NEVADA STATE BOARD
of
DENTAL EXAMINERS

LASER WORKING GROUP/
LEGISLATIVE & DENTAL
PRACTICE (RESOURCE GROUP)

MARCH 22, 2012
6:00 p.m.

*NO PUBLIC MATERIALS FOR
THIS MEETING*
Diode Perio Laser Training

William H. Chen,
DMD, MAGD, MWICD, MALD, FACD, FICD
Perio Disease
A National Epidemic

- Affects 75%-80% of the adult population
- Over 40% have attachment loss > 3mm

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Major Health Risks Linked to Gum Disease

- Heart Disease
- Stroke
- Diabetes
- Respiratory Disease
- Osteoporosis
- Low Birth Weight
“This evidence suggests a moderate association, but not a casual relationship between periodontal disease and heart disease. Animal studies suggest that infection with P. gingivalis enhances atheroma lesion formation.”

Seven of nine studies evaluating tooth loss and periodontal disease as risk factors for stroke or peripheral vascular disease showed some significant associations.

“Researchers have found that people with periodontal disease are almost twice as likely to suffer from coronary artery disease as those without periodontal disease.”
Progress of Periodontal Disease

Stage 1: Healthy gingiva and bone anchor teeth firmly in place.
Progress of Periodontal Disease

Stage 2: Gingivitis develops as toxins in plaque irritate the gums.
Progress of Periodontal Disease

Stage 3: Moderate periodontitis occurs when toxins destroy the connective tissues: collagen, elastin & hyaluronic acid. Early bone loss.

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Progress of Periodontal Disease

Stage 4: Advanced Periodontitis occurs with advancing destruction of connective tissues and alveolar bone.
The Benefits of the Diode Laser

- Laser incisions seal lymphatic vessels and nerve endings, which results in:
  - Less inflammation
  - Less swelling
  - Less pain
Laser Benefits

- Improves visibility.
- Can be used with topical anesthetics.
- Fewer shots translates into better treatment acceptance from patients. Patients with less anxiety have lower blood pressure (which lowers yours).
- Minimally invasive laser procedures extend the range of periodontal therapy that can be completed without an open flap procedure.

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Laser Benefits

· “Every year many patients with advanced periodontal disease lose their teeth because both the dentist and the patient dread treatment. Patients frequently have stories of friends and relatives that went through a painful ordeal and a seemingly never ending recovery with periodontal surgery. To add insult to injury, they frequently need retreatment in 3 to 5 years”.
  · Dr. Brett Dyer
Functions of a Diode Laser

- You can trough around the root and actually see what you are cleaning.
- You can remove the lining epithelium for reattachment.
- You can clean the root surface and leave a more biocompatible root surface than with any other instrument.
- You can enhance new bone growth.

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EzLase Versus Electrosurgery

- Can use Ezlase around metal
- Has zone of necrosis 3-5 cells deep
- Perio Applications
  - Whitens Teeth
  - Desensitizes Teeth
- Herpetic and Apthous Ulcer Treatment
- Marketing Benefits
Soft Tissue Indications

- Hemostasis
- Crown Troughing
- Sulcular Debridement
- Gingivectomy/Gingivoplasty
- Frenectomy/Frenotomy
- Implant Recovery
The objective of using a diode laser as an adjunct to scaling and root planing is to improve the efficacy of root planing, decontaminate the periodontal pocket, and reduce dentin hypersensitivity. By removing the epithelial lining, we promote reattachment.

The diode laser has been shown to be safe in the periodontal pocket with up to 2 watts of power. Root surfaces instrumented with hand instruments and diode laser in vivo did not show detectable surface alterations. There were no signs of thermal side effects in any of the teeth treated.

An 810nm diode laser used at 400 – 1200 mW eliminated Prevotella sp, Streptococcus betahemolitico, fusobacterium sp, and Pseudomonas sp. Moritz et al. have demonstrated the elimination of AA with a diode.

Diode lasers can remove biofilms

Biofilm

- The term “biofilm” describes a community of bacteria enclosed within their own mucinous, gel-like polymer secretions. In the oral cavity, biofilms are responsible for periodontal and peri-implant disease. In periodontal disease, the biofilm complex that is attached to the dental root and pocket epithelium protects pathogenic bacteria from exogenous assault (e.g., from antibiotics) and endogenous attack from the host’s inflammatory and immune responses.
Diode laser can be used to eliminate the biofilm by utilizing the inherent thermal properties. 1% methylene blue is used to stain the biofilm. It is used as a heat sink to achieve THERMOLYSIS and COAGULATION of the biofilm, which is changed from a mucinous liquid-gel to a semisolid coagulum. This coagulum can be easily removed from the affected pocket with scaling and root planing.

Laser Assisted Reattachment
With the Diode Laser

- Indications – 4 to 6 mm suprabony pockets in healthy patients.
- Patients with diabetes, taking blood thinners, in questionable health, or choose not to have laser assisted regeneration – 4+ mm pocket depth.
- What is the difference between reattachment and regeneration?
- Always begin treatment by recording pocket depth, gingival margin, BOP, mobility, and depth of furcation. FMX and blood pressure are required.
Should we scale and root plane before laser treatment or as a part of the laser treatment?

- Using the laser to trough around the teeth in sites with 4+ mm of pocket depth allows better visibility of the root and less bleeding.
Practical Considerations

- If your hygienist does not have the freedom to use a laser, then you can either begin the procedure with de-epitheliazation for her or
- She can complete scaling and root planing. After 1 month, you would reevaluate and then treat the remaining pockets with site specific care.
For hygienists that can use the diode laser – use the laser during scaling and root planing as demonstrated next. My hygienist can only use the code 4341. The laser is considered an adjunct to scaling and root planing.

Insurance companies do not reimburse more for using the laser as an adjunct.

In our office, we explain the benefits of the treatment to the patient and have them pay for the treatment in full. We do charge more than standard 4341 fees. We routinely use Capitol One financing to aid the patient or offer a discount for payment in full at the time of treatment.
Step 1

- Troughing and wounding of external epithelium. Watch the tissue disappear under your laser tip. Must wear magnification.

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Steps for Laser Assisted Periodontal Therapy with a Diode Laser

- First we stain the sulcular epithelium. Then I apply a topical anesthetic. Why stain?
- Diode lasers transform laser energy to radiant energy. So you are working with a “hot tip.” The pocket epithelium is not ablated with the low power achieved with a diode. Rather it is coagulated. The longer you use a diode tip in the periodontal pocket, the more the adjacent tissues are impacted by the heat.
- Therefore, we use a heat sink. A heat sink can preferentially absorb incandescent heat energy from the diode laser’s hot tip. This approach will protect deeper periodontal tissues from damage and target biofilm in the periodontal pocket for thermolysis.
Diode Periodontal Treatment

- Listgarten, et al have shown that biofilms and diseased epithelium are highly permeable to methylene blue.

- The initiated red tip on an activated diode laser emits energy between the spectrum of 600 – 700nm. Which corresponds to the peak absorption of methylene blue.

- There is a profound energy transfer to the live biofilm and diseased sulcular epithelium that has been stained with MB. This novel targeted and controlled heat transfer results in the formation of a semisolid coagulum (from the biofilm and stained epithelium) that can then easily be removed with root planing and scaling.
Diode Periodontal Treatment

Methylene Blue applied with brush

Laser activated and incandescent tip forms in 1 sec

Tip is inserted in pocket and moved from side to side quickly

Coagulum is removed. Roots are planed

3 mm healthy sulcus by 5 weeks

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Diode Periodontal Treatment

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Biofilm Removal Settings

- Peak Power 5.00 Watts
- Pulse Interval 0.20
- Pulse Length 0.05
- Average Power 1.00 Watts
- 300 um Micron Tip
A study published by the *Journal of Periodontal Research* shows that a combined course of Diode laser scaling and root debridement using methylene blue and LLLT treatments are more beneficial than non-laser scaling and root debridement alone for the treatment of chronic periodontitis.

Periodontal Pockets Settings

- Peak Power 5.00 Watts
- Pulse Interval 0.20
- Pulse Length 0.05
- Average Power 1.00 Watts
- 300 um Micron Tip
Post Surgery Healing

After the First 12 Hours

- Epithelium Migration: \(\frac{1}{2}\) mm per day (after the first 12 hours)
- Fibroblast Migration: 80-100 microns per day
- Osteoblast Migration: 80-100 microns per day

In Other Words

Epithelium grows back 1 mm every 2 days.
Fibroblasts and osteoblasts grow 1 mm every 10 days, or so.

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The Purpose of Soft Tissue Management

- The purpose of a soft tissue program is to restore the periodontal health so that there is:
  - Elimination of the diseased sulcular epithelium
  - Minimal intrasulcular bacterial activity
  - A halting of the apical migration of the epithelial attachment
  - Minimal pocket depth
  - No bleeding upon probing

- This program is continual

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Laser Techniques

1. Insert the fiber in the sulcus keeping parallel and slightly angled towards the diseased epithelium.
2. Starting on the crest and working down to the base of the pocket.
This laser treatment uses laser strokes with fast painting then diagonal direction overlapping horizontal direction. Move the tip in the fresh minor wound site and creates a dentureless necrotic reduces bacterial flora.
Ezlase Operating Setting

Wavelength: 940 nm  
Beam Diameter: 300 Micron Fiber

Perio Pockets – Removal of Diseased and Inflamed Tissue

- Peak Power: 3.25 Watts
- Peak Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 0.66 Watts
- 300 um tip

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Ezlase Operating Setting

Wavelength: 940 nm  Beam Diameter: 300 Micron Fiber

Bacterial Decontamination

- Peak Power: 1.00 Watts
- Continuous Wave Mode
- Average Power: 1.00 Watts
- 300 um tip
- Uninitiated tip

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Ezlase Perio Setting

Wavelength: 940 nm  
Beam Diameter: 300 Micron Fiber

- Initiated
- 3.00 Watts
- PI = 0.2 m seconds
- PL = 0.1 m seconds
- Average Power 1.00 Watt

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Ezlase Perio Setting

Wavelength: 940 nm  Beam Diameter: 300 Micron Fiber

- Initiated
- 3.25 Watts
- PI = 0.2 m seconds
- PL = 0.1 m seconds
- Average Power 1.25 Watt

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Ezlase Perio Setting

Wavelength: 940 nm  Beam Diameter: 300 Micron Fiber

Perio Pocket Decontamination

- Uninitiated
- 3.25 Watts
- PL = 0.2 m seconds
- PL = 0.05 m seconds
- Average Power 0.66 Watts
Twilite Operating Parameter

Wavelength: 810 nm      Beam Diameter: 400 Micron Fiber

Removal of Diseased Epithelium Lining

- Power: 1.0 – 1.5 Watts – Continuous
- Pulse Rate: ---- (Continuous)
- Rep Rate: ---- (Continuous)
- Exposure Time: 20-30 seconds per pocket

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Twilite Operating Parameter

Wavelength: 810 nm  
Beam Diameter: 400 Micron Fiber

Bacterial Decontamination

- Power: 1.0 – 2.0 Watts
- Pulse Rate: 10 pulses per second
- Rep Rate: .05 seconds
- Exposure time: 20-30 seconds per pocket

- Monitor / Adjust to Patient Comfort

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## CASE TYPE

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<thead>
<tr>
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<th>Gingivitis</th>
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<th>1-3 hours</th>
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<td>3-4 mm</td>
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<td>Type III.</td>
<td>Slight Perio</td>
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<td>Type IV.</td>
<td>Advanced Perio</td>
<td>6+ mm</td>
<td>6-12 hours</td>
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Twilite Periodontal Treatment
Sulcular Debridement
and Decontamination
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940 Ezlase
Perio
Periodontal Pockets Settings

- Peak Power 3.25 Watts
- Pulse Interval 0.20
- Pulse Length 0.05
- Average Power 0.66 Watts
- 300 um Micron Tip
Implantitis
Periodontal Pockets
in Implant,
Sulcular Debridement and
Decontamination

© William H. Chen, DMD, MAGD, MWIGD, MALD, FACP, FICD
Root Planing using Twilite for decontamination.

Scaled implant.

Irrigated with Peridex.
WILLIAM H. CHEN, DMD, MAGD, MWICD, MALD, FACD, FICD

P.O. Box 1178
4168 Nameoki Road
Granite City, IL 62040
Ph. (618) 931-2025
Fax (618) 931-8888
E-mail: chenlaser@gmail.com
Website: www.chenlaserinstitute.com

Thank You
940 nm wavelength

Identified in clinical testing as most effective wavelength for hemostasis and patient comfort

cleaner cutting and faster hemostasis with better absorption by hemoglobin and oxyhemoglobin

William H. Chen, DMD, MAGD, MWCLI, MALD, EdALD, FACD, FICD

BIOLASE: FDA Clearance Approvals

first 940 nm wavelength soft tissue diode laser to receive FDA 510k approval

only soft tissue diode laser with ComfortPulse® pulse control for maximum patient comfort
Continuous Wave:
The power is on all the time and is not subject to interruption.

Continuous Wave Mode
LASER Settings...Power: 3.0 Watts
Pulse Length: n/a
Rep Rate: n/a

AVERAGE POWER = 3.0 Watts

Modes of Operation
- Continuous Wave
- Gated Pulsed Mode
- Free-Running Pulsed Mode

Footswitch
The eziwave™ will not emit laser energy until the user presses down on the footswitch. The footswitch is designed to work using wireless technology. One full charge of the battery will allow approximately one week of regular operation. When the battery is low, a permanent cable should be connected to resume operation. For charging, unit must be turned ON. It takes 4 hours of charging time for full battery capacity.

NOTE: It is recommended to recharge the battery overnight every week.
Pulse Interval

- Laser OFF time allows tissue cooling.

Gated (Pulsed) Mode:
The energy is interrupted by electrical or mechanical means and the resultant energy delivered to the target tissue is thereby altered.

Pulse Length

- Laser ON time is when the actual energy is applied.
- Longer PL generally causes more thermal effects and less bleeding.

Gated (Pulsed) Mode

LASER Settings...
- Power: 3.0 Watts
- Pulse Length: 0.5 seconds
- Rep Rate: 10 per second

AVERAGE POWER = 1.5 WATTS
Energy, Pulse Menu, ezlase™

- 3 pages, 15 pre-sets
- Beep - 3 levels
- Aiming - 5 levels

ezlase™ Pulsed Mode

- CW mode
- Regular "pulsed" 50/50%

Unique ezlase™ pulsed mode
"cool cutting" - Comfortpulse™

Laser-Tissue Interaction
Laser-Tissue Interaction

PHOTO-THERMAL Effect

Tissue Effects Caused by Thermal Exposure

Zone of Necrosis – tissue is irreversibly damaged and will die

Zone of Coagulation – most of the tissue will recover and return to normal

Laser-Tissue Interaction

- Reflected
- Absorbed
- Transmitted (Refracted)
- Scattered

Absorbed
Dependent on Laser Wavelength, Tissue Composition, Pigmentation and Water Content
Laser-Tissue Interaction

Thermal Relaxation
The time that the laser energy is OFF is referred to as the thermal relaxation time, the time during which the target tissue is allowed to cool.

Power Density:
Watts per centimeter squared

When people discuss the efficiency of different fiber diameters, they are really asking about the effect of Power Density. 

\[ \text{Power Density} = \frac{\text{Watts}}{\text{cm}^2} \]

\[ \text{C} = \text{One unit of power} \]

The smaller the diameter of the fiber, the more power per square centimeter.

Laser-Tissue Interaction

Power Intensity
+ Exposure Time
+ Spot Size

POWER DENSITY (W/cm²)

Laser-Tissue Interaction

Power Density
+ Duration of Exposure, Amount of Cooling
+ Specific Wavelength, emission mode
+ Tissue Characteristics

BIOLOGIC EFFECT
### Thermal Effect of Laser on Tissue

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<tr>
<th>Tissue Temperature (°C)</th>
<th>Observed Effect</th>
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<td>Hyperthermia</td>
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<tr>
<td>&gt; 60</td>
<td>Coagulation</td>
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<tr>
<td>70-90</td>
<td>Protein Denaturation</td>
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<tr>
<td>100-150</td>
<td>Welding</td>
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<tr>
<td>&gt; 200</td>
<td>Vaporization</td>
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<td></td>
<td>Carbonization</td>
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</table>

### Changing Tips

### Preparation of the Ezlase
Changing Corks

Initiation of Tip

Initiation of Tip with Accu Film

Initiation Settings

- 2.75 Watts
- CW
- Fiber Tip of Choice (300 or 400)
EzLase Clinical Applications

Bending the Tip
Frenectomy
Maxillary
Maxillary Frenectomy Settings

- Peak Power: 5.00 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 1.00 Watt
- 300 um Tip
Frenectomy
Mandibular

Maxillary Frenectomy

s.s.

Maxillary Frenectomy

s.s.
Mandibular Frenectomy Settings

- Peak Power: 5.00 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 1.00 Watt
- 300 um Tip
Lingual Frenectomy

J.W.

Pre-op
1 Week Post-op
3 Weeks Post-op

Lingual Frenectomy

E.D.

Pre-op
3 Days Post-op
1 month Post-op
**Lingual Frenectomy Settings**

- Peak Power: 7.00 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 1.40 Watt
- 300μ Tip

**Biostimulation Settings**

- No Fiber Tip
- Power: 1.00 Watt
- CW
- Energy: 40 Joules/cm²
Aphthous Ulcer Treatment Settings

- Peak Power: 2.00 Watts
- Continuous Wave Mode
- Do not initiate tip
- 400 um tip
Biopsy Settings

Ezlase 940
- 1.00W, CW
- 1.50W, CW
- 2.00W, CW
- 2.5, CW New Tip
LLL T
- 1.00W, No HP, No Sheath, No Tip
- 40 J/cm²

Aphthous Ulcer Treatment Settings:

- Remove fiber tip
- Remove handpiece
- Direct laser beam on target tissue
- 1 Watt
- CW
- 40 Joules/cm²
Biopsy: Squamous Papilloma in the Palate

Operculectomy: Distal of #31

Biopsy Settings
- Peak Power: 4.50 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 0.9 Watt
- 300 um tip
Gingivectomy Settings

- Peak Power: 4.50 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 0.9 Watt
- 300 um Tip

Operculectomy Settings

- Peak Power: 2.50 Watts
- Pulse Interval: 1 ms
- Pulse Length: 0.50 ms
- Average Power: 0.83 Watt
- 300 um Tip

#12 Gingivectomy

Gingivectomy: Mesial of #15 to Remove Decay
**Crown Troughing Settings**

- Peak Power: 5.00 Watts
- Pulse Interval: 0.2 ms
- Pulse Length: 0.1 ms
- Average Power: 1.66 Watt
- 300 um Tip

**Gingivectomy Settings**

- Peak Power: 3.25 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 0.65 Watt
- 300 um Tip

**940 Troughing**

- 5 Watts, PI-.2ms, PL-.1ms, AP-1.66
- 5 Watts, PI-.2ms, PL-.05ms, AP-1.00

**Crown Troughing: #31 for Impression**

J.W.
E4D Crown Troughing:

- Peak Power: 4.50 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 0.9 Watt
- 300 um Tip

Crown Lengthening:
For bonded-bridge for #6, 11

Crown Troughing:
for CAD-CAM
Crown Lengthening Settings

- Peak Power: 5.0 Watts
- Pulse Interval: 0.2 ms
- Pulse Length: 0.05 ms
- Average Power: 1 Watt
- 400 um Tip

Crown Troughing Settings

Peak Power: 5.00 Watts
Pulse Interval: 0.2 ms
Pulse Length: 0.05 ms
Average Power: 1.00 Watt
300 um Tip
Soft Tissue
Crown Lengthening Settings

- Peak Power: 4.5 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 0.90 Watt
- 300 um Tip

Distal Wedge Gingivectomy #18
Implant Uncovering

Distal Wedge Gingivectomy Settings
- Peak Power: 2.50 Watts
- Pulse Interval: 1 ms
- Pulse Length: 0.5 ms
- Average Power: 0.83 Watt
- 300 um

Implant Uncovering: #15 for Abutment Placing

S.W.
Post-op

Implant Uncovering Settings

- Peak Power: 3 Watts
- Pulse Interval: 0.2 ms
- Pulse Length: 0.05 ms
- Average Power: 0.6 Watt
- 400 um Tip

Settings

400 um Tip

Pulpotomy
- 4 Watts (PP), 20 ms (Pl), 20 ms (PL), 2 Watts (AP)
- Hemostasis
- 1-2 Watts, CW

- I&D
- 3 Watts (PP), 20 ms (Pl), 20 ms (PL) 1.5 Watts (AP)

Pulpotomy, Hemostasis, and Incise & Drain of #K

K.C.
Laser Analgesia
Before Operculectomy

Pulpotomy and Incise and Drain of #J

EzLase Laser Analgesia Settings
- Remove fiber tip
- Direct laser beam on target tissue
- 1 Watt
- CW
- 62 Joules/cm²

Pulpotomy- I & D Settings
- 3-4.00 Watts
- 0.05 PI
- 1.00 PL
- 400 micron tip
Endo Laser Analgesia of #28
(instead of injection anesthesia)

• 1.50 Watts
• CW
• 420-620 Joules

Endo Decontamination of #11

• 2.00 Watts
• 20 PL
• 20 PL
• 1.00 Watt Average Power
• 60 Joule
• 300 micron tip
• 60 seconds

Settings

Endodontic Decontamination Settings

• 1.00 Watt Average Power
• 60 Joule
• 300 micron tip
• 60 seconds
Incision for Flap Settings

- Peak Power: 3.25 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 0.65 Watt
- 300 um Tip

Incision for Flap

Perio Therapy: Pocket Reduction and Biofilm Removal of #4, 5

No air, water cooling
- Some Charring

Air & water cooling
- No Charring

T.A.
Biofilm Removal Settings

- Peak Power: 5.00 Watts
- Pulse Interval: 0.20 ms
- Pulse Length: 0.05 ms
- Average Power: 1.00 Watt
- 300 um Tip

Perio Therapy: Pocket Reduction and Biofilm Removal of #7, 8

J.C.
Coagulation of Extraction Site
Settings

- 1.00-2.00 Watts
- 300 micron tip
- Continuous Wave Mode

EzLase Hemostasis & Biostimulation
Thank You

EzLase Hemostasis & LLLT Settings

- Hemostasis
  - 1 Watt, CW, Initiated Tip
- LLLT
  - 1 Watt, CW, Without Tip
ezlase™ Whitening Key Features

- Full-mouth whitening in less than 20 minutes of in-office treatment time
- Best whitening improvement compared to other solutions, in similar tests
- Excellent results right away, and even more dramatic improvement after 24 hours
- Desensitizer gel included to help reduce sensitivity if necessary
- Only required training is for ezlase™ laser system

¹ Does not include prep and post treatment preparation

Reasons to Choose the ezlase™ Whitening System

Why offer whitening?
- To make your patients even happier with a beautiful smile
- To provide your practice with another source of revenue

Why offer whitening now?
- To attract and retain patients with expanded service that differentiates your practice
- If you already have an ezlase laser, whitening will increase your ROI

Why use the ezlase Whitening System?
- Faster in-office treatment allows you to treat more patients in a day, and patients are happier to spend less time in the dental chair
- Best whitening improvement available
- A patient needs immediate results and might not have time for take home whitening (job interview, wedding, etc.)
- The ezlase laser can also be used for soft-tissue procedures and for some pain therapy (such as TMJ)
LaserWhite20 Whitening Gel

- Proprietary gel, chromophore engineered and designed to work with Biolase diode laser systems
- Laser energy is absorbed by special particles in the gel to activate the H₂O₂ (38% concentration, after mixing with activator gel), accelerating the whitening procedure
- Desensitizer gel included to help reduce sensitivity if necessary
- Each kit good for one full-mouth whitening case

Comparison of Treatment Times

<table>
<thead>
<tr>
<th>Product</th>
<th>Light Source</th>
<th>Treatment Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>35% H₂O₂ Gel</td>
<td>[none]</td>
<td>60 min</td>
</tr>
<tr>
<td>Britesmile</td>
<td>LED</td>
<td>60 min</td>
</tr>
<tr>
<td>NuPRO White Gold</td>
<td>[none]</td>
<td>60 min</td>
</tr>
<tr>
<td>Opalescence Xtra Boost</td>
<td>[none]</td>
<td>60 min</td>
</tr>
<tr>
<td>Sapphire</td>
<td>Plasma Arc</td>
<td>40 min</td>
</tr>
<tr>
<td>Zoom2”</td>
<td>Mercury Metal</td>
<td>60 min</td>
</tr>
<tr>
<td>LaserSmile</td>
<td>Diode Laser</td>
<td>40 min</td>
</tr>
<tr>
<td>ezlase 940 nm</td>
<td>Diode Laser</td>
<td>20 min</td>
</tr>
</tbody>
</table>

- ezlase™ and LaserSmile are the only laser-based whitening systems
- Other systems utilize light, but they do not use a laser

ezlase™ Diode Laser

- Three Systems in 1
  - Soft-Tissue procedures with minimal bleeding, swelling, or post-op pain
  - Teeth Whitening
  - Pain Therapy and Relief
- 940 nm or 610 nm wavelengths (whitening with 940 nm system)
- 7 Watts maximum output power for 940 nm
- Continuous Wave mode, or ComfortPulse™ settings for greater patient comfort with less anesthetic
- Battery pack for optimal operating convenience

ezlase™ Whitening Handpiece

- Contoured to treat an entire quadrant of teeth at once, consistently, and comfortably
- Ergonomically designed to fit comfortably in your hand
- Elegant, small and extremely lightweight
- Proprietary handpiece design ensures safety to you and your patient
In Early Clinical Trials

- St. Barnabas Hospital – Department of Dentistry (previously published LaserSmile Whitening System article in AADC)
- Various private practices in the US
- Goal: Demonstrate the efficacy of LaserWhite20 gel with the shorter improved clinical protocol
- Data collection expected at the end of Q2 2009

How to Use ezlase™ Whitening System

Note: Listed here is just a quick summary. Please carefully follow the Instructions for Use included with the LaserWhite20 gel and ezlase™ Whitening Handpiece.

1. Apply liquid dam to the gingiva, and cure with a standard curing light
2. Mix the activator and base gels by connecting the two syringes together and pushing the gels back and forth
3. Apply a thin layer of the mixed gel with a brushed applicator tip to each quadrant of teeth
4. Ensure that the doctor, patient, and all persons in the room wear protective eyewear before starting the laser
5. Place a disposable clear plastic cap over the whitening handpiece, and place the handpiece in close proximity (~1mm) to the first quadrant, without touching the gel

Laboratory Results on Hydroxyapatite Discs

- LaserWhite20 is approximately 44% more effective than LaserWhite10
- LaserWhite20 takes approximately 1/3 of the time compared to LaserWhite10 on hydroxyapatite discs (Note: Protocol recommends 9 min of gel contact time on teeth, but laser exposure time remains 1 min)
- Less laser exposure time reduces heating effects
- Note: Although those tests were not performed on teeth, enamel's primary material is hydroxyapatite (~95%)
How to Use ezlase™ Whitening System

6. Deliver 200 Joules of laser energy at 7 Watts to the quadrant (~30 seconds), and then repeat for all quadrants
7. Repeat step 6 one more time
8. Allow the gel to remain on the teeth for 5 more minutes, then remove with high-speed suction, and flush with an air and water spray
9. Replace the brushed applicator tip with a new one, and repeat Steps 3 through 8 one more time
10. Remove liquid dam

EzLase
Teeth Whitening with Whitening Handpiece

Laser System and Gel Compatibility

<table>
<thead>
<tr>
<th>Laser System</th>
<th>LaserWhite20 Gel</th>
<th>LaserWhite10 Gel</th>
</tr>
</thead>
<tbody>
<tr>
<td>ezlase™ 940 nm</td>
<td>✅</td>
<td></td>
</tr>
<tr>
<td>LaserSmile</td>
<td></td>
<td>✅</td>
</tr>
</tbody>
</table>

- LaserWhite20 Gel will be compatible with LaserSmile by Q3 2009
- LaserWhite10 Gel is still compatible with the ezlase, but it is not recommended for optimal results
Before Laser Teeth Whitening

After Laser Teeth Whitening

Maxillary Average: 7 shades lighter
C-1 to A-1

Mandibular Average: 6 shades lighter
C-2 to A-1

Laser Teeth Whitening Settings

- 7.00 Watts
- 200 J/site (or approximately 30 sec.)
- Continuous Wave
- Application 1: 2 cycles
- Application 2: 2 cycles
- Allow gel to remain on teeth for a minimum of 5 min. after second laser cycle
- *1 cycle = 4 quads

Laser Bleaching with Whitening Handpiece
Laser Teeth Whitening Settings

- Whitening Handpiece
- 5.5 Watts
- Approx. 2 Watts/cm²
- Continuous Wave
- 2.84 cm², approx. 20 X the area of a bare fiber

LLLT
(Low Level Laser Therapy)
with Whitening Handpiece

William H. Chen, DMD,
MAGD, MALD, EdALD,
MWCLI, FACD, FICD

P.O. Box 1178
4168 Nameoki Road
Granite City, IL 62040
Ph. (618) 931-2025
Fax (618) 931-8888
E-mail: chenlaser@gmail.com
Website: www.chenlaserinstitute.com

Biostimulation
with Whitening Handpiece
Therapeutic Indications

- FDA cleared indications
  - Temporary relief of minor muscle and joint pain and stiffness
  - Temporary relaxation of muscle
  - Temporary increase in local blood circulation

- Applicable Dental Procedures
  - TMJ Arthralgia (treatment of the Joint)
  - Myofacial Pain related to TMJ (treatment of the muscle related to painful trigger point)
  - Muscle relaxation related to pain and muscle stiffness after dental procedures or in general

Temporo-Mandibular Joint Dysfunction Affects Many People

- 10.8 million people in the US suffer from TMD (NIH report); 90% of this number are women
- Very complex origin – it is the only joint in the body that is associated with a psychological element as a very high correlation with stress.
- The condition is associated with pain in the joint that affects the mastication muscles. Pain can extend to the neck and the back.

Why compromise on your soft-tissue laser?

The Best Soft-Tissue Solution

- 940 nm wavelength developed specifically for dental applications
  - Tissue does not have to be inflamed or pink to cut well (compared to 810 nm)
  - Great hemostasis due to position on the absorption peaks of Hb and HbO₂

- ComfortPulse™ provides efficient cutting and greater patient comfort
  - Short, high-power cutting pulses with longer intervals are used for tissue thermal relaxation
  - Hundreds of pulse combinations

- ezTips™ reduces chair time
  - Single-use, disposable tips can be changed in seconds
  - No more stripping and cleaving of tips
  - Diameters from 200-400μm, lengths from 4-14 mm
  - Bendable for various procedures
Surgical vs. Therapeutic Effects

**Surgical**

- A concentrated beam of energy is delivered to tissue via a small diameter 200-400 μm fiber tip, and upon contact tissue is vaporized and removed.

**Therapeutic**

- A diffused beam of energy size 35 x 8 mm is delivered to the tissue site over a period of time. The level of laser energy is low enough to have a therapeutic effect without any tissue destruction.

---

**Temporo-Mandibular Joint Dysfunction**

Conventional Treatments

- **Non surgical**
  - Modified diet (soft food)
  - Cold/Hot Packs
  - Medication
  - Injection with Steroid
  - Occlusal mouth guards

- **Surgical**
  - Arthroscopy/arthroplasty (removing adhesions within the joint)
  - Discetomy/enectomy (joint replacement surgery)

---

**Surgical vs. Therapeutic Use**

**Surgical**

- Concentrated laser energy is applied to an outer layer of the fiber tip (absorber coating produced after tip initiation).
  - The Process — Absorption.
  - The Effect - Immediate tissue vaporization and removal.

**Therapeutic**

- Diffused laser energy is transmitted through tissue to treat. The image is of an ezlase beam transmitted through tissue as it was captured by an infrared camera.
  - The Process — Scattering (or Diffusion) through tissue.
  - The Effect - Pain relief and improved functionality immediately post-treatment or over a few treatments.

---

**Surgical vs. Therapeutic Effects**

**Surgical**

- Laser Treatment Beam Size: 0.13 cm²

**Therapeutic**

- Laser Treatment Beam Size: 2.8 cm²
  (-20 larger than surgical tip)
**TMJ Clinical Protocol – Treatment Schedule Example**

<table>
<thead>
<tr>
<th>SUN</th>
<th>MON</th>
<th>TUES</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 1</td>
<td>Treatment 1</td>
<td>Treatment 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 2</td>
<td>Treatment 3</td>
<td>Treatment 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TMJ Clinical Treatment Protocol**

- Treatment of Painful Trigger Points (Myofacial Pain)
  - Palpate masseter and temporals to identify painful trigger points; mark each point with a small dot and the covered area.
- VAS Pain measurements for each point pre- and post-
- Treatment of the Joint (TMJ Arthralgia)
  - Treat the joint at the three locations provided in the image to the right

**Therapeutic Mechanisms of Action**

- Increased micro-circulation in tissue
- Photo-activation of inactive enzymes (catalysts) present in painful muscle cells

**Normal Cell**

- Improved cellular functions through increase of ATP (fuel for the cell) production in cells

**TMJ Clinical Protocol – Therapeutic Settings**

| Laser Coverage Area | $2.80 \text{cm}^2 (35 \times 8 \text{mm})$
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure Time $(t)$</td>
<td>$1$ min and up to $10$ min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Contact Mode</th>
<th>Power Setting (P)</th>
<th>Power Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>contact</td>
<td>2.0 - 2.5 W</td>
<td>0.71 - 0.89 W/cm$^2$</td>
</tr>
<tr>
<td>2</td>
<td>Contact/non-contact</td>
<td>4.0 - 4.5 W</td>
<td>1.43 - 1.61 W/cm$^2$</td>
</tr>
<tr>
<td>3</td>
<td>non-contact</td>
<td>5.0 - 5.5 W</td>
<td>1.79 - 1.96 W/cm$^2$</td>
</tr>
</tbody>
</table>

- Settings vary depending on the type of skin and patient response
- Start at the lowest recommended setting (power and exposure time), and increase as necessary
- Therapeutic energies applied to any muscle or joint are measured in "Dose of energy"

The formula to calculate the Dose is as follows: $\text{Dose (J)} = P \text{ (W)} \times t \text{(s)}$
Biostimulation

**Teeth Whitening Handpiece**

**Biostimulation**

*Therapeutic Applications - Clinical Benefits*

- Progressive/immediate relief of pain
- Reduction in muscle tenderness and stiffness
- Improved functionality of the affected
- Improve quality of life
- Gentle to tissue in comparison to other alternatives such as steroid injections, or appliances such as mouth guards

**Biostimulation (LLLT)**

Limited Opening: 28mm
In 1916, Niels Bohr postulated that the atom could be represented by mathematical models that explained the process of stimulating portions of the electron to emit light and producing stimulated emission of light.

Laser Physics, History, Safety and Regulations

William H. Chen, DMD, MAGD, MALD, MWCLI FACD, FICD

Laser Energy and Safety

BOHR'S MODEL
Electrons have separate energy levels, E₀ and E₁.

A quantum of energy can be gained or lost by the atom, and there will be movement from one level to another. The atom prefers the stable, normal state of E₀.

Light
Amplification
Stimulated Emission of Radiation

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Einstein's Stimulated Emission Models

Anatom absorbs energy and a new energy level is created. When the excited state decays to the lower energy state by emitting the excess energy as a photon or quantum of energy, it is defined as spontaneous emission.

Spontaneous Emission

Bohr's Spontaneous Emission Models

Lasers in Dentistry

• Charles Townes developed the MASER – Microwave Amplification by Stimulated Emission of Radiation, in early 1950.
• In 1960, Theodore H. Maiman inserted a ruby rod into a photographic flash lamp, and the LASER was born. In 1964, Ralph Stern and Reidar Sognnaes used the ruby laser to vaporize enamel and dentin.
• In 1966 Leon Goldman used the laser clinically on enamel and dentin.

Stimulated Emission

An atom in the excited state absorbs another quantum of energy. As the excited state decays into a stable state, two coherent quanta are emitted, defined as stimulated emission.
1990 – Nd:YAG

Myers and Myers given credit for getting the Nd:YAG lasers approved by FDA for intraoral soft tissue surgery. This is the first laser designed specifically for general dentistry.

1991 – Argon

FDA approved this laser for curing of composite materials

1970s – CO₂ Laser

First lasers to be marketed for intraoral use

1995 – CO₂

FDA approved this laser for teeth whitening

1970s and 1980s

CO₂ laser used in surgery by specialists only: ENT surgeons Oral surgeons Some Periodontists
1999 – Diode

(Twilite) – FDA approved this laser to perform a wide range of soft tissue procedures.

1997 – Nd:YAG

FDA approved this laser for sulcular debridement

2000 – HeNe

(Diagnodent) – FDA approved this laser for caries detection

1997 – Er:YAG

FDA approved this laser for caries removal and cavity preparation

2001 – Diode

(LaserSmile, Twilite) – FDA approved this laser for teeth whitening

1998 – Er,Cr:YSGG

(Millennium) – FDA approved this laser for caries removal and cavity preparation, removal of coronal pulp and other soft tissue applications.
2003 – Er,Cr:YSGG
(Waterlase) – FDA approved this wavelength for apicoectomy.

2001 – Er,Cr:YSGG
(Waterlase) – FDA approved this laser for periodontal disease treatment

2004 – Er,Cr:YSGG
(Waterlase) – FDA approved for Periodontal Surgery that includes gingivectomy, gingivoplasty, osseous recontouring, osseous resecting, etc.

January 2002 – Er,Cr:YSGG
(Waterlase) – FDA approved this wavelength for endodontic applications

February 2002 – Er,Cr:YSGG
(Waterlase) – FDA approved this wavelength for bone applications: cut, shave, contour and resectioning

2004
Waterlase MD is launched
**Electromagnetic Waves**

- **Wavelength**: the distance between two corresponding points of successive waves.

- **Amplitude of a Wave**: total height of a wave from the top of one peak to the bottom of the next.

- **2006 – 940 nm Diode**

**Laser Physics 101**

- **Electromagnetic Waves**: time-varying electric and magnetic fields propagating through space.
Characteristics of Laser Light

1. Typically one color (monochromatic)
2. Highly focused and directional (collimated)
3. Organized, efficient (coherent energy)

Characteristics of Ordinary Light

1. Many colors (polychromatic)
2. Not focused and in many directions (non-collimated)
3. Unorganized (incoherent energy)

Velocity - the speed at which a wave travels through space

The Electromagnetic Spectrum as measured in micrometers (µ)

Electromagnetic Wave Scale

Ordinary Light
**Ordinary Light**

Non-coherent – energy waves travel randomly and are not in phase

**Laser Light**

Monochromatic

All One Color

**Laser Light**

Collimated – energy travels as a bundle

**Ordinary Light**

Polychromatic

Many Wavelengths and Colors

**Ordinary Light**

Non-collimated – energy travels in a multidirectional and random pattern

**Laser Light**

Coherent – energy waves remain in the same phase
Active medium:
gas, solid, dye (flashlamp-pumped, Argon-pumped) or semiconductor suspended in an optical cavity

Summary:

Laser Light
monochromatic
coherent
collimated

Ordinary Light
polychromatic
incoherent
non-collimated

Power Supply:
external energy source that acts as a pumping mechanism to continuous stimulated emission (population inversion)

What do you need to build a laser?

Optical Resonator:
mirrors for amplification

You Need:
• Active medium
• Power supply
• Optical resonator
• Cooling system
• Control system
• Delivery system
LASER COMPONENTS

Cooling system:
- water
- air

Delivery Systems:
- Fixed mirror and lens system
- Articulated arm
- Hollow waveguide
- Optic fiber

Control System:
- electronic

Fixed Lens Mirrors:
- Oldest and least flexible system to transmit laser energy. Not used much in medicine and dentistry today.

Delivery System:
- most efficient by optic fiber
Hollow Waveguides:

A tubing with mirrored internal walls that allows the energy to be reflected through the tube. Changing position can affect power.

Articulated Arms:

Uses mirrors to transmit energy through a series of "knuckles" when the wavelength cannot be used with a fiber.
Components of a Fiber Optic

- Core
- Cladding
- Jacket

Fiber Optics:
Usually quartz, silica, sapphire, or a combination.

Optic Fiber of Diode and Nd:YAG
A poorly cleaved fiber

A scored notch in fiber, ready to be cleaved.

Aiming beam of a poorly cleaved fiber

A well cleaved fiber end

Carbonized end of fiber, needs to be cleaved.

Aiming beam of a well-cleaved fiber
Modes of Operation

- Continuous Wave
- Gated Pulsed Mode
- Free-Running Pulsed Mode
**Federal and Local Regulations**

Manufacturer has an obligation to report an adverse effect to the FDA.

FDA requires distributors to report death and serious injuries to the FDA and the manufacturer.

FDA requires that facilities using the device report to the FDA deaths and serious injuries to the manufacturer.

Individual private practices are encouraged to voluntarily report adverse events to the FDA and strongly recommend reporting adverse effects to the manufacturer.

Medical surveillance log is to be kept, and when an employer becomes injured, immediate medical attention is to be sought, and a report of the incident is to be kept for 30 years.
**Laser Safety Officer Responsibilities Include:**

1. Oversees the safety practice of the laser.

2. Responsible to do hazard identification and assessment within the operative setting.

3. Establishes the standard operating procedure for the laser.

4. Ensures proper laser safety training for all persons working within the environment.

5. Approves use of protective equipment, such as eyewear.

6. Specifies use of warning signs and labels.

7. Implements an emergency action plan and incident report mechanism.

8. Be current with laser safety protocols and attend CE to update knowledge and standards.

9. Keeper of the key to unlock the laser for use.

10. Keeps records of supplies, repair and medical surveillance log.

11. Provide for proper evacuation of plume and to make certain that there are no combustible gases in the area.

12. Make certain that the electrical cords and footswitches are working correctly and that the emergency safety are operational.

13. Test-fire the laser.

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<table>
<thead>
<tr>
<th><strong>LASER TERMINOLOGY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amplitude</strong></td>
</tr>
<tr>
<td><strong>Articulated arm</strong></td>
</tr>
<tr>
<td><strong>Atom</strong></td>
</tr>
<tr>
<td><strong>Average power</strong></td>
</tr>
<tr>
<td><strong>Coherent</strong></td>
</tr>
<tr>
<td><strong>Collimated</strong></td>
</tr>
<tr>
<td><strong>Continuous wave</strong></td>
</tr>
<tr>
<td><strong>CW</strong></td>
</tr>
<tr>
<td><strong>Electromagnetic</strong></td>
</tr>
<tr>
<td><strong>Electromagnetic waves</strong></td>
</tr>
<tr>
<td><strong>Energy</strong></td>
</tr>
<tr>
<td><strong>Energy density</strong></td>
</tr>
<tr>
<td><strong>Exposure time</strong></td>
</tr>
<tr>
<td><strong>Fluence</strong></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hertz</td>
<td>Unit of Frequency in cycles per second</td>
</tr>
<tr>
<td>Joule</td>
<td>A unit of energy, abbreviated as J. When divided by 1000, it is known as a millijoule (mJ)</td>
</tr>
<tr>
<td>LASER</td>
<td>Acronym for Light Amplification by Stimulated Emission or Radiation. It is a device that uses the natural oscillations of atoms between energy levels for generating coherent electromagnetic radiation in the ultraviolet, visible, or infrared regions of the electromagnetic spectrum</td>
</tr>
<tr>
<td>Medium (active)</td>
<td>One or more gases, liquids, or solids used to produce amplified, stimulated emission in a laser</td>
</tr>
<tr>
<td>Micron</td>
<td>One millionth of a meter, used as a measure of wavelength. Abbreviated as $10^{-6}$ meter. Another term is micrometer.</td>
</tr>
<tr>
<td>Mode</td>
<td>A stable condition of oscillation in a laser. A laser can operate in one or more modes</td>
</tr>
<tr>
<td>Molecules</td>
<td>The smallest particle of a substance that retains the property of that substance, composed of one or more atoms</td>
</tr>
<tr>
<td>Monochromatic</td>
<td>A single wavelength of frequency (one &quot;color&quot;)</td>
</tr>
<tr>
<td>Nanometer</td>
<td>One billionth of a meter, used as a measure of wavelength. Abbreviated as $10^{-9}$ meter.</td>
</tr>
<tr>
<td>Output power</td>
<td>The power of a laser, expressed in Watts.</td>
</tr>
<tr>
<td>Peak power</td>
<td>The power level during a pulse from a free-running pulsed laser</td>
</tr>
<tr>
<td>Photon</td>
<td>A quantum of radiant energy. The basic particle of light</td>
</tr>
<tr>
<td>Population inversion</td>
<td>An energy distribution in which more electrons are in a higher energy state than in a lower one.</td>
</tr>
<tr>
<td>Power</td>
<td>The rate of doing work. The unit of power is a Watt.</td>
</tr>
<tr>
<td>Power density</td>
<td>Average power divided by the area of the laser beam.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulsed laser</strong></td>
<td>A laser that emits energy at timed intervals.</td>
</tr>
<tr>
<td></td>
<td>• <strong>A gated pulsed laser</strong> is a continuous wave emission that is physically shuttered on and off. The shortest pulse width is usually one one-thousandth second.</td>
</tr>
<tr>
<td></td>
<td>• <strong>A free-running pulsed laser</strong> emission is produced electronically, and its pulse width is measured in microseconds.</td>
</tr>
<tr>
<td><strong>Pulse width</strong></td>
<td>The amount of time that the pulsed laser energy is emitted in each pulse, also known as pulse duration.</td>
</tr>
<tr>
<td><strong>Quantum</strong></td>
<td>A measurement of quantities of energy. Can be referred to as a Photon.</td>
</tr>
<tr>
<td><strong>Radiant energy</strong></td>
<td>Quantity of energy traveling through space in the form of light waves, measured in Joules.</td>
</tr>
<tr>
<td><strong>Radiation</strong></td>
<td>The process of emitting energy in the form of waves or particles.</td>
</tr>
<tr>
<td><strong>Spontaneous emission</strong></td>
<td>The emission of a photon by an electron when it spontaneously drops from a higher energy level to a lower, more stable, one.</td>
</tr>
<tr>
<td><strong>Stimulated emission</strong></td>
<td>The process that occurs when an electron in an excited state is further stimulated, absorbs an additional photon, and then drops to its lower and more stable energy level. Typically, the photon doing the stimulating was just emitted from an electron that had just made the same transition.</td>
</tr>
<tr>
<td><strong>Velocity</strong></td>
<td>The rate of speed at which a wave travels. The speed of light.</td>
</tr>
<tr>
<td><strong>Watt</strong></td>
<td>A unit of power. One Watt equals one Joule for one second.</td>
</tr>
<tr>
<td><strong>Wavelength</strong></td>
<td>The distance between two corresponding points in a periodic wave, measured in meters. For our purposes, our measurements are in microns, micrometers, or nanometers.</td>
</tr>
</tbody>
</table>

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REFERENCES:

The Laser Course: A Clinical Training Seminar, The Institute for Advanced Dental Technologies, Wixom, MI.


Dental Application of Advanced Lasers, JGM Associates, Burlington, MA

**LASER CLIP-IN**

Do you wear magnifying loupes when working with a laser? The patented Clip-In design is to be worn with magnifying loupes when working with a laser. A gold metal frame with four clips, a spring adjustable brow bar and opaque universal side shields make this a complete package. Available in 14 sizes.

Also available, **X-RAY CLIP-IN**

Each clip-in is designed to fit a specific size frame.

**Innovative Optics Announces the New Custom Fit Laser Clip-In Loupes**

<table>
<thead>
<tr>
<th>LASER TYPE</th>
<th>OPTICAL DENSITY</th>
<th>GLASS OR POLY LENS</th>
<th>MODEL #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diode</td>
<td>O.D.5 @ 800-830nm</td>
<td>Glass</td>
<td>DIO</td>
</tr>
<tr>
<td>Multi Wave</td>
<td>O.D.5 @ 940/980/1064/2780-2940/10,600nm</td>
<td>Glass</td>
<td>MWL</td>
</tr>
<tr>
<td>Length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YAG/ERBIUM</td>
<td>O.D.7 @ 1064/2780-2940nm</td>
<td>Glass</td>
<td>YGE</td>
</tr>
</tbody>
</table>

Innovative Optics distributes and manufactures laser safety, x-ray safety, and IPL safety eyewear for healthcare and Industrial protection.

**INNOVATIVE OPTICS**
6812 Hemlock Lane
Maple, Grove, MN 55369
Phone: 763-425-7789
Fax: 763-425-6689
Email: tom@innovativeoptics.com
Methylene Blue Injection, USP

Product No. 0517-0301-10

Description 1% 10 mg/mL (Preservative Free)

Supplied 1 mL Single Dose Vial

Shelf Pack 10

Wholesaler Numbers

AmerisourceBergen Item #: 558031
Cardinal Item #: 1426980
HD Smith Item #: 5170733
Mckesson Item #: 1733179
Morris Dickinson Item #: 079988
Peppermint flavored topical anesthetic gel used to numb injection site for a painless experience or to provide pain free procedures without an injection. The combination of these two local anesthetics has profound anesthetic effect. Phenylephrine is a powerful postsynaptic alpha-receptor stimulant with little effect on the beta-receptors of the heart. Phenylephrine promotes local hemostasis to decrease systemic absorption and prolong duration of action.

Available in a more viscous gel, request THICK (green in color).

TAC 20% May Be Used For The Following:
- Used Prior For A Painless Injection
- Extracting Loose Primary Teeth
- Laser And Soft Tissue Procedures
- Scaling And Root Planning Of Deep Perio Pockets
- Labial And Lingual Frenectomies
- Dry Socket Irrigation
- Suture Removal
- Gag Reflex
- Gingival Curettage
- Pre-Palatal Injections
- Impressions
- Intra-Oral Radiographs
- Easing Pain Of Ulcers Or Mouth Wounds During Dental Visit

Directions for Use:
1. **Dry mucosal area thoroughly.**

2. **Apply a very small amount** with Q-tip or micro-brush to **dry mucosa**, leave in place 2 to 3 minutes before procedure.

3. Peak effect will occur within 6 minutes after initial application and last a minimum of 25 to 30 minutes.

*Please note if irritation occurs you are using too large of an amount or leaving the applicator on the area too long.*
MEDICATION
Lidocaine 10%/Tetracaine 4%/Phenylephrine 2% in Solution

USE
This medication is used as a topical anesthetic to prevent pain from lasers, injections and other medical procedures.

SIDE EFFECTS
This product may cause local irritation at the site of administration. You may also experience a feeling of warmth or coolness. This is considered normal and does not indicate an allergic reaction. Side effects that may go away during treatment include skin paleness, loss of feeling, itching, redness, or swelling at the treated site. If they continue or are bothersome, check with your doctor. If you notice other effects not listed above, contact your doctor, nurse, or pharmacist.

PRECAUTIONS
Do not use this medication if you are hypersensitive to tetracaine, lidocaine or any other anesthetics. Avoid getting this medicine in your eyes. If you get this in your eyes, rinse them with plenty of water. This medicine blocks pain and feeling to the skin, therefore be careful not to injure the treated skin by scratching or rubbing.

DIRECTIONS
This medicine is usually applied at your doctor's office, hospital, or a clinic. However, it may also be applied at home shortly before a scheduled procedure. Your doctor will instruct you on the proper time to apply the medicine (usually one hour before the procedure). Apply this medicine in a thick layer at the site of the procedure. Rub medication thoroughly and liberally. Your doctor may want you to apply it more than once to meet specific patient needs.
Lasers and Their Characteristics as Used in Dentistry

<table>
<thead>
<tr>
<th>Laser Type</th>
<th>Wavelength</th>
<th>Output Type</th>
<th>Absorbed Tissue</th>
<th>Treatment Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexandrite (Frequency-Doubled)</td>
<td>777 nm</td>
<td>Ultraviolet (Invisible)</td>
<td>Melanin, Hemoglobin, Calculus (13)</td>
<td>Optic Fiber, Pulsed, Lens, Cataract, Skin Burn, Pigment Darkening, Hyperpigmentation</td>
</tr>
<tr>
<td>Argon Ion</td>
<td>488 nm, 514.5 nm</td>
<td>Blue, Green</td>
<td>Gas, Xanthophyll (488 nm), Hemoglobin and Melanin (488 and 514.5 nm)</td>
<td>Optic Fiber, CW, Retina, Retinal Lesion, Skin Burn and Photosensitive Reactions</td>
</tr>
<tr>
<td>Helium-Neon</td>
<td>632 nm</td>
<td>Red</td>
<td>Gas, Melanin</td>
<td>Optic Fiber, CW, Retina, Retinal Lesion, Skin Burn and Photosensitive Reactions</td>
</tr>
<tr>
<td>Ruby</td>
<td>694.3 nm</td>
<td>Deep Red</td>
<td>Solid Melanin</td>
<td>Optic Fiber, CW and Pulsed, Lens and Retina, Cataract and Retinal Burn, Skin Burn</td>
</tr>
<tr>
<td>Diode</td>
<td>812-980 nm</td>
<td>Near Infrared (Invisible)</td>
<td>Solid Melanin, Water, Hemoglobin (Weak)</td>
<td>Optic Fiber, Pulsed or CW, Lens and Retina, Cataract and Retinal Burn, Skin Burn</td>
</tr>
<tr>
<td>Neodymium:YAG and Neodymium CGSGG</td>
<td>1.064 µm, 1.061 µm</td>
<td>Near Infrared (Invisible)</td>
<td>Solid Melanin, Water, Dentin, Oxygenated Hemoglobin (Weak)</td>
<td>Optic Fiber, CW and Pulsed, Lens and Retina, Cataract and Retinal Burn, Skin Burn</td>
</tr>
<tr>
<td>Neodymium:YAP</td>
<td>1.31 µm</td>
<td>Near Infrared (Invisible)</td>
<td>Solid Melanin, Water, Dentin</td>
<td>Optic Fiber, Pulsed, Lens and Retina, Cataract and Retinal Burn, Skin Burn</td>
</tr>
<tr>
<td>Holmium:YAG</td>
<td>2.12 µm</td>
<td>Near Infrared (Invisible)</td>
<td>Solid Water, Dentin</td>
<td>Optic Fiber, Pulsed, Cornea, Aqueous and Lens, Corneal Burn, Aqueous Flare, and Cataract, Skin Burn</td>
</tr>
<tr>
<td>Erbium:YSGG and Erbium:YAG</td>
<td>2.79 µm, 2.94 µm</td>
<td>Near Infrared (Invisible)</td>
<td>Solid Water, Hydroxyapatite (2.79 and 2.94 µm), Collagen (2.94 µm)</td>
<td>Articulated Arm, Optic Fiber, Pulsed, Cornea, Aqueous and Lens, Corneal Burn, Aqueous Flare, and Cataract, Skin Burn</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>9.3-9.6 µm</td>
<td>Mid-Infrared (Invisible)</td>
<td>Gas Hydroxyapatite, Water</td>
<td>Lens System, Pulsed, Cornea, Corneal Burn, Skin Burn</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>10.6 µm</td>
<td>Mid-Infrared (Invisible)</td>
<td>Gas Water, Hydroxyapatite</td>
<td>Articulated Arm, Hollow Waveguide, CW or Pulsed, Cornea, Corneal Burn, Skin Burn</td>
</tr>
</tbody>
</table>

**Abbreviations**
- ArF: Argon Fluoride
- CGSGG: Chromium Gallium Scandium Gallium Garnet
- GaP: Germanium Arsenide
- YAG: Yttrium Aluminum Garnet
- YAP: Yttrium Aluminum Perovskite
- YSGG: Yttrium Scandium Gallium Garnet
- XeCl: Xenon Chloride
- XeF: Xenon Fluoride
- XeCl: Xenon Chloride
- YAG: Yttrium Aluminum Garnet
The i-glasses HRV is a small, portable, high-resolution video monitor that will connect to common video sources. With twice the resolution of a traditional TV set, and weighing only seven ounces, the i-glasses HRV offers the ideal combination of price and performance for most any video application. Use it with your camcorder, VCR, or other video sources. Or, for even higher image quality, connect i-glasses HRV to a DVD player or even the video output of your computer or laptop using an S-Video input. For superb clarity and fantastic color depth, consider i-glasses HRV, where seeing is believing!

A Wide Range of Video Applications:
- Personal and Private Video Viewing
- Portable Video Entertainment
- Remote Video Input
- Portable Video Solutions
- Immersive Video Gaming
- Medical Monitors
- Trade Show Attractions
- Video Inspection Systems
- Video Surveillance Tool
- Video Gaming Accessory
- Outdoor Video Monitor Solution
- Notebook Computer S-Video Out Capability

Package Includes:
- i-glasses HRV Head Mounted Display
- AC Power Adaptor
- RCA (Composite) Cable
- S-Video Cable

Optional Accessories:
- i-glasses HRV Battery Charger
- i-glasses HRV Portable Battery

Specifications:
- Resolution: 800 x 600
- Field of View: 26 Degrees Diagonal
- Image Size: 70" at 13'
- Color Depth: 24 Bit Input
- IPD Adjustments: None Required
- Focus: 13' TBR
- Eye Relief: 25mm
- Exit Pupil: 17mmH x 6mmV
- Convergence: 7*10", 100% Overlap, TBR
- Refresh Rate: Flicker Free 120hz display rate
- Input Frequency: 50 or 60 Hz
- Audio: Full Stereo
- Weight: < 7 Ounces
- Adjusts to Fit all Individuals
- Power: Barrel Connector
- Power Supply: Power Cube
- Control Features: On / Off, Volume Control, OSD-Control
- HMD Cable Configuration: Audio: Red and White RCA connectors
- PAL/NTSC Composite or S-Video Input: Scaled to 800 x 600