Utilizing Laser Technology in a Periodontal Environment

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Left untreated, serious consequences can occur.
Without proper diagnosis and treatment, periodontal disease can lead to:
- The spread of infection
- Loss of teeth
- Surgery

Healthy mouth, healthy body –
The impact of oral health on overall health

Dental History is critical in formulating a patient’s periodontal status
- Familial history
- Medical status
- Smoking habit
- Stress activity
- Parafunctional habits

Dental Plaque – An Oral Biofilm

Bacteria → Biofilm → Plaque/tartar → Enhanced Oral Health

Signal Molecules → Bad breath → G/P/Perio

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Healthy mouth, healthy body – The impact of oral health on overall health

When severe gum disease is present, some pregnant women may be more likely to deliver a pre-term, low-birth weight baby.

Patients with severe periodontal disease may have an increased risk of heart attack or stroke.

The relationship between periodontal disease and diabetes is bi-directional - diabetes can worsen gum disease and gum disease can make diabetes difficult.

The relationship between periodontal disease and cancer is also thought to exist.

Dental history is critical in formulating a patient’s periodontal status:
- Familial history
- Medical status
- Smoking habit
- Stress activity
- Parafunctional habits

ENTRY POINT FOR BACTERIA

Progressive Periodontitis

1990

1995

Dental History is critical in formulating a patient’s periodontal status

Dental Plaque – An Oral Biofilm

Bacteria → Biofilm → Plaque/tartar → Enhanced Oral Health

Signal Molecules → Bad breath → G/P/Perio
Compliance with Supportive Periodontal Therapy Part I and II: Risk of noncompliance in a ten year period, Novaes, 2001

- Factors of gender, age, surgery vs. non-surgery
- 43.0% noncompliant in surgery
- 53.2% noncompliant in non-surgery
- Highest risk for noncompliance:
  - Female
  - Under 30 years age
  - Over 51 years of age
  - Underwent non-surgical care

Local Delivery Antibiotics

- User-friendly
- Stays in place
- Requires no removal
- Enhances the effect of debridment

Probiotics

Defined as the daily administration of certain live microorganisms in amounts adequate to confer a health benefit on the host.

Data Collection

- Etiology
- Diagnosis
- Prognosis
- Treatment Plan

Diagnosis

Etiology

Prognosis

Treatment Plan
Data Collection

- Radiographic Exam
- Probing
- Tissue Characteristics
- Mobility

Digital Versus Digital......

Depth of Sulcus Critical !!

- Angulation
- Pseudopockets
- Bleeding

Main Chart

Rationale for pocket reduction surgery....

- Access to the sulcus by both the clinician and the patient
- Modify habitat for periodontal pathogens
- Decrease quantity/quality of host inflammatory cells

Attachment

- Long Junctional Epithelium
- Connective Tissue Adherence
- Connective Tissue Attachment
- New Attachment
Procedures for Pocket Reduction

- Excisional periodontal surgery
  - Gingivectomy
- Incisional periodontal surgery
  - Flap surgery

Lasers
Fields of application in medicine

- Neurosurgery
- ENT
- Ophthalmology
- Dentistry
- Cardiology
- Urology
- Orthopedics
- Dermatology
- Neurosurgery
- ENT
- Pneumology
- Gastroenterology
- Oncology
- Gynecology
- Angioplasty

Terminology:

- **Joule**: a unit of energy, ability to do work
- **Watt**: unit of power, the rate of doing work
- **Frequency**: the number of oscillations per unit time of a wave

One Watt = One Joule for one second

Laser Operating Parameters:

- Energy (Joules)
- Repetition Rate (Frequency)
- Power (Watts)
- Fiber size
- Energy Density
- Total Energy
Effects on human tissue

Reflection
Dispersion
Absorption
Transmission

Thermal Effect of Laser Energy on Tissue

<table>
<thead>
<tr>
<th>Tissue Temperature (degrees C.)</th>
<th>Observed effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>37-50</td>
<td>Hyperthermia, Coagulation, Protein Denaturation</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>Welding, Vaporization</td>
</tr>
<tr>
<td>70-90</td>
<td></td>
</tr>
<tr>
<td>100-150</td>
<td></td>
</tr>
<tr>
<td>&gt;200</td>
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</table>

What happens with this energy?

- As the laser energy is absorbed by water, the water vaporizes within the cells and denatures the bacterial cells that comprise the decay.
- Thus, in a nut shell, the area is sterilized.

Laser Surgery Vs. Electrosurgery

- Less pain
- Less swelling
- Less redness
- Decreased surgical time on vascular lesions

Zones of necrosis...

- Electrosurgery: 500 to 700 cell layers (electro thermal)
- Laser: 3-5 cell layers (photo thermal)

Protecting Target and Non Target Tissue

- The laser should never be directed at an area that is not to receive energy.
- Specular reflections, which are mirror like reflections, should be eliminated.
- The laser is not a drill, it has an effect even when not in contact.
- All accidental exposures should be avoided.
### Antibacterial...
- Bio-films
- Bacterialcidal

### Soft Tissue
- Decontaminate
- De-epithelialize
- Degranulate
- Denature proteins
- Gingivectomy
- Inhibit epithelial migration...clot establishment

### Hard Tissue
- Teeth
  - Cementum
  - Calculus
  - Dentin
- Bone
  - Removes
  - Biostimulates

### Access
- Hemostasis
- Visualize site

### Soft Tissue
- Decontaminate
- De-epithelialize
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- Gingivectomy
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### Diode Lasers

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**Access**

- Hemostasis
- Visualize site
Diode Soft-Tissue Lasers

- Advantages:
  - Can cut and coagulate gingiva with virtually no bleeding or collateral damage to healthy tissue
  - Most cases - topical anesthetic is sufficient for a pain free procedure
  - Surgical precision
  - Little to no postoperative discomfort and a short healing time

Modes of Laser Operation:

- **Continuous Wave**
  - Maximizes coagulation and speed

- **Pulsed Wave (Gated or Free-Running)**
  - Minimizes thermal damage and pain

Pulsed Mode

The time that the laser is off in a pulsed mode is termed "Thermal Relaxation". During this time, the target tissue is allowed a period of cooling.

Thermal Effects on Tissue Temperature (°C):

- 37-50 Hyperthermia
- >60 Coagulation, Protein Denaturation
- 70-90 Welding
- 100-150 Vaporization
- >200 Carbonization

Choosing a laser

- **CO2**
  - Soft tissue
- **Nd YAG**
  - Hard tissue
- Diode
- **CO2**, **ER, Cr, YSGG**
- **ER, Cr, YSGG**

Rationale for pocket reduction surgery:

- Access to the sulcus by both the clinician and the patient
- Modify habitat for periodontal pathogens
- Decrease quantity/quality of host inflammatory cells
Primary tasks of a periodontal laser protocol:

1. Have a bactericidal effect
2. Remove diseased sulcular lining
3. Remove calculus
4. Create root detoxification
5. Promote repair via selective wound healing

Comparison of Er,Cr:YSGG Laser and Hand Instrumentation on the Attachment of Periodontal Ligament Fibroblasts to Periodontally Diseased Root Surfaces: An In Vitro Study

Hakki, et al J Perio August 2010

Laser-treated specimens showed a significantly higher pdl cell density, the Gracey-treated group showed a lower cell density compared to the positive control group

Biostimulation:

- Enhance angiogenesis
- Collagen formation
- Osteoblastic
- Fibroblastic

Low Level Laser Therapy (LLLT)

- ATP increase in mitochondria
- ROS decrease
- Growth factors increase
- Stressed cells react to light

Effects of LLLT

- Reduction of bad inflammation
- Regeneration of connective tissue
- Factor of energy power and time over a spot size
- Frequency can be a factor
Whitening & Temporary Pain Relief

Cost for DTHP?

Temporary Pain Relief

Treat TMJ and other myofascial disorders with available Deep Tissue Handpiece™

Rationale for pocket reduction surgery:
- Access to the sulcus by both the clinician and the patient
- Modify habitat for periodontal pathogens
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Perio Phase II Decisions

Periodontal Debridement/Curettage

1. Pocket Depth: 4-5 mm
2. Local factors as calculus
3. Edematous
4. Single rooted
5. Horizontal Bone loss
6. Less Compliant

Perio Phase II Decisions

Surgical indications

1. Pocket depths 5mm greater
2. Minimal local factors as calculus
3. Fibrotic gingivae
4. Multi rooted
5. Angular bone loss
6. More compliant

Comparative summary of results from clinical trials using Nd:YAG, Er:YAG, or diode lasers for treatment of periodontitis (4-6mm PDs)

<table>
<thead>
<tr>
<th>Laser</th>
<th># of Trials</th>
<th>PPD</th>
<th>CAL</th>
<th>BOP (%)</th>
<th>Microbes</th>
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<tr>
<td>Nd:YAG (10)</td>
<td></td>
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<td>1.04</td>
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<tr>
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<td>2.30</td>
<td>1.68</td>
<td>47</td>
<td>0/11</td>
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<tr>
<td>Diode (5)</td>
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<td>1.70</td>
<td>1.52</td>
<td>68</td>
<td>1/5</td>
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<tr>
<td>Photo dyn (5)</td>
<td></td>
<td>1.05</td>
<td>0.91</td>
<td>56</td>
<td>0/5</td>
</tr>
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</table>

Phase I Therapy (Debridement, O.H., etc.)

Phase I Re-evaluation

1. Periodontal Surgery

2. Recycle

Maintenance Recall

Examination

PASS
Gingivitis / Bleeding
Pocket Depths
Mobility
Occlusion
Steps in non surgical laser periodontal procedure

- Measurements
- Anesthesia
- Sulcular debridement
- Ultrasonic debridement
- Laser Bacterial Reduction
- LLLT
- Postoperative

Considerations for laser periodontal procedures...

- Measure GM to CEJ
- Measure CEJ to pocket depth
- Establish attached gingiva
- Consider horizontal osseous resorption
- Consider angular osseous resorption
- Establish esthetic requirement

Steps in non surgical laser periodontal procedure

- Anesthesia
  - No compromise for patient comfort
  - More inflammation, the deeper the pocket, the more local over topical

Steps in non surgical laser periodontal procedure

- Laser Bacterial Reduction
  - 0.8 watt
  - Un-initiated tip
  - Continuous setting (CW)

Steps in non surgical laser periodontal procedure

- Sulcular debridement
  - Pulsed
  - 1 watt
  - Initiated

Steps in non surgical laser periodontal procedure

- Ultrasonic debridement
  - If calculus, triple bend tip
  - If biofilm only, thin tip
  - Know concavities
Steps in non-surgical laser perio procedure

- Laser Bacterial Reduction
  - 0.5 watt
  - Un-initiated tip
  - Continuous setting (CW)

- Bio stimulation (LLLT)
  - Know SPOT size
  - 5-15 JOULEs per square centimeter
  - Frequency more effective

Steps in non-surgical laser perio procedure

- Pre and Postoperative
  - Anti-inflammatory analgesia

Steps in non-surgical laser perio procedure

- Tip movement
  - Faster movement: slow and shallow cutting
  - Slower movement: fast and deep
  - Speed and tip distance control depth

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Steps in laser perio procedure

- Measurements
- Gingival reduction
- Sulcular debridement
- Ultrasonic debridement
  - Degranulation
  - Decortication
- Augmentation
- LLLT
- Postoperative

Surgical Curettage

Flap Surgery

Treatment outcome following use of the erbium, chromium:yttrium, scandium, gallium, garnet laser in the non-surgical management of peri-implantitis: a case series

R. Al-Falaki, M. Cronshaw and F. J. Hughes
BRITISH DENTAL JOURNAL OCT 2014

- Mean pocket depth at baseline was 6.64
- 6 months pocket depth was 2.97

Closed Crown Lengthening
Why would a dentist want an laser for periodontal therapy

1. Implant market is variable
2. Today’s practice must add technology
3. Ability to manage periodontal disease with minimally invasive procedures
4. Success is creating a practice niche and marketing such to the patients.

5. ONE MUST HAVE A STRATEGY TO COMPETE!

“The goal of my practice is simply to help my patients retain their teeth all of their lives if possible............ In maximum comfort, function, health, and esthetics”

Dr. L. D. Pankey