Slide 1

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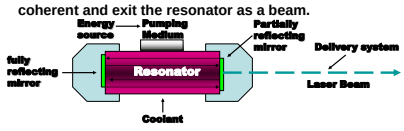
DEFINITION OF A LASER

- ❑ **L** = **L**ight
- ❑ **A** = **A**mplification by
- ❑ **S** = **S**timulated
- ❑ **E** = **E**mission of
- ❑ **R** = **R**adiation

Slide 3

BASIC FUNCTION OF A LASER

- Conversion of light energy (radiant) into thermal energy.
- Atoms inside a laser "resonator" are excited by energy, which comes from "pumping" the laser medium. Photons of energy are emitted
- These excited atoms become collimated and coherent and exit the resonator as a beam.



Slide 4

ACTIVE MEDIUM OF LASERS

- ***Crystal Laser:*** **Active medium is suspended in a transparent crystal. The host material is grown in or "doped" with atoms that will create the desired wavelength. Erbium, Neodynium, Holmium, etc.**
- ***Gas Lasers:*** **Have a hollow tube filled with the appropriate gas or mixture of gases. Carbon dioxide, argon.**
- ***Liquid Dye Lasers:*** **Have the dye dissolved in methanol or water solvent.**
- ***Diode Laser:*** **Semiconductor crystals. Pumped electronically.**

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DELIVERY SYSTEMS

- **Fiberoptic**
- **Articulated Arm**
- **Hollow Tube**

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LASER TISSUE INTERACTION

- **Absorption – Dependent on laser wavelength, tissue pigment, composition and water content.**
- **Transmitted – Energy travels w/no effect, dependent on tissue type and wavelength.**
- **Scattered – Dependent on wave length absorption may obscure effect.**
- **Reflected – Dependent on tissue type laser has no effect on tissue.**

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ABSORPTION CHARACTERISTICS

- **Laser light is absorbed in target tissue differently depending on the wavelength.**
- **This affects the way it ablates the tissue.**
- **Tissue elements that exhibit a high affinity for particular wavelengths are called chromophores.**

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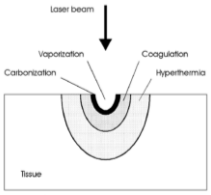
Laser Tissue Interaction

The propagation of laser light in biological tissue, (soft) and its transformation to thermal energy, due to absorption, is governed by the optical properties of the tissue and the wavelength of the laser.



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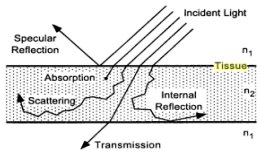
Lower power density Interaction



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Variables which impact Laser Results

- Wavelength
- Average power output, Peak power output
- Spot size (power density)
- Duration and interval of laser pulses
- Initiated Tips verses direct laser energy
- Tissue Relaxation – thermal accumulation, pain sensation
- Rate of motion – often overlooked –but critical
- Color of Tissue, water content, pigment, (composition)
- Cooling, via air or water

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810, 940 and 980nm Diode Laser.

- The 810nm diode wavelength has been in dentistry for 20 years because it was readily available in other fields, Because of the availability, it has since been widely used and published. The 810 is the lowest cost diode, and most readily available
- The 980nm diode is also quite common in dentistry. It is typically thought to cut faster than an 810 because of it's absorption characteristics. Many users believe the trade off to the 810 is that it is not as comfortable for patients.
- The 940 is a more recent innovation, and is generally thought to be a nice blend of the 810 and 940.

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New Technology; 1064nm Semiconductor / Diode Laser

- Deeper penetration than most dental wavelengths.
- The 1064nm wavelength is well established in dental lasers, but previously only available from the Nd:YAG crystal as the laser medium.
- Dramatically smaller and more efficient method to produce .
- Longer pulse durations , and more control over output; micropulsing, millipulsing and continuous.
- Up to 5,000 shots per second

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Nd:YAG WAVELENGTH

- **The Nd:YAG wavelength has a 16x greater selectivity for destruction of pigmented oral pathogens vs. the diode laser.**
- **Deeper penetration into the tissue and into the periodontal pocket.**

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SOFT TISSUE LASER PROCEDURES PERFORMED BY:

Dentists

- **Frenectomy**
- **Biopsy**
- **Fibrotomy**
- **Gingival Recontouring**
- **Gingival Troughing**

Dental Hygienist

- **Laser Bacterial Reduction**
- **De-epithelialization**
- **Desensitizing dentinal sensitivity**
- **Apthous Ulcers/Herpetic lesions**

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ADVANTAGES OF LASERS

- **Significantly reduces the amount of bacteria in the area to be scaled thereby reducing the bacteria introduced into the blood stream.**
- **Biostimulation (LLLT) by the laser increases regeneration of the connective fibers that support the teeth that would not occur without the use of a laser.**

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CONVENTIONAL DENTAL HYGIENE

- **Mechanically remove the deposits with area specific and ultrasonic scalers however, after scaling there are still invasive bacteria embedded in the lining of the periodontal pockets.**
- **Non-laser assisted therapies attempt to reduce the bacteria by using chemotherapeutics and antimicrobial agents.**

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ADVANTAGES OF LASERS

- **Periodontally diseased tissue can be detoxified and disinfected.**
- **Lasers can be used on a wide range of the population such as children and pregnant women.**
- **Hard and soft tissue procedures that were formerly referred out can be performed according to clinicians experience, training and confidence.**

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PERIODONTAL (HYGIENE) APPLICATIONS

- **Bacterial Decontamination**
- **Elimination of diseased epithelial lining**
- **Biostimulation (PBM)**

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LASER HYGIENE PROTOCOL

- **Review health history**
- **Patient interview**
- **Probe and observe tissue**
- **Laser Bacterial Reduction (LBR)**

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LASER BACTERIAL REDUCTION

- **Set the laser at an average power of .50-.75 watts is being delivered.**
- **Before turning the power on insert fiber into the sulcus.**
- **Direct fiber towards tissue, away from the tooth.**
- **Lase approximately 7-10 seconds per tooth surface.**
- **Uninitiated fiber**

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LASER ASSISTED PERIODONTAL THERAPY

- **Anesthetize the area to be treated (not because of laser, but because of scaling!)**
- **Full mouth Laser Bacterial Reduction (NON-INITIATED TIP)**
- **Mechanically scale hard deposits from the teeth (ultrasonic/hand scale)**
- **De-epithelialize periodontal pockets (INITIATED TIP)**
- **Review Post operative instructions and home care**

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BIOSTIMULATION
(Low Level Laser Stimulation)

- Laser energy stimulates local blood flow, macrophages, fibroblasts, etc.
- Reduces pain receptor mechanisms.
- Used in TMJ, post-op surgery, pulpal inflammation, dentin hypersensitivity, dental abscess, etc.

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PHAST

- P = Photo
- H = Hydro
- A = Acoustic
- S = Systems
- T = Technology

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Er:YAG WAVELENGTH

- The 50 microsecond pulse with a square shape allows for new procedures as well as improving speed and efficiency with other laser dental procedures.
- 300% higher absorption in water.
- Ability to adjust the hertz/pulses per second.
- Net result is increased comfort to patient.

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PHOTO HYDRO ACOUSTIC SYSTEMS TECHNOLOGY (PHAST)

- **Laser energy is absorbed by the atomized water particles creating a microexplosion or micropropulsion of the water molecules which is the *photomechanical* cutting force on the target tissue. This principle is the foundation of PHAST technology.**

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HARD TISSUE LASER

- **Erbium crystal.**
- **Water spray cutting technology.**
- **Hard and soft tissue applications.**
- **Endodontic applications.**
- **Periodontal applications.**
- **Surgical applications.**
- **Contact/noncontact modes.**
- **Precision cuts with no dentinal smear layer.**
- **Crystalline structure preserved.**
- **Many procedures can be performed with little or no anesthetic.**

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LASERS IN ENDODONTICS

(HISTORICAL)

- **Both near-infrared and mid-infrared wavelengths used.**
- **Initial application was for canal decontamination.**
- **Mid-infrared wavelengths receive FDA approval for cleansing and shaping the canal.**
- **Results showed the irradiated dentin was clean and debrided but serious secondary effects were also seen primarily in thermal damage to the canal.**

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PHAST ENDODONTICS

- **PHAST is an endodontic method using laser energy at sub-ablative power levels to chemically clean and debride the root canal system (Laser Activated Irrigation).**
- **PHAST harnesses the power of the Er:YAG laser to create a photoacoustic shock wave.**
- **Research is showing that the net result within the canals is a near 100% bacterial kill rate.**

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PHAST ENDODONTICS

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WAVELENGTH-OPTIMIZED PERIODONTAL THERAPY (WPT)

- **Laser surgical periodontal pocket reduction procedure involving multiple wavelengths, Er:YAG and Nd:YAG.**
- **These unique wavelengths produce optimal pocket elimination with bone and attachment regeneration.**
- **The result is a healthy periodontal environment.**

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WAVELENGTH-OPTIMIZED PERIODONTAL THERAPY (WPT)

(LASER APPLICATIONS)

- **Nd:YAG - Diseased epithelial lining removal**
- **Erbium - Calculus removal**
- **Erbium - Biofilm destruction (PIPS) & root surface decontamination**
- **Nd:YAG - Clot formation, biostimulation**

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LASER SAFETY

(HAZARDS)

- **Ocular: Retinal or corneal burn (N.O.H.D.).**
- **Tissue: Thermal photodisruption.**
- **Environmental: Airborne plume.**
- **Combustion: Flammable materials.**

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LASER SAFETY

(Control Measures)

- **Laser safety officer.**
- **Eye protection.**
- **Control of airborne contaminants.**
- **Workspace controlled area.**
- **Laser regulatory agencies**

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CHART DOCUMENTATION (SPECIFIC TO LASER USE)

- **Patient use of safety glasses.**
- **Wavelength (specific to *your* laser)**
- **Watts (what energy setting?)**
- **Pulse mode (continuous or pulsed)**
- **Areas treated**
- **Tip (initiated vs. uninitiated)**

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Advantages of Owning a Laser

- More comfortable in-chair experience for your patients
- Reduces the anxiety and fear of dentistry
- Fewer shots, less anesthesia
- Minimal or no bleeding in most cases
- Less post operative swelling - faster healing
- Reduced chance for post operative infection
- More precise and selective tissue reduction
- More comfortable alternative for children and phobic patients
- Minimal pain, inconvenience, discomfort for patients and staff
- More procedures per visit -less appointments for the patient!

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Advantages of Owning a Laser

- Practices focused on delivering the very best care to their patients
- Less invasive alternatives to traditional treatment modalities, i.e. drill, scalpel, needle
- Interested in creating a exciting, energizing environment in the office
- Wanting to reduce stress in their practice for themselves, patients, and their staff
- Interested in efficiently growing practice revenue
- Searching for a more satisfying work experience