The dental diode laser in Orthodontics

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Athens, Georgia
Welcome!

Overview of the day’s schedule

• Course Lecture
  – Overview of l-a-s-e-r
  – Lasers available to dentists
  – Practice Management
  – Laser Safety
• Clinical observations
• Lunch
• Hands-on
  – Using the ezlase 940
  – Mandatory post-course test

Six-hour session begins at 9:00 a.m. and ends at 3:00 p.m.
Lecture during lunch (eat-in)
2-3 patient procedures scheduled
Mandatory hands-on session
Post-course written and practical assessments
About this course...

Introductory Courses offer general information but do not assess enrollee’s proficiency.

**Standard Proficiency Courses offer a level of education including instruction, hands-on exercises, and examination. This course must be satisfactorily completed before independently using lasers.**

Advanced Proficiency Courses offer a level of education including instruction, hands-on exercises, clinical case studies and examination.

Educator Course offers instruction for teaching lasers in dentistry.¹


Four levels of laser education:

1. Introductory (i.e., sales presentations)

2. **Standard (includes assessments)**

3. Advanced (includes assessments and case studies)

4. Educator (specialized for “training the trainers”)

**THIS COURSE IS THE STANDARD PROFICIENCY COURSE...**
Today’s topics...

- PART ONE: Fundamentals of lasers, review of laser types, device characteristics, and clinical applications in dentistry
- PART TWO: Practice management
- PART THREE: Laser Safety
- PART FOUR: Clinical simulation (hands-on demonstration)
**Today’s clinical topics...**

**Fundamental Procedures**: We will use case studies, video examples, appointment/treatment sequencing...all to help establish laser-assisted therapies in dentistry.

Types of appointments, objectives of each, and what can be accomplished in the time available:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gingivectomy</td>
<td>Frenectomies (labial/lingual)</td>
</tr>
<tr>
<td>Operculectomy</td>
<td>Canine exposure</td>
</tr>
<tr>
<td>Gingival recontouring</td>
<td>Mucocoele/fibroma removal</td>
</tr>
</tbody>
</table>

**Fundamental Procedures**: case studies, video examples, appointment/treatment sequencing...all to help establish laser-assisted therapies in orthodontics. Types of appointments, objectives of each, and what can be accomplished in the time available:

Gingivectomy, Frenectomy, Operculectomy, Canine exposure, Gingival recontouring, Mucocoele and fibroma removal, Biopsy, Periodontal pocket curettage, Low Level Laser Therapy, and others...
Laser vs. electrosurgery:

Laser benefits include:
1. Ability to seal blood vessels
2. Ability to seal lymphatic vessels
3. Ability to seal nerve fibers
4. Less mechanical trauma
5. Minimal scarring
6. Precise surgical target
7. Predictable post-treatment results (less shrinkage)
8. Reduced need for suturing
9. Dry operating field
10. Minimal post-operative swelling
11. Statistically-proven 90% clinical reduction in post-op pain
12. Less damage to target tissue
13. Reduced bacterial counts = effective in patients with bacteremia risks
Lingual frenectomy

- Use caution (vascular area)
- Technique:
  - Initiated tip
  - 400 micron tip
  - 0.20 msec interval/0.10 msec pulse cycle
  - 1 watt average power to begin*
  - Work from alveolar end first
  - Direct laser laterally (not downward)

*Always begin with lowest power necessary to perform a procedure
Production of laser light

Quantum theory: *atom absorbs a quantum of energy, it is pumped to an excited state of a higher energy level*

Stimulated emission: *outside source excites already-excited atoms to release stored-up energy as photons*

*elemental quantity, or quantum of radiant energy

“**LASER**” = “light amplification (by) stimulated emission (of) radiation”
Einstein’s quantum theory: “as an **atom absorbs a quantum of energy**, it is **pumped to an excited state** of a higher energy level.”

“**Stimulated emission**” = an outside source excites already-excited atoms to release stored-up energy.
The excited photon and the released photon stimulate two more atoms, producing a chain reaction.
The end-result is photons of identical wavelength traveling in the same direction, as well as oscillating together (in phase).
“Wavelength” is the dimension of oscillation of electromagnetic energy – the distance a photon travels through one complete oscillation:
Micrometer (millionth of a meter) – $10^{-6}$ meters (microns)
Nanometer (billionth of a meter) – $10^{-9}$ meters (nm)

Lasers are named by their characteristic wavelength and their active medium (argon, carbon dioxide, mixed gases, etc)

In contrast to laser light, visible light =
1. Combination of multiple wavelengths
2. Non-directional
3. Non-focused
**Medical laser wavelengths***

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*Spectrum of medical lasers (informational):*

**CO2 (surgical) Laser:** 10,600 nanometers (nm)
**Argon Laser:** 488 and 514 nm
**YAG Lasers:** Yttrium-Aluminum-Garnet with neodymium (Nd), Erbium (Er) or Holmium (Ho)
  - **Nd:YAG Laser:** 1064 nm or 1320 nm
  - **KTP Laser:** Nd:YAG + potassium-titanyl-phosphate (KTP) crystal = 532 nm
  - **Er:YAG Laser:** 2940 nm
  - **Ho:YAG Laser:** 2070 nm
**Ruby Laser:** 694 nm
**Alexandrite Laser:** 755 nm
**Pulsed Dye Laser:** 577-585 nm
**Copper Vapor Laser:** 577 nm and 511 nm
**Diode Lasers:** 800-900 nm
**Excimer Lasers:** Argon:Fluorine (Ar:F) = 193 nm

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*wave crest to wave crest distance in nanometers (one billionth of a meter or 0.001 micrometers)*
Characteristics of laser light

L.A.S.E.R. = “light amplification by stimulated emission of radiation” (first demonstrated by T. H. Maiman)

1. Spatial/temporal coherency
   *(photons in same space/time)*
2. Monochromaticity *(one color)*
3. Collimation *(straight line)*, vs. “divergent” visible light

<table>
<thead>
<tr>
<th>1. Spatial and temporal beam coherency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The laser light is in phase (the same time and space)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Monochromaticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>The laser light is all of one wavelength (color)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Collimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The laser light travels in a straight line</td>
</tr>
</tbody>
</table>
Laser requirements, delivery systems and emission modes

Laser cavity:
1. Active medium (diode = a type of crystal)
2. Pumping mechanism (power source)
3. Optical resonator (mirrors)

1. A solid, liquid, or a gas supplies photons that determine the wavelength generated and the energy/power. It is suspended in an optical cavity space.

   “Solid state laser” = suspended in a transparent crystal. The crystal has atoms that create the desired wavelength (erbium, neodymium, etc).

   “Gas lasers” = hollow tube with specific gas (CO₂, argon, etc).

   “Liquid dye laser” = dye dissolved in methanol or water.

   “Diode laser” = semiconductor crystals are pumped electronically

   THINK: “Light emitting diodes” are lights used in cars, modern traffic lights, etc.

   Diode LASERs are like LEDs on steroids!

   (Describes the ezlase 940 diode laser)

2. A power source excites/pumps particles of the medium causing a population inversion (greater number of the atoms of a substance are in a state of excitation).

3. A system of two mirrors that houses the medium and amplifies the light.
Laser requirements, delivery systems and emission modes

Delivery system involves:
1. Lens/mirror directs laser beam
2. Fiberoptics supports the delivery media
3. Hollow sheath supports the fiber
4. Optical fiber carries aiming beam (visible light) and laser beam (infrared light)

- **Fixed lens and mirror** -- Focuses and directs the laser beam.

- **Articulated arm** -- Provides support for the delivery medium (fiberoptics).

- **Waveguide** -- Hollow sheath to carry the laser beam.

- **Optical fiber** -- The actual medium through which the laser light travels.
Laser requirements, delivery systems and emission modes

Emission modes:
1. Continuous wave
2. Pulsed (50-50 duty cycle)
3. Variable Pulsed – significant characteristic of the ezlase 940 soft tissue diode laser

1 watt = 1 joule/second

1. **Continuous wave**: 2 watts peak power = 2 watts average power

   When peak power is not the same as average power:

2. **Chopped**: pulse length = pause length (i.e., 0.5 sec laser w/0.5 sec pause)…
   @ 2 watt peak power, average power = 1 watt

3. **Pulsed** vs. “free running” (pulse length not same as pause length)…
   @ 5 watt peak power for 0.05 milliseconds with 0.20 rest interval = 1 watt average power
**THE HEART OF THE EZLASE’S ABILITY TO DELIVER COMFORTABLE TREATMENT IS IN THE COMFORTPULSE… EXERCISE:**

**ComfortPulse** cutting may be too subtle for some new ezlase users, especially if they are transitioning from electrosurge. There are three major ways that diode lasers are used in dentistry for incision and beveling:

1. **CW Mode** (laser is on continuously)
2. **50%-50% Pulse Mode** (1 millisecond on and 1 millisecond off)
3. **ComfortPulse** (50 microseconds on and 200 microseconds off)

Competitive dental diode lasers are used in either CW or the 50-50 duty cycle and all clinical literature published prior to the introduction of the ezlase document only these two methods of cutting.

Fast cutting like an electrosurge with the ComfortPulse setting enabled may not be impressive at first exposure, especially when cutting on a hot dog. *Hot dogs don’t have the hemoglobin and other target tissue they will see when using the laser on their patients.*

After thoroughly initiating the tip, start out in CW at 1.5 to 2.5 watts on the hot dog. If expect faster cutting is desired, turn it up until the desired effect is reached.

Lower settings on patients in the 0.8 to 1.2 watt range are ideal in CW mode, but must be used with topical or on patients otherwise anesthetized. At the perio setting (50-50 cycle pulse setting like all other diodes), turn it up until satisfied with the cutting; power ~2 watts can be used at 50-50, giving an average power of 1 watt – the same range as the CW recommendation for patients.

**ComfortPulse** is new, developed by BIOLASE to provide more comfort to the patient, less thermal effects on the tissue, and a cleaner cut – a subtle way of cutting, but requires practice to perfect, the tip to be well-initiated, and can often be used without even topical anesthesia. Tissue effects and cutting speed on the hot dog requires power to be set at 4 watts or higher, giving an average power back to 1 watt, due to the 25% duty cycle.

At the end of the demonstration and hands-on, further practice all three major modes of cutting with the ezlase and use the those which suits you best. 90% of all diode users only use CW and 50% pulse modes and that it is ok if you use them too.

Bottom line is you may not feel totally comfortable with ComfortPulse right out of the gate. While it is a breakthrough in comfort and clean cutting, it takes practice and is more subtle at the lower power settings where it excels.
Summary of laser effects on tissue

Reflection, scattering, transmission, absorption, photothermal effects:

1. Warming (50-60)
2. Coagulation, tissue shrinkage, hemostasis (60-80)
3. Vaporization, ablation (100)
4. Carbonization* (>200 degrees C)

*Undesirable in laser surgery

TISSUE EFFECTS:

“Reflection” = laser beam bounces off the target without any effect

“Scattering” = molecules and atoms deflect the laser beam into many unintended directions

“Transmission” = laser beam travels through the tissue unchanged

“Absorption” = tissue converts absorbed laser light into heat, chemical, acoustic, and/or non-laser light energies.

Laser effects include (in increasing degree):

1. Warming the tissue (~50-60° C)
2. Coagulation and hemostasis, with/without tissue shrinkage (~60-80° C)
3. Vaporization or other destruction of tissue (100° C)
4. Charring (200° +C)
Labial frenectomy

• 400 micron tip
• Initiated tip
• “20-10” cycle
• 1 watt average power
• Technique:
  – Work from most coronal aspect toward the periosteum w/perpendicular incision
  – Release fibers moving apically
  – Diamond-shaped surgical area = release
Influences on laser energy

- Wavelength effect varies, depending on degree of pigments/water
- Tissue optical properties (pigments)
- Duration of laser application
- Amount of laser energy applied
- Degree by which the tissue absorbs the energy applied
Review of the various laser types, device characteristics, and clinical applications in medicine and dentistry is in your course manual...
i.e., CO$_2$, YAG, etc.

*(Informational purposes)*
LASERS IN ALPHABETICAL ORDER BY MANUFACTURER

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>A.R.C. Laser</th>
<th>Biolase</th>
<th>Hoya</th>
<th>Ivoclar</th>
<th>Kavo</th>
<th>Sirona</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model/reference</td>
<td>FOX</td>
<td>ezlase 940</td>
<td>Diodent Micro 980</td>
<td>Odyssey Navigator</td>
<td>GENTLEray 980 Premium</td>
<td>SiroLaser</td>
</tr>
<tr>
<td>Wavelength</td>
<td>810, 980, 1064nm</td>
<td>810, 940nm</td>
<td>980nm</td>
<td>810nm</td>
<td>980nm</td>
<td>980nm</td>
</tr>
<tr>
<td>Max Power (Watts)</td>
<td>9.0</td>
<td>7.0</td>
<td>3.50</td>
<td>3.00</td>
<td>6.00</td>
<td>7.00</td>
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<tr>
<td>Pulse Time</td>
<td>Variable: 1.0 msec to CW</td>
<td>Variable from 0.05 msec - CW</td>
<td>50% chopped or CW</td>
<td>Pulsed (specs n/a) or CW</td>
<td>CW and variable</td>
<td>50% chopped or CW</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>Variable: 1.0 msec to CW</td>
<td>Variable from 0.05 msec - CW</td>
<td>10,50,100,200,500,1000/sec - CW</td>
<td>10,000/sec - CW</td>
<td>CW and variable</td>
<td>1-10,000/sec - CW</td>
</tr>
<tr>
<td>Available Tips</td>
<td>200,300,600 microns</td>
<td>200,300,400 microns</td>
<td>200,300,400 microns</td>
<td>400 microns</td>
<td>300 micron (200 optional)</td>
<td>200,300,400 microns</td>
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<tr>
<td>Ortho Clinical Training?</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>UNIQUE FEATURES</td>
<td>One knob control</td>
<td>ComfortPulse mode</td>
<td>None</td>
<td>Portable (Rechargeable battery)</td>
<td>Optic-free handpiece</td>
<td>Foot Switch AND Finger switch</td>
</tr>
</tbody>
</table>

Zap lasers not referenced; 2 watts insufficient for pulsed use

The next few pages compare diode lasers (listed above) currently available to dentistry.
## A.R.C FOX

<table>
<thead>
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<th>A.R.C. Laser</th>
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<tbody>
<tr>
<td>Model/reference</td>
<td>FOX</td>
</tr>
<tr>
<td>Wavelength</td>
<td>810, 980, 1064nm</td>
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<td>Max Power (Watts)</td>
<td>9.00</td>
</tr>
<tr>
<td>Pulse Time</td>
<td>Variable: 1.0 msec to CW</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>Variable: 1.0 msec to CW</td>
</tr>
<tr>
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<tr>
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<td>Yes</td>
</tr>
<tr>
<td>UNIQUE FEATURES</td>
<td>One knob control</td>
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</tbody>
</table>
Biolase ezlase 940*

*Also available in 810 nm wavelength

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Biolase</th>
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<tbody>
<tr>
<td>Model/reference</td>
<td>ezlase 940</td>
</tr>
<tr>
<td>Wavelength</td>
<td>940nm</td>
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<tr>
<td>Max Power (Watts)</td>
<td>7.00</td>
</tr>
<tr>
<td>Pulse Time</td>
<td>Variable from 0.05 msec - CW</td>
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<tr>
<td>Duty Cycle</td>
<td>Variable from 0.05 msec - CW</td>
</tr>
<tr>
<td>Available Tips</td>
<td>200, 300, 400 microns</td>
</tr>
<tr>
<td>Ortho Clinical Training?</td>
<td>Yes</td>
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<tr>
<td>UNIQUE FEATURES</td>
<td>ComfortPulse mode</td>
</tr>
</tbody>
</table>
## Hoya Diodent Micro 980

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Hoya</th>
</tr>
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<tbody>
<tr>
<td>Model/reference</td>
<td>Diodent Micro 980</td>
</tr>
<tr>
<td>Wavelength</td>
<td>980nm</td>
</tr>
<tr>
<td>Max Power (Watts)</td>
<td>3.50</td>
</tr>
<tr>
<td>Pulse Time</td>
<td>50% chopped or CW</td>
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<tr>
<td>Duty Cycle</td>
<td>10, 50, 100, 200, 500, 1000/sec - CW</td>
</tr>
<tr>
<td>Available Tips</td>
<td>200, 300, 400 microns</td>
</tr>
<tr>
<td>Ortho Clinical Training?</td>
<td>No</td>
</tr>
<tr>
<td>UNIQUE FEATURES</td>
<td>None</td>
</tr>
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</table>
## Ivoclar Odyssey Navigator

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Ivoclar</th>
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<tbody>
<tr>
<td>Model/reference</td>
<td>Odyssey Navigator</td>
</tr>
<tr>
<td>Wavelength</td>
<td>810nm</td>
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<tr>
<td>Max Power (Watts)</td>
<td>3.00</td>
</tr>
<tr>
<td>Pulse Time</td>
<td>Pulsed (specs n/a) or CW</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>10,000/sec - CW</td>
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<tr>
<td>Available Tips</td>
<td>400 microns</td>
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<tr>
<td>Ortho Clinical Training?</td>
<td>No</td>
</tr>
<tr>
<td>UNIQUE FEATURES</td>
<td>Portable (Rechargeable battery)</td>
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Kavo GENTLEray 980 Premium

<table>
<thead>
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<th>Kavo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model/reference</td>
<td>GENTLEray 980</td>
</tr>
<tr>
<td>Wavelength</td>
<td>980nm</td>
</tr>
<tr>
<td>Max Power (Watts)</td>
<td>7 or 12</td>
</tr>
<tr>
<td>Pulse Time</td>
<td>CW and variable</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>CW and variable</td>
</tr>
<tr>
<td>Available Tips</td>
<td>200 micron tip optional</td>
</tr>
<tr>
<td>Ortho Clinical Training?</td>
<td>No</td>
</tr>
<tr>
<td>UNIQUE FEATURES</td>
<td>Optic-free handpiece</td>
</tr>
</tbody>
</table>
# Sirona SiroLaser

<table>
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<tr>
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<th>Sirona</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model/Reference</td>
<td>SiroLaser</td>
</tr>
<tr>
<td>Wavelength</td>
<td>980nm</td>
</tr>
<tr>
<td>Max Power (Watts)</td>
<td>7.00</td>
</tr>
<tr>
<td>Pulse Time</td>
<td>50% chopped or CW</td>
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<tr>
<td>Duty Cycle</td>
<td>1-10,000/sec - CW</td>
</tr>
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<td>UNIQUE FEATURES</td>
<td>Foot switch AND Finger switch</td>
</tr>
</tbody>
</table>
The ezlase operates at 940 or 810 (hygiene) nm wavelengths for cleaner cutting and faster hemostasis with better absorption by both hemoglobin and oxyhemoglobin.

The beam spot is the laser’s size at the targeted tissue surface and depends on the tip size used; 200, 300, and 400 micron (0.2, 0.3, 0.4 mm) are available.

The power range runs from 0 to 7.0 continuous watts. (Class 4 medical laser)

The energy density (Joules/cm²) is fully dependent on the variable settings of wattage, pulse length, and pulse intervals.

The repetition rate (number of pulses per second) can be variably adjusted; optimal calibration results in the most favorable tissue response to treatment.

The duration of the laser exposure can be continuous or pulsed.

The total energy delivered over time is a function of maximum wattage, pulse length, and pulse interval and is measured in joules (1 joule/sec = 1 watt).
Laser Clinical applications (per FDA)

- Intraoral soft tissue surgery
- Treatment of aphthous ulcers
- Sulcular debridement (soft tissue curettage)
- Composite curing
- Tooth shade lightening
- Caries removal
- Cavity preparation
- Enamel modification
- Illumination for caries detection
- Illumination for endodontic orifice location
- Removal of coronal pulp
- Experimental applications

The FDA has approved laser use in dentistry for these procedures:
- Dental Excisional and incisional biopsies
- Soft Tissue Exposure of unerupted teeth
- Fibroma removal
- Frenectomy
- Frenotomy
- Gingival troughing for crown impressions
- Gingivectomy
- Gingivoplasty
- Gingival incision and excision
- Hemostasis
- Implant recovery
- Incision and drainage of abscess
- Leukoplakia
- Operculectomy
- Oral papillectomies
Treatment objective and surgical technique simulation

- Indications for laser use in dentistry
  \textit{(see your course manual)}

Dental Excisional and incisional biopsies
Soft \textbf{Tissue} Exposure of unerupted teeth
\textbf{Fibroma} removal
\textbf{Frenectomy}
Frenotomy
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\textbf{Gingival incision and excision}
\textbf{Hemostasis}
Implant recovery
Incision and drainage of abscess
Leukoplakia
\textbf{Operculectomy}
Oral papillectomies
Gingival contouring

• “3-3-3”...
  – 300 micron tip
  – 33% duty cycle
  – 3 total watts

• Initiated tip
Gingival contouring

- Technique:
  - Probe depths (avoid biologic width)
  - Direct laser apico-incisally at the contact point
  - Incremental ½ mm slice intervals
  - Clean up edges afterward
Better esthetic results

Post-orthodontic treatment
10 days post-op

Tell patient it may require refinements…
A few words about the gingival sulcus

**The Golden Rule of Gingivectomy**

The indications for gingivectomy in orthodontics are easily determined by following a specific rule:

*Only excise tissue where suprabony pockets exist in situations where “attached and keratinized” gingiva is adequate (2mm or more).*

You may be questioned by referring dentists (and especially by your periodontists) about violation of the biologic width.

**THE BIOLOGIC WIDTH MUST NEVER BE VIOLATED.**

This graphic provides a visual cue to help you visualize the limits of laser treatment.

(Slide courtesy of Dr. Jim Moncrief, Periodontist)
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What are some elements in a Laser Safety Training program?

* What is a laser and how it works.
* Laser hazard classifications and its relation to potential hazards and need for control measures.
* Laser beam hazards (eye and skin hazards).
* Potential hazards arising as a result of the use of laser beam.
* Non-beam hazards from laser equipment.
Accurately-placed high-volume suction is a MUST.
Laser plume components include carbonized tissue and blood, potential virus and bacteria, hard tissue fragments, polycystic aromatic hydrocarbons, and more…
The operator and assistant might also consider wearing masks.
Note the orientation of the three components:
1. The laser
2. The air supply
3. The high-volume suction*

*ALWAYS USE PLASTIC MIRRORS AND USE CARE TO KEEP THE LASER FROM STRIKING THE MIRROR AND REFLECTING AWAY FROM THE TREATMENT AREA
Laser safety

1. Standards organizations and regulatory requirements
2. Laser safety officer
3. Laser safety mechanisms
4. Mechanism for reporting adverse conditions
5. Eye protection
6. The use environment
7. High volume evacuation

Topics:
1. Standards organizations and regulatory requirements
2. Laser safety officer
3. Laser safety mechanisms
4. Mechanism for reporting adverse conditions
5. Eye protection
6. The use environment
7. High volume evacuation
A variety of agencies governs the use of the laser in dentistry. The FDA is at the leading edge; their approval of the device is required before it enters the clinical arena.

As with other medical devices, they must meet ANSI standards to be approved.

The use of the laser is governed by OSHA in so much as they can affect the worker: both employee-doctor and the staff. OSHA does NOT oversee patient care.

There are state regulatory agencies that regulate the use of the laser in dentistry, such as Board governance regarding the use of the laser by dental hygienists, for instance.
Main Two:

- FDA...
  - Assure clear manufacturer marketing claims
  - Maintain good manufacturer processes
  - Review preclinical and clinical studies in support of marketing claims
- OSHA: protect the employees
- State may require laser registration
Before installing a laser device, a laser safety program should be established according to the ANSI Z136.3 standard: “(4) the program must be outlined in written policies, procedures for training, laser use, maintenance and service. This program is centered on the manufacturer's safe operation instructions that incorporate recommendations for training, maintenance and safe use.

A mandatory designated laser safety officer (LSO) is appointed to supervise this program. The dentist may designate her/himself or any member of the dental team to be the LSO. Currently, there is no national certification requirement for LSO.

The LSO must be familiar with

1. Operation characteristics of the ezlase 940
2. Its biological effects and hazards
3. Current OSHA regulations
4. Safety control measures
5. Training of staff
6. Protective equipment (primarily eyewear)
7. Warning signage in usage areas

This course meets the ANSI standard.
Safety housing: prevents unintended access to the laser

Emergency stop switch: interrupts laser emission immediately, if needed

Safety key: laser cannot be operated without key, which can only be removed when laser is ‘off’

(NOTE: The ezlase uses a digital ‘key’ that must be punched in for the unit to operate)

Warning labels: contains class of laser and exposure warnings

Laser indicators: visual and audible indicators of laser use in progress

Separate ‘standby’ and ‘ready’ buttons: ensures desired state

Lockable coasters for console models: prevents rolling/tipping

Remote interlock jack: must be in place for laser to operate. It prevents the laser’s operation when triggered: i.e., it can be tethered to a door, allowing immediate laser shutdown should someone enter the room...

Footswitch cover: prevents accidental operation

Safety glasses: protects the eyes of the operator, staff, and patient and all people in the immediate area of use. Model of glasses is specific to the wavelength of the laser...
1. Removable windows allow the replacement of damaged windows.

2. Lift-front windows may be raised, as needed, or left in the lowered position.

(Windows are available in both removable or lift-front designs.)

DOCTORS THAT WEAR LOUPES MUST USE SPECIAL FILTERS THAT CLIP BEHIND THEM...

AVAILABLE FROM
WWW.INNOVATIVEOPTICS.COM
Significant controls are required of Class IV laser facilities.

The ezlase is a Class 4 laser.

**Posting with Appropriate Laser Warning Signs.**

Class 4: high power lasers (CW: >500 mW, pulsed: various wavelength based limits which are, in general, related to diffuse reflection exposures).

Class 4 lasers are hazardous to view under any condition (directly or diffusely scattered) and are a potential fire hazard and a skin hazard.

ANSI requires posting of areas where Class 4 lasers are used using the DANGER design.

During times of service and other times when a temporary laser-controlled area is established, an ANSI NOTICE sign format is required: white background, red laser symbol with blue field and black lettering. This sign is posted only during the time when service is in progress.

The presence of reflective materials in the laser use area helps ensure beam containment.
What is an example of a Laser Safety Checklist?

Room:
- Warning signs.
- Window and door covers (non-transparent, non-reflecting material).
- Fire extinguishers.
- Storage for gas tanks.
- Secure locked designated place for the laser key.
- Designated place for accessories.

Personal Protection:
- Documented personal protection program.
- Training for use and maintenance of personal protective equipment.

Laser Equipment:
- Electrical outlets.
- Electrical power cords.
- Cooling water pressure.
- Cooling water temperature.
- Maintenance up-to-date.
- Laser log up-to-date.

Smoke Evacuator:
- Filter change date record.
- Responsibility for filter change assigned.
- Valid safety sticker.
- Laser Operation.
- Documented authorization procedure.
- Written operating procedures.
- Emergency contact telephone numbers of persons responsible for laser safety.
CLASS 4 LASER CONTROLS – GENERAL REQUIREMENTS.

Those items required for Class 4 lasers are as follows:

1. Supervision directly by an individual knowledgeable in laser safety.
2. Entry of any noninvolved personnel requires approval.
3. A beam stop of an appropriate material must be used to terminate all potentially hazardous beams.
4. Use diffusely reflecting materials near the beam, where appropriate.
5. Appropriate laser protective eye wear must be provided all personnel within the laser controlled area.
6. The beam path of the laser must be located and secured above or below eye level for any standing or seated position in the facility.
7. All windows, doorways, open portals, etc., of an enclosed facility should be covered or restricted to reduce any escaping laser beams below appropriate ocular MPE level.
8. Require storage or disabling of lasers when not in use.

ENTRYWAY CONTROL MEASURES (CLASS 4).

In addition, there are specific controls required at the entryway to a Class 4 laser controlled area. These can be summarized as follows:

1. All personnel entering a Class 4 area shall be adequately trained and provided proper laser protective eye wear.
2. All personnel shall follow all applicable administrative and procedural controls.
3. All Class 4 area and entryway controls shall allow rapid entrance and exit under all conditions.
4. The controlled area shall have a clearly marked "Panic Button" (nonlockable disconnect switch) that allows rapid deactivation of the laser.

(OSHA Regulations)
OSHA Office Documentation

Resource:
http://web.princeton.edu/sites/ehs/laserguide
Operculectomy

- 400 micron tip
- Initiated tip (may require reinitiation)
- CW an option
- 1-2+ watts (very fibrous)
- Avoid extending facially beyond the DF corner
USE OF THE EZLASE DENTAL LASER IN THE DENTAL PRACTICE:
The ezlase is very portable and can be used at practically any chair. A rolling enclosed cabinet with a drawer (a high-end microwave cart works well) provides storage for the materials and safety glasses.
Some doctors set aside certain ½-days to deliver their laser procedures, relying on the “tooling” of the day for multiple procedures with greater efficiency.
When billing for the procedures, it is important to not undercut the periodontists’ fees, which would essentially lower the “usual and customary” for your area.

Current fee surveys from the ADA can be a good source.
Rather than file laser insurance claims for the patient, you might consider providing them with a “superbill”. Occasionally, the insurer will come back and ask for periodontal charting, x-rays, doctor’s narrative, etc.

Sample documents to use in your office can be found on the following pages.
Finally, it is important to be open and matter-of-fact with your periodontists. Some may still not be using the laser and may exhibit “laser envy!” Meet with them and assure them that the nature of your procedures are the type that they really do not benefit from having in their care anyway (single too gingival recontouring, etc.)

Plus, the patients are better-served by being able to have an orthodontic procedure performed alongside the laser procedure. Additionally, the patient does not require the “drama” of the referral visit (possible sedation, new and unfamiliar doctor/surroundings, etc.).
Periodontal Charting Report For: ________________________________

Date of Periodontal Charting: ________________________________

Oral Hygiene Care:  □ Excellent  □ Good  □ Fair  □ Poor

Facial

Lingual

Facial

Lingual
INFORMED CONSENT FOR LASER DENTAL PROCEDURES

I DECLARE THAT I UNDERSTAND THE FOLLOWING INFORMATION:

The goal of laser dental treatment is to reduce or eliminate tissue or scarring that might interfere with providing optimal desired results in orthodontic care. Generally, laser treatment results in improvement in the tissue being treated; however, as with any medical or dental procedure, complete elimination without recurrence cannot be guaranteed.

ALTERNATIVES TO LASER SOFT TISSUE TREATMENT:

Alternatives to laser dental treatment include conventional scalpel surgery using with local anesthesia and/or sedation. The advantages and disadvantages (risks and benefits) of this alternative to laser treatment have been explained to me, as well as the alternative of having no surgery and accepting my present dental condition.

POSSIBLE INTRAOPERATIVE COMPLICATIONS OF LASER DENTAL TREATMENT:

1. Burns - There is a risk of accidental injury by the laser energy or beam, which could cause permanent scarring, unlike, though, since the laser energy is carefully metered and contained.
2. Eye Damage - Injury to the eyes can result by looking at the laser beam. Complete eye protection is provided at all times during applications to prevent any possibility of eye damage.

POSSIBLE SHORT-TERM EFFECTS OF LASER DENTAL TREATMENT:

1. Pain – Discomfort, burning, or pain for a few days after treatment. A topical anesthetic may be used to block any discomfort during the treatment, but some minor discomfort may occur after the anesthetic has worn off and may last for several hours.
2. Redness of Tissue – Redness of the treated area for a time.
3. Swelling – Temporary swelling or bruising of the treated tissue, usually subsiding in a few hours. However, minor bruising may rarely persist for a few days.
5. Tissue Thickening – Textural changes of the treated area, such as thickening, which may persist for a variable time following the laser treatment.
7. Contact Dermatitis – Allergic reaction, usually secondarily to topical ointments used pre- and/or postoperatively.
8. Herpes Simplex Dermatitis (Fevers Blisters) – Recurrence of existing herpes simplex dermatitis, particularly if not treated pre-, intra- and post-operatively with an antiviral medication such as Zovirax.
10. Tissue Hyperpigmentation – Transient darkening, especially in dark-skinned people, after laser therapy.
11. Cellulitis or Infections – Cellulitis or infection of the soft tissues, especially if careful post-operative hygiene is not practiced.
12. Tissue Hypopigmentation – Lightening of the skin because of laser-induced injury to the melanocytes (pigment containing cells in the skin), which can be permanent.

POSSIBLE LONG-TERM COMPLICATIONS OF LASER DENTAL TREATMENT:

1. Scarring – The risk of scarring exists in all cases. It is variable and is often related to an individual's genetic makeup. Scarring can be minimized by carefully following appropriate aftercare instructions and by notifying the doctor if a problem develops.
2. Tissue Pigment Changes – Soft tissue color and texture changes may occur. At the junction of the treated and untreated areas, there may be a difference in color, texture, and/or thickness of the tissue.
3. Infection – A risk that occurs in any invasive or surgical procedure. It is minimized by the use of proper surgical technique and proper post-operative care.
Sources for important materials

Suppliers for pertinent materials *listed in your course manual*:

- Ultradent makes the topical anesthetic syringe... [http://store.ultradent.com](http://store.ultradent.com) SKU #1680
- The tips for it are SKU #127
- The TAC topical gel is available from: Professional Arts Pharmacy @ 1-888-237-4737
- Download the latest eZlase 940 presets from: [http://webpages.charter.net/wandaortho/chart.pdf](http://webpages.charter.net/wandaortho/chart.pdf)
- You can order the latest dental fee survey book from: [http://www.ndas.com](http://www.ndas.com)
Fee survey

Available at www.ndas.com
Infection control

- Identification and disposal of biologic hazards
- Plume hazards and precautions

Manage biologic hazards as with others encountered in dental practice.

Manage smoke plume as described earlier
The **infection control** protocol for the ezlase™ handpiece and tips is the steam sterilization method. However, before sterilization, the ezlase™ reusable handpiece should be carefully cleaned per the following procedure.

1. Carefully remove tip from the handpiece and **dispose in a sharp container**.
2. Carefully remove the handpiece from the fiber optic cable.
3. Wipe entire handpiece outer surface with cotton gauze and chemical disinfectant.
4. Soak gauze in chemical disinfectant, and then wrap handpiece in gauze.
5. Leave handpiece wrapped in gauze for 10 minutes.
6. Remove disinfectant gauze and wipe handpiece dry with dry gauze.

**NOTE**: The fiber optic cable and Handpiece and single use tips are delivered from the manufacturer as non-sterile.

**NOTE**: Tips are designed to withstand a single sterilization cycle and should be disposed of after single use in a sharp container.
Mucosele/biopsy

- Initiated tip
- 0.20 msec interval/0.10 msec pulse*
- 1 watt average power
- Procedure
  - Grasp lesion (use suture for biopsy)
  - Quick strokes to minimize thermal change
  - 2 mm boundary of normal tissue for biopsy

*pulsed mode vs. CW minimizes thermal damage
This is a demonstration of the ezlase used in a bracket positioning procedure, where the crown must be exposed to allow for bonding.

The entire procedure is shown in essentially real-time, including placement of the bracket.

Alternatives to using the laser here would include:
1. waiting for the tooth to erupt
2. Referral to a periodontist
Laser Contraindications

• Medical history
  – Allergies
  – Heart & lung disease
  – Bleeding disorders
  – Autoimmune deficiencies

All clinical procedures performed with ezlase™ must be subjected to the same clinical judgment and care as with traditional techniques.

Patient risk must always be considered and fully understood before clinical treatment.

The clinician must completely understand the patient’s medical history prior to treatment. Exercise caution for general medical conditions that might contraindicate a local procedure. Such conditions may include allergy to local or topical anesthetics, heart disease, lung disease, bleeding disorders, or an immune system deficiency. Medical clearance from patient’s physician is advisable when doubt exists regarding treatment.
Contraindications

Therapeutic lasers have been used for more than 30 years. There are no reports of patients being harmed by therapeutic dental lasers.

However, the risk of eye injury must be considered, especially for high-output lasers in the invisible range. Diode laser light is generally not divergent; however, since the light is collimated, the risk of eye injury increases significantly. Protective goggles, specific for the wavelength, must be used for the patient and the therapist.

Although there are no contraindications reported for dental therapeutic lasers, some caveats and side effects exist:

1. Suspected malignancies should never be treated by anyone but the specialist.
2. Because laser light affects several rheologic factors, patients with coagulation disorders need special attention.
3. Diabetes may preclude healing.
4. Patients with chronic pain have reported increased tiredness for a brief period, and long-standing pain conditions may transiently increase.*

*Low-level Laser Therapy in Dentistry, Grace Sun, DDS. The Dental Clinics of North America, Elsevier Saunders
Treatment objective and surgical technique simulation

- Alternate methods of treatment

1. Conventional surgery (*referral to a periodontist or the patient’s general dentist*)
2. Electrosurgery (*see earlier slide*)
3. No treatment
The assistant totally prepares the patient for the procedure, summoning the doctor only after verifying adequate anesthesia or for some special need.

After the doctor delivers the laser care, the assistant provides post-operative care instructions to the patient and schedule a follow-up appointment for 7-10 days.

**Post-laser instructions**

1. Dental laser procedures result in little discomfort following surgery. If needed, OTC anti-inflammatories like Motrin for 3 days after surgery may be helpful.

2. For the next 10 days after laser surgery, avoid chewing in the areas where the laser was used. Healing begins almost immediately after laser procedures, so it is important to maintain tiny healing clots that form.

3. **Daily Care:**
   1. During the first 24 hours, drink liquids only.
   2. During the first week, eat soft foods like yogurt, cottage cheese, mashed potatoes, etc. Do not chew where the surgery was performed for at least 10 days.
   3. Brush by gently placing the bristles of a soft toothbrush on the gums below the tooth and carefully roll the bristles upward over the tooth. Brush the test of the teeth as usual.
   4. (Frenectomies) Gently pull the upper lip outward slightly several times each day the first few days after surgery to help prevent the tissue from growing together.

4. Other aides such as the use of a Proxabrush or rubber tip, and certain rinses, should not be used until after your doctor has re-examined you.
Topical anesthesia using TAC almost always provides adequate anesthesia.

Occasionally, a conventional injection may be required.

A very effective and more innocuous method of delivering an anesthetic intra-tissue is through the MadaJet.
• Topical anesthesia in many cases
  
  20% TAC alternative gel (thick)
  20g jar; rapid onset; 20 minute duration

• 20% lidocaine
  4% tetracaine
  2% phenylephrine

• Professional Arts Pharmacy
• 1-888-237-4737
Management of complications

- Uncommon possibilities include:
  - Infection
  - Post-op pain
  - Hemorrhage
  - TMJ pain
  - Most anything conventional care might trigger, but usually with less severity
  - Recurrence of condition

Complications associated with dental laser surgery are rare. The operator should always anticipate untoward responses, however. Management of complications associated with laser surgery mirrors conventional surgery. However, eye injury is serious and the affected person should be seen by an ophthalmologist immediately.
Surgical and healing assessment

- Tissues treated with lasers heal more quickly than tissues treated with conventional surgical techniques.
- Post-op exam @ 7-10 days
- Any concerns addressed immediately

Tissues treated with lasers heal more quickly than tissues treated with conventional surgical techniques.
A post-op examination should occur 7-10 days after the procedure.
Any patient concerns must be addressed immediately.

When performing a maxillary frenectomy, make sure the patient/parent knows to inflate self with air under the upper lip several times a day for the next 48 hours; or, gently pull the upper lip up and away from the underlying mucosa. Both help prevent reattachment.
LLL

- Accelerates healing due to increased circulation
- Good for HSV, aphthous ulcers
- Technique:
  - 400 micron tip
  - 3 watts CW
  - NO tip initiation
  - Test beam on hand: distance/movement
  - Apply for 2-3 minutes continually moving the laser tip. DO NOT TOUCH THE TISSUE.
  - "Bandage" optional
Soft Tissue Contouring Sequence

Pre-treatment

Mid-treatment

End-of-treatment

- **EARLY TX**
  - INITIAL: Gingivectomy for bracket placement; Operculectomy

- **MID-TREATMENT**
  - MID-TX: Gingivectomy for hygiene

- **END-TX**
  - Frenectomy; Gingival contouring for esthetics
# Soft Tissue Contouring

<table>
<thead>
<tr>
<th><strong>Pre-treatment</strong></th>
<th>1. Gingivectomy for visualizing tooth long axis/CEJ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mid-treatment</strong></td>
<td>2. Gingivectomy for bracket access/position</td>
</tr>
<tr>
<td><strong>End-of-treatment</strong></td>
<td>3. Tooth exposure for soft tissue impactions</td>
</tr>
<tr>
<td></td>
<td>4. Lingual frenectomy</td>
</tr>
<tr>
<td></td>
<td>5. Operculectomy for hygiene, band, or crown placement</td>
</tr>
</tbody>
</table>

Generally prior to bracket placement
Pre-Tx Soft Tissue Contouring

[Image of pre-treatment soft tissue contouring with a green circle highlighting the area of concern]
Pre-Treatment Soft Tissue Contouring:

Gingivectomy for Bracket Placement
Tissue Interference

*Stainless steel crown placement*
Case Selection

- Is this patient a good candidate for gingivectomy?
Soft Tissue Contouring

Pre-treatment

Mid-treatment

End-of-treatment

1. Gingivectomy for hyperplastic tissue (TAD, brackets)
2. Alteration of tissue for esthetics and hygiene/ulcers
3. Operculectomy
Mid-Tx Gingivectomy
for Improved Hygiene
Removal of gingival enlargements, the location and bevel of the gingivectomy begins at the junction of the enlarged gingiva and adjacent gingiva. The location of this junction should be 1-2 mm coronal to the mucogingival line for the gingivectomy procedure to be indicated.
4 days post-laser
Mid-Tx Gingivectomy
for Idealizing Pontic Esthetics
Waterlase MD used...
Mid-Tx Exposure of a Palatally-Impacted Canine
Mid-Tx Operculectomy for Improved Hygiene

*Mid-Tx Procedures for Soft Tissue Irritation*
Aphthous Ulcer
Irritation Fibroma Removal
Soft Tissue Contouring

Pre-treatment

Mid-treatment

End-of-treatment

1. Contouring prior to restorative procedures
   - Creation of ovate pontic space
   - Mesial/Distal papillae contour for cosmetic bonding
2. Contouring for isolated symmetry problems
3. Anterior six esthetic Contouring and/or refinement
4. Upper/Lower labial frenectomy
5. Rotational fiberotomy
6. Implant exposure
End-Tx Soft Tissue

Contouring Prior to Restorative Procedures
End-Tx Soft Tissue

Contouring Problematic Labial Frenae
End-Tx Soft Tissue

Esthetic Contour
10 days post-op
Not always what you expect...
Not very “wow”...
Progress photos taken by the patient’s mother at days #0-3
Final Records
5 days post-laser
Progress photos taken by the patient’s mother at days #6-11
What Makes It All Worthwhile...

WOW!
Ezlar 940 machine review:
Regarding the:
1. Handpiece (inset): To ensure proper operation, regularly check the protective window (end of handpiece @ BLUE ARROW) and clean it if necessary.
2. Fiber: The fiber optic cable is permanently attached to the ezlase™ Console. The Handpiece is a reusable accessory. The Handpiece will require cleaning and sterilization after each patient treatment.
3. Fiber spool: Wind excess fiber optic cable on to fiber spool (clockwise).
4. Emergency stop
5. Service (power) connector
6. Remote interlock connector
7. Footswitch connector
8. Power connector
9. Stand: Acts as the cooling fin for the laser source (DO NOT COVER)
10. Rocker main power switch on the back of unit (red arrow)
Set laser operating parameters
Preview of the touch pad operating screen:

**TOP LEGEND**
1. ON/OFF – Turns the controls and display on and off.
2. READY – Allows energy delivery.
3. READY LED – Indicates unit is in READY mode.
4. STANDBY – Does not allow energy delivery.
5. STANDBY LED – Indicates unit is in STANDBY mode.
6. EMISSION LED – Indicates emitting of the laser power.
7. WIRELESS ON – Indicates communication with footswitch.
8. NAVIGATION WHEEL – Allows to select functions and adjust parameters.

**BOTTOM LEGEND**
1. AVERAGE POWER DISPLAY – Indicates average power delivered.
2. MAXIMUM POWER DISPLAY – Indicates maximum allowable delivered power.
3. POWER (up/down) – Allows adjustment of delivered optical power.
4. MENU – Selects user function.
5. PROCEDURES – Selects pre-set procedure parameters.
6. PULSE LENGTH (up/down) – Allows adjustment of pulse length.
7. PULSE INTERVAL (up/down) – Allows adjustment of pulse interval.
8. LASER MODE – Allows switching and indicates laser operation mode (continuous or pulsed).
9. ENERGY DISPLAY – Allows setting and displays amount of laser energy that has been delivered or to be delivered.
NOTE: The tips for ezlase™ are finger-bendable, single-use accessories provided in three core diameters: 200 µm, 300 µm and 400 µm of varying lengths. Tips are intended for single-use only and come pre-sterilized in individual packets.

THE MAXIMUM POWER THAT SHOULD BE USED WITH A 200 µm TIP IS 3 WATTS! (See Quickstart guide)

CAUTION: Do not bend tips with sharp angle – it will break the tip. If the red aiming beam is not present in READY mode – replace the tip.

Tighten the fiber tips clockwise (only when handpiece is connected to fiber)
When bending the tip canula, use only your fingers
Wind excess fiber optic cable on to fiber spool (clockwise).
Place handpiece in handpiece holder.

NOTE: The fiber optic cable is permanently attached to the ezlase™ Console. The Handpiece is a reusable accessory. The Handpiece will require cleaning and sterilization after each patient treatment.

WARNING: Never operate the laser without a fiber tip attached.

WARNING: All persons present in the operatory must wear appropriate laser eyewear protection.
ezlase™ 940 diode laser

• Setting up for use...
  – Tip selection
  – Tip initiation (or not)
  – Wavelengths
  – Power settings
    • Selected vs. total wattage delivered
    • Wattages for various procedures
  – Troubleshooting

Available one-use tips:

**Surgical use:**
200 μm core diameters
300 μm core diameters
400 μm core diameters

**Periodontal use:**
300 μm core diameters
400 μm core diameters

**Endodontic use:**
200 μm core diameters
Tip sizes and power settings

• 400 μm tip: use up to the maximum 7 watts.
• 300 μm tip: reduce wattage by 1/3...
  (i.e., 6 watts w/400 μm = 4 watts w/300 μm)
• 200 μm tip = reduce the wattage by 1/3 again.
  (i.e., 4 watts w/300 μm = just 2 $\frac{2}{3}$ watts w/200 μm tip)

NEVER EXCEED 3 WATTS W/200 μm TIP
Tip initiation:

Recommended: AccuFilm II (Stock number 017) red/black.

1. Use CW 1 watt to start.
2. Rather than just punch the tip through the paper, scratch the pigment off the surface of the plastic by dragging the fiber tip though the AccuFilm paper, keeping the fiber almost parallel to the paper.
3. It takes about 4-5 seconds of scratching the paper for the tip to initiate.
4. The tip gets treated up the fiber 1-3mm. This allows the fiber to cut on the side as well as the tip.

NOTES:

1. When the tip is on its side it is great for beveling.
2. You can control the cut by rotating the tip from the tip to the side thus slowing down the cutting and having a greater surface area to bevel.
3. The diode laser is the only laser that can cut on it's side.

TEST: Shine the aiming beam on a white surface. If the beam is still sharp and you can see the “donut” clearly, the tip is not initiated. Repeat initiation until the aiming beam is “fuzzy and indistinct”.

NOTE: It may be necessary to re-initiate the tip during a longer procedure.
OPERATING

1. Press ON/OFF button. The test fire laser will power up in a STANDBY mode.

2. Press READY button. System can start and after 2 second delay aiming red beam will be turned ON. Laser parameters can be selected from the pre-set features or adjusted manually.

**NOTE:** Unit will only emit laser energy when footswitch is pressed and set to READY mode. In READY mode, values may be changed only when footswitch is released.

When the tip is straight, the aiming beam will look like a circle, outlining the area where main laser power is applied.

When footswitch is pressed, laser power is applied and beam will fill the middle area of the spot.

**WARNING:** When aiming beam is not present or has a significantly different shape, change the tip or inspect/clean the protective window.

3. At this point laser is ready to use, pressing the footswitch will activate laser radiation. Refer to EQUIPMENT DESCRIPTION for guide through main menu functions or User Manual for detailed explanation.

4. Press ON/OFF button to go to SLEEP mode when not in use.

**NOTE:** System will automatically go first to STANDBY mode and then to SLEEP mode when not in use for 15 minutes.

Test fire laser
This clip demonstrates the proper manner to initiate the tip.

Keep in mind that the effective power output can vary ±20%, with the quality of the tip initiation being just one factor.

Remember that the initiated tip can be evaluated by shining the aiming beam on a light-colored surface:

1. If the beam is crisp and donut-shaped, it has not been fully initiated and the procedure must be repeated;
2. If the beam is fuzzy, the tip is ready for use…

Many doctors are now using a cork to initiate the tip. You may want to try a lower power setting (i.e., 0.6 watts CW) to see if it gives you better results. Also try the ComfortPulse mode.

Finally, coffee beans may work for you as well…
When using the cork...

Use proper power (~1.0 watt or less)

- Touch tip to cork w/o firing
- Fire laser and let tip sink until metal canula touches cork.
- *Keep firing* and draw tip out; STOP firing as tip leaves cork

4. Fire laser downward and watch <flash> of white or glow
5. Evaluate and re-initiate as needed
Successful tip initiation

When the tip is straight, the aiming beam will look like a circle, outlining the area where main laser power is applied.

When footswitch is pressed, laser power is applied and beam will fill the middle area of the spot.

Crisp donut shape **NOT** desired  \hspace{1cm} \textit{Fuzzy} beam **IS** desired

**WARNING:** When aiming beam is not present or has significantly different shape than shown, change the tip and inspect/clean the protective window.
ezlase™ Energy and Pulse Menu

PULSE LENGTH BUTTON (FIGURE 24)
While in the Pulse Mode, press PULSE LENGTH button to adjust pulse length. Press right arrow to increase pulse length and the left arrow to decrease. Laser ON time is when the actual energy is applied. Longer – generally more thermal effect, less bleeding. Press PULSE LENGTH again to exit to the Main Menu with modified setting. Press BACK to exit to the Main Menu. This action will not change any settings.

PULSE INTERVAL BUTTON
Laser OFF time allows tissue cooling, generally with less thermal effect. While in the Pulse Mode, press PULSE INTERVAL button to adjust pulse interval. Press right arrow to increase pulse interval and left arrow to decrease.
MENU BUTTON

By pressing the MENU button, you can get access to several system settings:

- Aiming Beam (5 levels of brightness adjustment)
- Beep Sound (3 levels of sound adjustment)
- Service Mode – accessible only by authorized Biolase Service Representatives.
**ezlase™ Energy and Pulse Menu**

- **Beep** – 3 levels
- **Aiming** – 5 levels

**Note:** Too low of an aiming beam may adversely affect ability to check initiation quality.
<table>
<thead>
<tr>
<th>Pre-set Name</th>
<th>Indications</th>
<th>Tip</th>
<th>Power</th>
<th>Average Power</th>
<th>Pulse Interval</th>
<th>Pulse Length</th>
<th>Duty Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>GINGIVECTOMY</td>
<td>Hypertrrophic tissue or cosmetic recontouring</td>
<td>Initiated</td>
<td>5.0 W</td>
<td>1.0 W</td>
<td>0.20 ms</td>
<td>0.05 ms</td>
<td>20%</td>
</tr>
<tr>
<td>TROUGHING</td>
<td>Gingival troughing for crown impressions</td>
<td>Initiated</td>
<td>3.75 W</td>
<td>1.2 W</td>
<td>0.20 ms</td>
<td>0.1 ms</td>
<td>33%</td>
</tr>
<tr>
<td>CURETTAGE</td>
<td>Removal of inflamed/recorced tissue</td>
<td>Initiated</td>
<td>3.0 W</td>
<td>1.0 W</td>
<td>0.20 ms</td>
<td>0.1 ms</td>
<td>33%</td>
</tr>
<tr>
<td>EXCISION</td>
<td>Gentle removal of soft tissues for biopsy</td>
<td>Initiated</td>
<td>4.0 W</td>
<td>0.8 W</td>
<td>0.20 ms</td>
<td>0.05 ms</td>
<td>20%</td>
</tr>
<tr>
<td>FRENECTOMY</td>
<td>Removal of labial or sublingual组织</td>
<td>Initiated</td>
<td>4.0 W</td>
<td>1.33 W</td>
<td>0.20 ms</td>
<td>0.1 ms</td>
<td>33%</td>
</tr>
<tr>
<td>IMPLANT RECOVERY</td>
<td>Exposure of implant during second stage</td>
<td>Initiated</td>
<td>3.0 W</td>
<td>0.6 W</td>
<td>0.20 ms</td>
<td>0.05 ms</td>
<td>20%</td>
</tr>
<tr>
<td>PERIO POCKETS</td>
<td>Removal of diseased and inflamed tissue</td>
<td>Initiated</td>
<td>1.5 W</td>
<td>0.75 W</td>
<td>20 ms</td>
<td>20 ms</td>
<td>50%</td>
</tr>
<tr>
<td>PULPOTOMY</td>
<td>Adjunct to root canal therapy</td>
<td>Initiated</td>
<td>2.0 W</td>
<td>1.0 W</td>
<td>1.0 ms</td>
<td>1.0 ms</td>
<td>50%</td>
</tr>
<tr>
<td>CROWN LENGTHENING</td>
<td>Soft tissue crown lengthening</td>
<td>Initiated</td>
<td>5.0 W</td>
<td>1.0 W</td>
<td>0.20 ms</td>
<td>0.05 ms</td>
<td>20%</td>
</tr>
<tr>
<td>INFECTED POCKETS</td>
<td>Removal of infected tissue in periodontal pockets</td>
<td>Initiated</td>
<td>2.0 W</td>
<td>1.0 W</td>
<td>1.0 ms</td>
<td>1.0 ms</td>
<td>50%</td>
</tr>
<tr>
<td>ELECTROSURGE</td>
<td>Continuous Wave Fast Cutting-ElectroSurge Equivalent</td>
<td>Initiated</td>
<td>1.3 W</td>
<td>CW</td>
<td>--</td>
<td>--</td>
<td>100%</td>
</tr>
<tr>
<td>Hemostasis</td>
<td></td>
<td>Uninitiated</td>
<td>0.7 W</td>
<td>CW</td>
<td>--</td>
<td>--</td>
<td>100%</td>
</tr>
<tr>
<td>Aphthous Ulcer Stage I</td>
<td></td>
<td>Uninitiated</td>
<td>1.5 W</td>
<td>0.75 W</td>
<td>20 ms</td>
<td>20 ms</td>
<td>50%</td>
</tr>
<tr>
<td>Aphthous Ulcer Stage II</td>
<td></td>
<td>Well initiated</td>
<td>3.5 W</td>
<td>0.7 W</td>
<td>0.2 ms</td>
<td>0.05 ms</td>
<td>20%</td>
</tr>
<tr>
<td>Bliostimulation</td>
<td></td>
<td>Uninitiated</td>
<td>0.3 W</td>
<td>CW</td>
<td>--</td>
<td>--</td>
<td>100%</td>
</tr>
</tbody>
</table>
TURN THE UNIT OFF

► Place handpiece back on handpiece holder.

■ **CAUTION**: Verify that fiber optic tubing assembly is not twisted once the handpiece is returned to the holder. The fiber may break if it is twisted.

► Press the ON/OFF button to turn display OFF.
► Switch the Power Switch to OFF position, if laser system will not be used for a long period of time.
► Put the fiber cable on the spool.
THE HEART OF THE EZLASE’S ABILITY TO DELIVER COMFORTABLE TREATMENT IS IN THE COMFORTPULSE... EXERCISE:

ComfortPulse cutting may be too subtle for some new ezlase users, especially if they are transitioning from electrosurge. There are three major ways that diode lasers are used in dentistry for incision and beveling:

1. CW Mode (laser is on continuously)
2. 50%-50% Pulse Mode (1 millisecond on and 1 millisecond off)
3. ComfortPulse (50 microseconds on and 200 microseconds off)

Competitive dental diode lasers are used in either CW or the 50-50 duty cycle and all clinical literature published prior to the introduction of the ezlase document only these two methods of cutting.

Fast cutting like an electrosurge with the ComfortPulse setting enabled may not be impressive at first exposure, especially when cutting on a hot dog. *Hot dogs don’t have the hemoglobin and other target tissue they will see when using the laser on their patients.*

After thoroughly initiating the tip, start out in CW at 1.5 to 2.5 watts on the hot dog. If expect faster cutting is desired, turn it up until the desired effect is reached.

Lower settings on patients in the 0.8 to 1.2 watt range are ideal in CW mode, but must be used with topical or on patients otherwise anesthetized. At the perio setting (50-50 cycle pulse setting like all other diodes), turn it up until satisfied with the cutting; power ~2 watts can be used at 50-50, giving an average power of 1 watt – the same range as the CW recommendation for patients.

ComfortPulse is new, developed by BIOLASE to provide more comfort to the patient, less thermal effects on the tissue, and a cleaner cut – a subtle way of cutting, but requires practice to perfect, the tip to be well-initiated, and can often be used without even topical anesthesia. Tissue effects and cutting speed on the hot dog requires power to be set at 4 watts or higher, giving an average power back to 1 watt, due to the 25% duty cycle.

At the end of the demonstration and hands-on, further practice all three major modes of cutting with the ezlase and use the those which suits you best. 90% of all diode users only use CW and 50% pulse modes and that it is ok if you use them too.

Bottom line is you may not feel totally comfortable with ComfortPulse right out of the gate. While it is a breakthrough in comfort and clean cutting, it takes practice and is more subtle at the lower power settings where it excels.
THE FUTURE OF THE DENTAL LASER:
Photobiomodulation is also known as low level laser therapy (LLLT), cold laser therapy, and laser biostimulation, a medical technique in which exposure to low-level laser light has certain beneficial effects.
Possible future uses include treating soft tissue injuries and chronic pain, aiding smoking cessation, wound healing and nerve regeneration, and possibly even resolving viral and bacterial infections.
The fluorescence feature of laser use is already being seen in preventive dentistry for caries detection and its use can be expected to expand.
Combining laser and drug therapies adds to the efficacy of these procedures; promise is already being seen in dermatology with regard to treatment for rosacea and actinic damage, and for stimulating dermal collagen production, without significant injury to the epidermis.
In implantology, the use of surgical lasers has been advocated to aid in the placement and second stage recovery of dental implants, together with soft tissue contouring. In addition, laser use has been suggested as an aid in decontamination of the implant surface in cases of peri-implantitis.
Oral surgery uses that show promise include treatment for bisphosphonate-induced necrosis of the jaw.