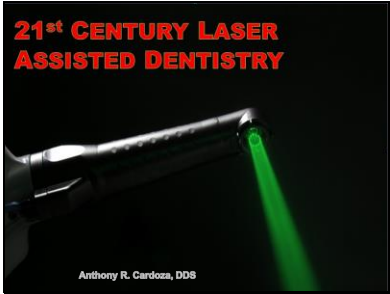


Slide 1

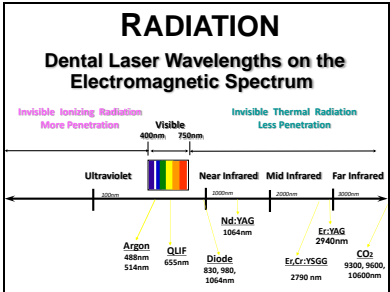


Slide 2

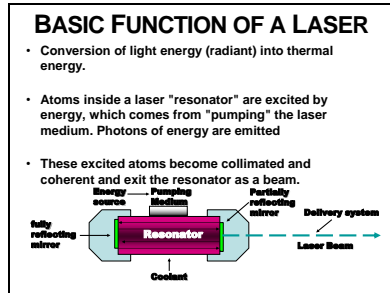
DEFINITION OF A LASER

- **L** = Light
- **A** = Amplification by
- **S** = Stimulated
- **E** = Emission of
- **R** = Radiation

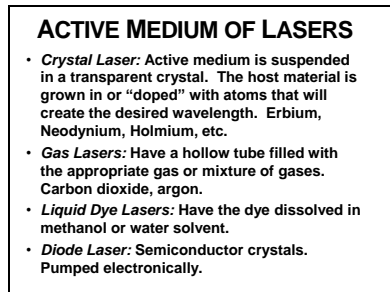
Slide 3



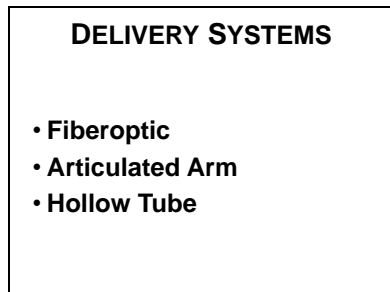
Slide 4



Slide 5



Slide 6



Slide 7

MODES OF OPERATION

- **Continuous wave mode**
- **Gated pulse mode**
- **Free running pulse mode**

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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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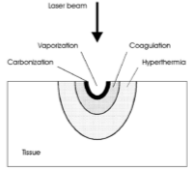
LASER TISSUE INTERACTION

- **Photomechanical** – High power density, short pulse duration.
- **Photothermal** – Moderate power density, longer pulse duration.
- **Photochemical** – Low power density, longest pulses.
- **Photofluorescence** – Low power density, longest pulses.
- **Photobiomodulation (PBM)** – Very low power density, low thermal input.

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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.



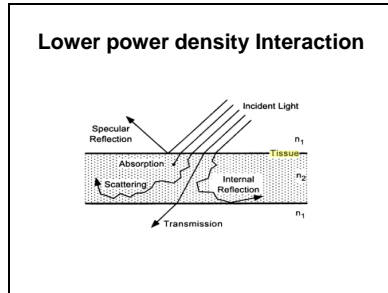
The diagram illustrates the interaction of a laser beam with tissue. A downward arrow labeled 'laser beam' points to a cross-section of tissue. The tissue surface is shown with a central crater. Labels indicate 'Vaporization' at the top edge of the crater, 'Carbonization' on the left side, 'Coagulation' on the right side, and 'Hyperthermia' in the surrounding tissue. The bottom of the tissue is labeled 'Tissue'.

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LASER/TISSUE INTERACTIONS

- **Photothermal**
 - Laser light is absorbed by the tissue and converted to heat energy.
 - Near visible infrared wavelengths (Nd:YAG, Diode) are absorbed more by pigments such as hemoglobin
 - Dental target tissues gingiva and mucosa
- **Photomechanical**
 - A.K.A. "Photoacoustic"
 - Pulsed laser energy is converted into thermo-mechanical (acoustic) energy
 - Photon energy absorbed by water and hydroxyapatite in tissue and handpiece water
 - Resulting shock wave physically disrupts or breaks apart target tissue (ablation)
 - Dental target tissues enamel, dentin, and bone

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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 Tissue versus 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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PHOTOTHERMAL EFFECT OF LASER ON TISSUE

<i>Tissue Temperature(°C)</i>	<i>Observed Effect</i>
• 50	• Bacterial inactivation, PBM
• 60	• Protein denaturation, coagulation
• 100-150	• Vaporization, ablation
• 200	• Carbonization

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LASER CLASSIFICATIONS

- Class 1: Self contained (CD ROM, laser printer).
- Class 2: Low powered visible light (laser pointers, UPC scanners).
- Class 3: Requires special training (argon curing lasers, cold/soft lasers).
- Class 4: Potentially hazardous, specific safety measures (dental & medical lasers).

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**SOFT TISSUE LASER
PROCEDURES PERFORMED BY:**

<u>Dentists</u>	<u>Dental Hygienist</u>
<ul style="list-style-type: none">• Frenectomy• Biopsy• Fibrotomy• Gingival Recontouring• Gingival Troughing	<ul style="list-style-type: none">• Laser Bacterial Reduction• De-epithelialization• Desensitizing dentinal sensitivity• Aphthous Ulcers/Herpetic lesions

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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 1mm 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) 1mm from base of pocket
- 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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PHOTOMECHANICAL TISSUE INTERACTION

- 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.

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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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LASER ACTIVATED IRRIGATION

- LAI is an endodontic method using laser energy at sub-ablative power levels to chemically clean and debride the root canal system (Laser Activated Irrigation).
- LAI 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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L.A.I. ENDODONTICS



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LASER PERIODONTAL THERAPY

- 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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LASER PERIODONTAL THERAPY (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 PERI-IMPLANTITIS

- Nd:YAG is effective at removal of the granulation tissue and will decontaminate the implant threads.
- Er:YAG will debride calculus off implant surfaces safely (with minimal temp. changes) and remove biofilm as well.

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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