengths. Even though the 635nm wavelength has less body penetration it still has been found to stimulate proper oxygenation, detoxification of the cell, DNA replication, and regeneration of damaged nerve tissue more efficiently than other wavelengths.*** This is especially true in the study presented at The 2nd Congress of The World Association for Laser Therapy. This study demonstrated the systemic healing effect of LLLT where low doses 635-nm wavelength laser therapy were the primary stimulus in those studies. And ***due to the higher physiological responses, the AURA PTL II utilizes much less power with the same or greater response as infrared therapy units. To date, no research demonstrates any negative properties from low-level 635nm wavelength lasers.***

[6] Low-level Laser Therapy for Wound Healing: Feasibility of Wound Dressing Transillumination, Lilge L, Tierney K, Nussbaum E., Photonics Research Ontario, Toronto, Canada.

[7] Evaluation of low level laser therapy on primary healing of experimentally induced full thickness teat wounds in dairy cattle, Ghamsari SM, Taguchi K, Abe N, Acorda JA, Sato M, Yamada H., Department of Veterinary Surgery, School of Veterinary Medicine, Obihiro University of Agriculture and Veterinary Medicine, Hokkaido, Japan.

Power or Amplitude of Light

The brightness of light is measured in Watts of power. If you have a 100-Watt light bulb it will produce a brighter, hotter light than a 50-Watt light bulb. The brightness and heat of lasers are also measured in watts, however, low-level lasers are far below 1 Watt therefore measured in Milliwatts (mW) of power. One mW is 1/1000 Watt***. LLLT is sometimes referred to as cold laser, which means that the level of energy will not significantly raise the temperature of the skin or internal tissues when exposed to the light, no matter how long the exposure period.*** Their power is important since it has been discovered that raising the temperature in the tissue can have many adverse effects on the healing process. The class IIIa laser is considered a Low Level or cold laser and must be under 5mW in power. This is in contrast to what most people relate a laser to be which is a hot laser commonly used in medical practice for cauterizing, cutting, and burning tissue. These lasers usually start at 1,000mW or 1 Watt and higher. The number of watts determines the amount of energy the laser produces in any given time frame. This unit of measure is referred to as Joules of energy. Many higher power infrared lasers and LED arrays base their therapy protocols on the Joules of energy produced. However, ***Joules of energy produced does not appear to have the same importance when it comes to low level pulsed visible red laser light.***

Many times the desired physiological effect is obtained within a few seconds of exposure and any additional exposure can cause over stimulation of the tissue. So even though logic would dictate that the more energy the better the therapy, how the body responds to the energy is the final factor for determining the best therapy session.

Effects of Laser Light on Bacteria

The effects of laser light on bacteria are quite varied depending on the wavelength and pathogen.

- The 905-nm wavelength light had a negative effect on S. aureus bacteria with an increased growth of 27% following irradiation at 50 J/cm^2.
- The 660-nm wavelength light had a marginal benefit on some pathogens.
- The 810-nm wavelength light reduced the growth of P. aeruginosa by 23% following irradiation of 5 J/cm^2 but increased the growth of E. coli by 30% following irradiation of 20 J/cm^2
- ***The 630-nm wavelength light reduced the growth P. aeruginosa and E. coli by 27% with only 1 J/cm^2***

This study concluded that a wavelength of 630-nm appeared to be most commonly associated with bacterial inhibition.[8]

Overall the 635nm wavelength lasers at about 5mW of power have shown to be the safest and still possess the greatest impact on the widest array of tissue. Consequently, the medical advisers BioVeda Technologies have elected to use this wavelength and power output for the AURA PTL II.

[8] Effects of 630-, 660-, 810-, and 905-nm laser irradiation delivering radiant exposure of 1-50 J/cm2 on three species of bacteria in vitro, Nussbaum EL, Lilge L, Mazzulli T.,Rehabilitation Services, Mount Sinai Hospital and Department of Physical Therapy, University of Toronto, Toronto, Ontario, Canada

Frequency Therapy

Frequency therapy has been utilized in the health field for nearly 75 years. It is probably one of the most researched, most documented and well established health procedures in existence. It is utilized world-wide and proven to be extremely powerful.

A recent article studied the rate and pulse duration on mast cell number and degranulation. They concluded that they could increase the mast cell number with continuous wave light but to achieve degranulation, pulsed light was more effective. Furthermore, different pulse rates had a greater influence on the degranulation effect. Unfortunately they did not select a specific frequency known to achieve the best effects they just selected a variety of different frequencies and still found a significant difference.[9]

To better understand the influence of frequencies on your health, consider how some frequencies can pollute your body and damage your health. It is well documented that EMF frequencies from your house electrical current or from high tension power lines, or the frequencies given off by your telephones and cell phones can have severe adverse effects to our health. When the body is polluted with foreign and destructive frequencies the most direct therapy is to use the proper frequency and light energy to restore this imbalance.

Frequencies are a natural form of communication. For example, Morse Code is nothing but a pattern of frequency changes. High-speed communications systems utilize pulsed frequency to transmit data. Pulsed frequency equates to the number of times you turn the laser on and off in one second. Amazingly, one of the fastest methods of transferring data is the use of high speed pulsed laser light through fiber optic cables. James L. Oschman concluded that the body utilizes coherent light for communication. Today's science is examining the various frequency components of that light communication. This is further verified by doctors around the world documenting the fact that specific frequencies stimulate or change specific functions in the body with remarkable accuracy.

[9] Effect of Laser Pulse Repetition Rate and Pulse Duration on Mast Cell Number and Degranulation. el Sayed SO, Dyson M., Tissue Repair Research Unit, U.M.D.S., London, United Kingdom.

Reference Articles

Low Level Laser Irradiation and Its Effect on Repair Processes in the Skin [Article in Croatian]

Matic M, Lazetic B, Poljacki M, Duran V, Ivkov-Simic M.
Klinika za kozno-venericne bolesti, Medicinski fakultet Novi Sad, Klinicki centar Novi Sad.
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INTRODUCTION:

Application of laser beams for therapeutic purposes is of relatively recent date, but today there is no field of medicine where lasers cannot be used.

PHYSICAL CHARACTERISTICS OF LASER RADIATION:

Laser radiation is a type of electromagnetic radiation with some specific characteristics such as coherence, monochromaticity and parallelity.

TYPES OF LASER DEVICES:

Nowadays, there are many laser devices on the market used in medicine and dentistry. According to the type of their active medium, lasers can be classified as solid, gas, semiconductor and liquid.

EFFECTS OF LOW LEVEL LIGHT THERAPY ON BIOLOGICAL SYSTEMS:

The exact mechanism of action of low-level light therapy is still not completely understood. Its basic feature is to modulate cell behavior, without causing significant temperature increase. During irradiation of a tissue with a laser beam, an interaction between cells and photons takes place--photochemical reaction. After a cell absorbs the photon, the photon stops existing, and its energy is incorporated into the molecule which has absorbed it. Once this energy is transferred to different biomolecules, it can be transferred to other molecules as well. The energy transferred to the molecule can increase its kinetic energy, and activate or deactivate enzymes or alter physical or chemical properties of main macromolecules.

EFFECTS OF LOW LEVEL LIGHT THERAPY ON WOUND HEALING:

Effects of low level light therapy on wound healing process are one of the most fully studied aspects of this type of therapy. It affects all phases of this very complex process. This paper offers a more detailed analysis of these aspects.

WOUND HEALING PROCESS:

INFLUENCE OF LLLT ON THE PROLIFERATION OF FIBROBLASTS AND ON THE LYMPHATIC REGENERATION

Lievens P, van der Veen Ph Department of Rehabilitation Research Vrije Universiteit Brussel, Brussels, Belgium

In order to fully understand the positive influence of LLLT on wound healing, we investigated the influence that laser has on proliferation of fibroblasts, one of the basic elements in the wound healing process, and on the regeneration of the lymphatic system, which is important for the evacuation of fluids and waste products out of the wound area.

Material and Method:

1) To do so we cultivated cells coming from 2 different mice (type NMRI) and divided 4 groups per mouse. Two were irradiated, two not using a IR (904nm, 3,7mW) laser. Then we did a BrdU labeling with 4 flasks (2 were irradiated, 2 control)

2) To investigate the regeneration of the lymphatic system, we made a standardized incision on the ventrolateral side of 600 mice. In the control group (n=500) as well as the experimental group the evolution of 4 parameters was studied (Adhesion, local edema, regeneration of the vein and regeneration of the lymph vessel) by means of transillumination microscopy. The wounds in the test group were irradiated twice a day with a combined HeNe (632nm, 5mW)-IR (904nm 68,8mW) laser.

Results:

1) The results show a significant increase ($p<0.05$) of fibroblast proliferation. The BrdU labeling showed an increased DNA activity. There is also a perfect match between number of fibroblasts and DNA activity.

2) The adhesion of the scar with the under laying tissues disappeared after 10 days in the control group and after 4 days in the experimental group. The local edema disappeared in the test group after 8 days, while in the control group it lasted until 10 days. A considerable acceleration of the regeneration of both vein and lymph vessel was seen in the test group.

Effect of Helium-Neon Laser on Wound Healing. Indian journal of experimental biology. 1999; 37(2): 187-189 Bisht D, Mehrotra R, Singh P A et al.

Two linear skin wounds were produced on either side of dorsal midline in rats and immediately sutured. Wounds on the left side were irradiated daily with helium neon laser at 4 J/cm2 for 5 min., while those on right side were not exposed and served as controls. The mean time required for complete closure in control group was 7 days while irradiated test wounds took only 5 days to heal. The mean breaking strength, as measured by the ability of the wound to resist rupture against force, was found to be significantly increased in the test group. Early epithelization, increased fibroblastic reaction, leucocytic infiltration and neovascularization were seen in the laser-irradiated wounds.

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Wound Healing on Animal and Human Body with Use of Low Level Laser Therapy - Treatment of Operated Sport and Traffic Accident Injuries: A Randomized Clinical Study on 74 Patients with Control Group.

Simunovic Z, Ivankovich A D, Depolo A.

A wound healing study on rabbits suggested that 4 J/cm2 was the optimal dose. A clinical study was performed on 74 patients suffering from injuries of soft tissue upon traffic accidents and sport activities. Two types of lasers were used: 830 nm for Trigger point treatment and a combined 633/904 for scanning, both applied in monotherapy. Clinical parameters studied were redness, heat, pain, swelling, itching and loss of function. Wound healing was accelerated 25-35% in the laser group compared to the control group. Pain relief and functional recovery was significantly improved in the laser group as well.

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Wound healing; US Food & Drug Administration: results from a preliminary wound healing trial.
Waynant R,
Notes from a presentation at The 2nd Congress of The world Assoc. for Laser Therapy,
Kansas, MO, USA, Sept. 2.5 1998.
A pilot study used six Sprague-Dawley rats - three controls with no treatment and three that were irradiated for 250 seconds with 630 nm. All rats were wounded on both hips - an 8mm circular full thickness hole. The irradiated rats received the 630nm 5 J/cm2 dose on only the left hip. The animals were irradiated one hour after the wounds were given and then one dose per day for four days. The results are: ten days after wounding the closure on the control rats averaged 26%, but irradiated rats averaged a closure of 65% on both left (irradiated) and right hips - a systemic effect on the right, as it received no irradiation.

Low-level Laser Therapy for Wound Healing: Feasibility of Wound Dressing Transillumination.
Lilge L, Tierney K, Nussbaum E.
Photonics Research Ontario, Toronto, Canada. Llilge@ociautoronto.ca

OBJECTIVE:

The purpose of this study was to assess the feasibility of exposing wounds during low-level laser therapy (LLLT) by transillumination of the wound dressings.

BACKGROUND DATA:

LLLT has been associated with accelerated wound healing in chronic ulcers. The usual approach is to remove wound dressings prior to exposure and to treat three to five times weekly. Frequent change of wound dressings is time consuming and costly; it disrupts the healing process, increases the risk of wound infection, and may be traumatic for the patient.

METHODS:

A double integrating sphere setup was employed to quantify the diffuse transmittance and reflectance of various wound dressings. Differences in transmittance for large area sources and point sources were demonstrated through the use of a diode laser and an incoherent light source. RESULTS: There were a number of gels and membrane style wound dressings with diffuse transmittance of more than 50%. Hence, for these dressings the prescribed radiant exposure to the wound surface could be achieved by increasing the exposure duration, while maintaining reasonable overall treatment times.

CONCLUSIONS:

Although LLLT by transillumination of wound dressings is feasible for a variety of wound dressings without significant commitments in additional treatment time, the specific transmission of products not included in this study needs to be determined at the intended treatment wavelength. A transillumination approach may facilitate a faster rate of wound healing than LLLT applied to exposed wounds by reducing trauma and the risk of infection.

Vet Surg. 1997 Mar-Apr;26(2):114-20.

Evaluation of low level laser therapy on primary healing of experimentally induced full thickness teat wounds in dairy cattle.

Ghamsari SM, Taguchi K, Abe N, Acorda JA, Sato M, Yamada H.
Department of Veterinary Surgery, School of Veterinary Medicine, Obihiro University of Agriculture and Veterinary Medicine, Hokkaido, Japan.

OBJECTIVE:

The purpose of this study was to evaluate the effect of low-level laser therapy (LLLT) on sutured wounds of the teat in dairy cattle.

STUDY DESIGN:

By using the Latin square design, the effect of LLLT was evaluated by radiography, measurement of microcirculation flow, histopathology, tensiometry, and hydroxyproline analysis.

ANIMALS OR SAMPLE POPULATION:

Sixteen teats of four dairy cattle.

METHODS:

Full thickness wounds were made on the cranial surface of the teats. Teats were distributed into four groups; group A and B wounds were closed with a Gambee pattern, group C and D wounds were closed with three-layers of continuous suture pattern. Group B and D wounds were treated with 3.64 J/cm2 of LLLT using a helium-neon system continuous wave (632.8 nm) output of 8.5 nW. RESULTS: The teat wall in non-LLLT groups was significantly thicker than in LLLT groups on day 7, 14 and 21. The mean blood flow differences between control and sutured sites in LLLT groups were significantly lower than those in non-LLLT groups. The morphology of the epidermis in LLLT groups more closely resembled the normal epidermis than that of non-LLLT groups. Collagen fibers in LLLT groups were denser, thicker, better arranged and more continuous with existing collagen fibers than those in non-LLLT groups. The mean tensile strength was significantly greater in LLLT groups than in non-LLLT groups.

CONCLUSION:

The LLLT affects various aspects of the healing process, including minimizing inflammation, formation of edema, improvement of skin regeneration and enhancement of collagen synthesis.

CLINICAL RELEVANCE:

The LLLT could accelerate healing of sutured wounds of the teat in dairy cattle.

Effects of 630-, 660-, 810-, and 905-nm laser irradiation delivering radiant exposure of 1-50 J/cm2 on three species of bacteria in vitro.

Nussbaum EL, Lilge L, Mazzulli T.
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University of Toronto, Toronto, Ontario, Canada. e.nussbaum@utoronto.ca

OBJECTIVE:

To examine the effects of low-intensity laser therapy (LILT) on bacterial growth in vitro.

BACKGROUND DATA:

LILT is undergoing investigation as a treatment for accelerating healing of open wounds. The potential of coincident effects on wound bacteria has received little attention. Increased bacterial proliferation could further delay recovery; conversely inhibition could be beneficial.

MATERIALS AND METHODS:

Pseudomonas aeruginosa, Escherichia coli, and Staphylococcus aureus were plated on agar and then irradiated with wavelengths of 630, 660, 810, and 905 nm (0.015 W/cm(2)) and radiant exposures of 1-50 J/cm(2). In addition, E. coli was irradiated with 810 nm at an irradiance of 0.03 W/cm(2) (1-50 J/cm(2)). Cells were counted after 20 h of incubation post LILT. Repeated measures ANOVA and Tukey adjusted post hoc tests were used for analysis. RESULTS: There were interactions between wavelength and species (p = 0.0001) and between wavelength and radiant exposure (p = 0.007) in the overall effects on bacterial growth; therefore, individual wavelengths were analyzed. Over all types of bacteria, there were overall growth effects using 810- and 630-nm lasers, with species differences at 630 nm. Effects occurred at low radiant exposures (1- 20 J/cm^2. Overall effects were marginal using 660 nm and negative at 905 nm. Inhibition of P. aeruginosa followed irradiation using 810 nm at 5 J/cm(2) (-23%; p = 0.02). Irradiation using 630 nm at 1 J/cm(2) inhibited P. aeruginosa and E. coli (-27%). Irradiation using 810 nm (0.015 W/cm(2)) increased E. coli growth, but with increased irradiance (0.03 W/cm(2)) the growth was significant (p = 0.04), reaching 30% at 20 J/cm(2) (p = 0.01). S. aureus growth increased 27% following 905-nm irradiation at 50 J/cm(2). CONCLUSION: LILT applied to wounds, delivering commonly used wavelengths and radiant exposures in the range of 1-20 J/cm(2), could produce changes in bacterial growth of considerable importance for wound healing. **A wavelength of 630 nm appeared to be most commonly associated with bacterial inhibition.** The findings of this study might be useful as a basis for selecting LILT for infected wounds. J Clin Laser Med Surg. 2000 Oct;18(5):235-40.

Effect of laser pulse repetition rate and pulse duration on mast cell number and degranulation.

el Sayed SO, Dyson M.
Tissue Repair Research Unit, U.M.D.S., London, United Kingdom.

BACKGROUND AND OBJECTIVE:

Mast cell activation by low-level laser therapy (LLLT), leading to degranulation and the release of mediators, may be one of the mechanisms by which LLLT can accelerate tissue repair in mammals. The objective of this work, part of an investigation to determine the optimum parameters for increasing mast cell number and degranulation in injured skin, was to determine the effect of different pulsing frequencies of LLLT.

STUDY DESIGN/MATERIALS AND METHODS:

Partial-thickness wounds in anaesthetized adult male Wistar rats were irradiated immediately after injury with monochromatic coherent light (wavelength 820 nm) pulsed at either 2.5, 20, 292, or 20,000 Hz at an average power density of 800 mW/cm2 for 27 seconds; the energy density was 21.6 J/cm2. The effects on mast cell number and degranulation were assessed 2 hours post-treatment by counting the numbers of intact and degranulated mast cells in Carnoy-fixed, toluidine blue-stained, sections of irradiated and sham-irradiated wounds.

RESULTS:

The total number of mast cells was increased significantly ($P < 0.05$) by all the frequencies when compared to the sham-irradiated group, but there was no significant difference between frequencies ($P > 0.05$). However, although the number of degranulated mast cells was higher in all laser-treated wounds, in comparison with the sham-irradiated group, only the 20 Hz (pulse duration 45 ms) and 292 Hz (pulse duration 3 ms) frequencies were significantly effective ($P < 0.05$).

CONCLUSION:

Increase in mast cell number is not pulsing frequency dependent, whereas degranulation is.