Buffalo Niagara Dental Meeting

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Experience The Functionality of Lasers in Today's Oral Healthcare

Hands-on Workshop

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The 2 Basic Functions a Laser Can Perform:

1. Heats Up / Vaporizes Material

- Inactivate Bacteria & Microorganisms
- Protein Denaturation
- Ablate (Vaporize or Erase)
- Soft Tissue & Similar Substances
- Incise / Excise Soft Tissue

2. Stimulates a Response

- Photobiomodulation (LLLT, Phototherapy, Photomedicine)
- Stimulates or Inhibits a Physiologic Response
- Photochemical Reaction (Curing Materials, etc.)

Hard Tissue Laser Procedures & Applications:

Partial List of Hard Tissue (Dentition and Osseous) Procedures that a Laser Can Perform or Assist in the Treatment of:

- Caries Removal, Restorative Preparations,
- Enamel Roughing
- Cleaning of Endodontic Canals and Pulpal Chambers
- Osseous Crown Lengthening
- Osseous Shaving, Contouring, and Recontouring (Osteoplasty and Osteotomy)
- Treatment of (Bisphosphonate Related) Osseous Necrosis of the Jaw (BONJ / ONJ)
- Assisting in Bleaching of Dentition
- Removal of Coronal Pulp (Pulpotomy and hemostasis of pulp horns)
- Treatment of a Failing Implant
- Apicoectomy Surgery
- Removal of Composite Restorative Material
- Removal of Porcelain Veneer (and removing cement from a porcelain veneer)
- Removal of Filing Materials During Root Canal Retreatment
- Detection and Removal of Subgingival Calculus

Soft Tissue Procedures & Applications Performed with the Assistance of a Soft Tissue Laser

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Basic Functions of a Soft Tissue Laser

- Vaporize Soft Tissue (Ablation)
  - Ablate (Erase) Soft Tissue
  - Incise Soft Tissue
  - Excise Soft Tissue
- Stimulate (Photobiomodulate) Tissue Responses

A Partial List of Specific Procedures That Can Be Performed with the Assistance of a Soft Tissue Laser

- Gingivectomy
- Gingivoplasty
- Gingival Troughing
- Periodontal Pocket Decontamination Laser Therapy (PDLT)
- Biopsies
- Fibroma Removal
- Implant Uncovering
- Flap Surgery
- Soft Tissue Incisions
- Excising Soft Tissue
- Destruction of Lesions
- Aphthous Ulcer Treatment
- Treatment of Herpetic Lesions
- Treatment of a Venous Lake
- Distal / Proximal Wedge
- Operculectomies
- Excision of Pericoronal Gingiva
- Soft Tissue Crown Lengthening
- Removal of Hyperplastic Tissue
- Pulpotomy as an Adjunct to Root Canal Therapy
- Coagulation of Extraction Sites
- Cementum Mediated New Periodontal Attachment to the Root Surface
- Exposure of Un-erupted Teeth
- Vestibuloplasty / Frenuloplasty
- Frenectomy / Frenotomy
- Incision and Drainage
- Assisting in Bleaching of Dentition
- Prevention & Treatment of Oral Mucositis
- Management of Temporal Mandibular Discomfort
- Stimulate & Enhance Healing
- Reduce Inflammation

Overview of Soft Tissue Laser Techniques

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3 Basic Techniques Used with the for Soft Tissue Laser Procedures are:

- **Ablation ("vaporizing / erasing") technique**
- **Incisional / excisional ("blade / sawing") technique**
- **Photobiomodulation (PBM) / Phototherapy ("stimulating / non-contact") technique**

The appropriate technique used for any procedure is based on the treatment objective and case specific factors. Remember that the two basic functions of a soft tissue laser are to raise the temperature of the cells or to stimulate a biologic response within the cell. For all surgical procedures, the process is to simply to remove tissue by raising the temperature of water inside the cell past the vaporization point (100° C) thus increasing the intracellular pressure and causing the cell to explode.

For all surgical procedures with the 970nm Diode and Nd:YAG Lasers the tip of the fiber is in contact with the tissue. The primary motion is sweeping the fiber tip of the laser in light contact with the target tissue with a pulling vs. pushing motion of the tip over the treatment area. Being in contact with the target tissue enables the use of both radiant and conductive energy transfer mechanisms. If the fiber is out of contact there is no conductive heat transfer, and the fluids between the fiber tip and tissue will absorb the laser energy instead of the target tissue.

The speed that the laser's tip is moved over the tissue is often referred to as "hand speed". The hand speed of the clinician applying laser energy is a critical component in determining how much energy is absorbed into each cell of the tissue. The slower the clinician's hand speed the more time and thus laser energy the cells will absorb. Conversely, the faster the clinician's hand speed the same amount of laser energy will be spread over a greater area thus decreasing the amount of laser energy that will be absorbed in any one cell.

Most treatments are accomplished by using a combination of the below techniques. High volume evacuation (HVE) is always used for all of these techniques to assist in the safe removal of the Laser Generated Airborne Contaminates (LGAC), often referred to as the laser plume or surgical smoke. The use of HVE will also assist in tissue cooling.

Ablation Technique / Procedures are performed with the 970nm Wavelength

An ablation technique is removing tissue with the 970nm and Nd:YAG lasers is performed by moving the laser fiber in a two-way "sweeping" motion, similar to using a pencil eraser in light contact with the tissue with the primary motion of pulling the fiber. This is accomplished with a motion of moving the laser fiber laterally on the tissue's surface, rather than going deeper into the tissue as when an incisional technique used.

- An ablation technique is accomplished by using the 970nm and Nd:YAG Lasers with the fiber in light contact with the tissue allowing for both conductive and radiant energy transfer to occur. Additionally, being in contact enables the clinician to have some tactile sensitivity.
- Ablation procedures can be accomplished using all the same parameters and principles that are used with the incision / excision techniques. However, the continuous wave mode can also be used with diode lasers, especially if coagulation / hemostasis is needed or desired.
- Almost all lasers procedures that are performed with incisional or excisional techniques are finished with the tissue being smoothed or polished with an ablation technique.

Ablation procedures include, but are not limited to: Frenectomy, Soft tissue troughing, Gingivoplasty, Tooth exposures, Destruction of a lesion, Distal wedge procedures, Operculectomy, Gingivectomy, Vestibuloplasty, Implant uncovering, Periodontal Pocket Decontamination Laser Therapy (PDLT), etc.

Incisional and Excisional Procedures performed with the 970nm and Nd:YAG lasers.

An **incisional technique** (blade type or sawing technique) is using the 970nm and Nd:YAG laser energy to perform a procedure like a scalpel to make an incision or to excise a block of tissue.

- An incisional technique is performed with a two way back and forth "sawing" type motion going deeper into the tissue with each pass with the fiber in light contact with the tissue for tactile sensitivity.
- Incisional procedures can be accomplished using all the same parameters and principles that are used with the ablation techniques. However, the continuous wave (CW) mode should not be used as it has the potential for causing an excessive of collateral tissue damage.
- The slower the clinician's hand speed the more energy that will be absorbed into the cell and faster the incision will be made. However, the slower the hand speed, the more heat that will be spread into the surrounding tissue and its resulting effect of hemostasis and collateral damage.

An **excisional technique** is used when the tissue to be removed is cut off in block section(s) with incisional technique.

- The use of tissue pickups or preferably a silk suture can be helpful in controlling the specimen (tissue) to be removed or excised.
- An excisional technique is used when a large amount of tissue is to be removed.
- An excisional technique is used for biopsies so there is a tissue specimen to be evaluated by a pathologist. When using a laser for a biopsy a notation should be noted as part of the clinical findings that the specimen was obtained with the use of a laser. In turn the pathologist report will note that there were heat artifacts on the border of specimen consistent with the use of a laser.

Incisional / excisional procedures include, but are not limited to: Gingivectomy, Gingival flap incisions, Distal wedge, Biopsies, Tooth exposures, Fibroma removal, etc.

Photobiomodulation (Phototherapy / LLLT) Technique / Procedures with the 970nm WL

Photobiomodulation (PBM) commonly referred to in the past as, Phototherapy, or Photomedicine, or Low Level Laser (or Light) Therapy (LLLT) or Biostimulation is the technique of achieving a therapeutic tissue response without removing any tissue. It is accomplished with the 970nm fiber completely out of contact with the tissue. When treating an Aphthous ulcer, Herpetic lesion, or for tooth desensitization with the 970nm laser fiber the tip should be constantly moving, similar to the use of a spray painter to "paint" the target area with laser energy. Controlling the dosage of light energy is very critical.

- **Photobiomodulation procedures with the 970nm laser uses a freshly cleaved and non-initiated fiber**. Do not test fire fiber in contact as any debris on the end (tip) of the will block or disperse the laser energy from the target tissue. The 970nm laser should be test fired out of contact, aimed a piece of articulating paper to observe an interaction the pigment in the paper.
- The goal of Photobiomodulation with 970nm laser is to apply laser energy to the target area, for Aphthous Ulcers, Herpetic Lesions, and Tooth desensitization, start at least 2 inches away from the target and moving the tip closer until the patient feels some sensation or heat, then backing slightly away and constantly applying the 970nm light energy to the target in 30 second increments while continually trying to move closer to the target tissue.
- If it is not possible to back the tip far enough back from the target, the power should be lowered to remove any sensation for the patient. The patient should only occasionally feel some sensation or warmth as the laser tip is moved in closer to the tissue, but it should never be uncomfortable.

Anesthesia is NEVER used with Photobiomodulation (neither local nor topical). The patient's feedback and response is essential in determining tissue interaction and preventing unwanted tissue damage.

Photobiomodulation procedures include, but are not limited to: Treatment of Aphthous ulcers, Herpetic lesions, Desensitization, Pain reduction, Improved healing, etc.

While the goals of Photobiomodulation (PBM) with the 970, 810, 1064, and 660nm wavelengths are the same, the techniques are different due the differences in absorption and penetration properties of each wavelength.

Photobiomodulation

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What is Photobiomodulation (PBM)?

Photobiomodulation (PBM) is the use of Low Levels of Light / Laser Energy to produce a chemical response that has a biological effect on the target cells / tissue that are absorbing the light energy. Usually the wavelength (WL) of the light energy used is in the visible or near infrared (NIR)

Photobiomodulation is the application of light energy of narrow spectral width to a pathology to promote tissue regeneration, reduce inflammation and relieve pain. Ideally it is applied to the injury for a minute or so, a few times a week for several weeks. PBM) is not an ablative but rather a photochemical effect comparable to photosynthesis in plants whereby the light is absorbed and exerts a chemical change.

The effects of Photobiomodulation on the target tissue can be either the STIMULATION or INHIBITION of a biologic response.

Photobiomodulation (PBM) / Photobiomodulation Therapy (PBMT) Definition:

"Light energy (photons) penetrating tissue where it interacts with chromophores located in cells resulting in photophysical and photochemical changes that lead to alterations at the molecular, cellular and tissue levels of the body. PBM and PBMT are accurate and specific terms for this effective and important therapeutic application of light."

http://www.aslms.org/for-the-public/treatments-using-lasers-and-energy-based-devices/photobiomodulation

In the Past PBM / PBMT has Been Also Known As (AKA):

- Low Level Laser Therapy (LLLT)
- Low Level Light Therapy (LLLT)
- Low Intensity Laser Therapy
- Soft Laser Therapy
- Cold Laser Therapy
- Laser Therapy
- Phototherapy
- Photomedicine
- Laser Biostimulation
- Laser Inhibition
- **and over 70 Other Names…..**

Photobiomodulation Research

- Over 30 Studies on PBM are Being Published Every Month
- Approximately 500 Randomized Controlled Trials have Been Performed
- Over 4,000 Laboratory Studies have Been Published

Partial List of Photobiomodulation's Dental / Oral Applications:

- Preventing, Managing, and Eliminating Oral Mucositis
- Reducing Inflammation and Edema
- Reducing Peri & Post-Operative Pain
- Enhancing Healing and Tissue Repair
- Enhancing Orthodontic Treatment
- Treatment of Herpetic Lesions
- Treatment of Aphthous Ulcers
- Dentinal Desensitization
- Dentin Formation
- Providing Analgesia

Treating and Managing

- Paresthesia / Nerve Damage
- Neuropathic Pain
- Xerostomia
- ONJ
- TMJD
- Trismus
- Gingivitis
- Lichen Planus
- Denture Stomatitis
- Trigeminal Neuralgia

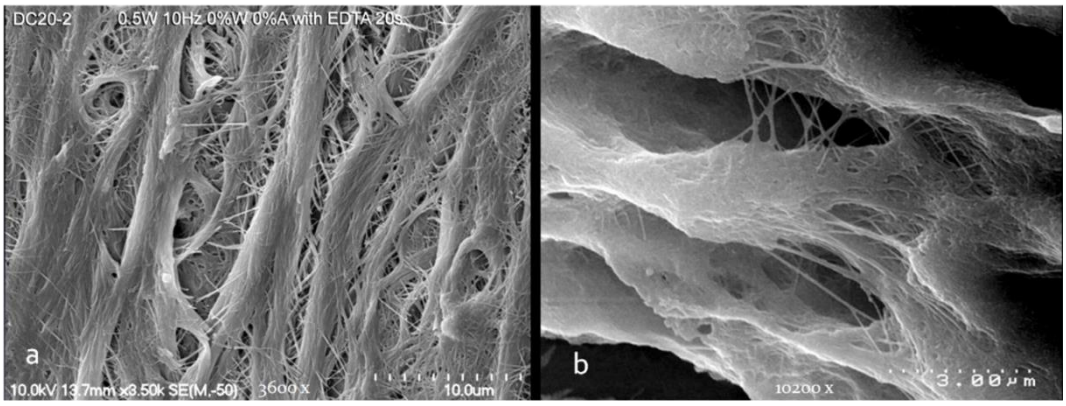
Overview

Photon-Induced Photoacoustic Streaming (PIPS®) & Shock Wave Enhanced Emission Photoacoustic Streaming (SWEEPS) Utilizing the LightWalker Er:YAG Laser in Root Canal Therapy

Use of the Photon-Induced Photoacoustic Streaming (PIPS) and Shock Wave Enhanced Emission Photoacoustic Streaming (SWEEPS) protocols enables the 3-dimensional cleaning and disinfection of the entire root canal system. They enable the removal of the smear layer after root canal instrumentation thus permitting the complete obturation of the entire root canal system including lateral / accessory canals and the anastomoses between the all of the canals.

Presently these techniques can only be accomplished the use of LightWalker® Er:YAG laser due to its ability to produce a very short 50 microsecond (µsec) pulses and unique pulse configurations. The protocol also requires the use of specially designed tips to produce the desired photon induced action to remove the organic materials from the entire root canal system.

The protocols are very specific and involves the use of a series of irrigation techniques with water, Sodium Hypochlorite (NaOCl), and Ethylene Diamine Tetra Acetic acid (EDTA) while applying photonic laser energy in 50 µsec pulse increments for several delivery cycles. The goal is to dissolve and remove all of the organic materials from the entire root canal system to help facilitate sealing the complete system to prevent reinfection.



SEM of the Endodontic Canals After Treatment with the PIPS® Protocol and the LightWalker® Er:YAG Laser
Images Courtesy of Dr. Enrico DiVito, Scottsdale, AZ.

Due to minimal removal of the hard structures and the very fine constrictions of the systems architecture, lateral / accessory canals, and the anastomoses between the canals that have been thoroughly cleaned and disinfected with this technique the canals must be obturated with a very thin bio-compatible material / sealer such as Ultradent's EndoRez. Conventional obturation techniques can additionally be performed to compliment the procedure if so desired.

To utilize the PIPS and SWEEPS protocols and acquire the specialized tips required to perform the technique, clinicians are required to attend a recognized detailed training program on the techniques. The goal is to gain a thorough and comprehensive knowledge of the protocol and to help insure successful outcomes.