Lasers and Periodontal Therapy

Sam Low
slow@dental.ufl.edu

Model of Risk Factor Interaction in Human Periodontal Disease

Interaction of Risk Factors for Periodontal Disease

Behavioral Risk Factors
- Oral Hygiene
- Smoking
- Stress

Biologic Risk Factors
- Systemic Diseases
- PST

HOST

Metabolic Changes

Anatomic Changes

“Knowing” your patient
- Who was your previous dentist's experiences?
- Any symptoms of gum disease?
- Has any dentist mentioned gum disease?
- When was your last “cleaning”? Frequency?
- Brothers, sisters, parents.. any history of gum disease?
- Tobacco use??
- Grind or clench your teeth..?

Data Collection
- Etiology
- Diagnosis
- Prognosis
- Treatment Plan

Data Collection Diagram

Examination

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

Phase I Re-evaluation

1. Recycle

2. Periodontal Surgery

3. Recycle
Data Collection

- Radiographic Exam
- Probing
- Tissue Characteristics
- Mobility

Furcation Involvement

- Class I
- Class II
- Class II+
- Class III

Modes of Laser Operation:

- **Continuous Wave**
  - Maximizes coagulation and speed
- **Pulsed Wave (Gated or Free-Running)**
  - Minimizes thermal damage and pain

The laser and tissue can react in the following ways:

- **Reflected** - Depending on the tissue type, if the beam is reflected the laser energy has no effect.
- **Absorbed** - This is dependent on wavelength, tissue composition, pigmentaion, and water content.
- **Transmitted** - The laser energy travels through the tissue but has no effect. (Also termed "Refracted")
- **Scattered** - Depending on wavelength, the energy can travel in several random directions which obscures the effect.

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):

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>37-50</td>
<td>Hyperthermia</td>
</tr>
<tr>
<td>&gt;60</td>
<td>Coagulation, Protein Denaturation</td>
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<tr>
<td>70-90</td>
<td>Welding</td>
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<td>Vaporization</td>
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<td>&gt;200</td>
<td>Carbonization</td>
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ways lasers can improve patient care:

- Precision cutting with a minimum of collateral damage
- Promotes minimally invasive dentistry
- Has been proven to be a safe technique
- Increases patient comfort
- Many procedures done with no local anesthesia
- Coagulation can be easily achieved with soft tissue procedures
- Promotes fast soft tissue healing due to less trauma

Thermal Effect of Laser Energy on Tissue

<table>
<thead>
<tr>
<th>Tissue Temperature (degrees C.)</th>
<th>Observed effect</th>
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Laser Wounds

- Compensate over time
  - Tensile strength
  - Epithelialization
  - Collagen production
- Less scar contraction
  - Due to 3x less myofibroblasts at laser wound site compared to blade site

Biostimulation....

- Enhance angiogenesis
- Collagen formation
- Osteoblastic
- Fibroblastic

Zones of necrosis...

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

Laser-Tissue Interaction

<table>
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<th>Absorption Characteristics of Dental Lasers</th>
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<tbody>
<tr>
<td>Diode</td>
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<tr>
<td>812-980 nm</td>
</tr>
<tr>
<td>Nd:YAG</td>
</tr>
<tr>
<td>1064 nm</td>
</tr>
<tr>
<td>Ho:YAG</td>
</tr>
<tr>
<td>2120 nm</td>
</tr>
<tr>
<td>Erbium</td>
</tr>
<tr>
<td>2780-2940 nm</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>10.6 um</td>
</tr>
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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 nutshell, the area is sterilized.

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.

Laser Safety:

- Cornea, Lens, and Retinal Damage from various wavelengths

Soft Tissue

- De-epithelialize
- Degranulate
- Denature proteins
- Gingivectomy
- Inhibit epithelial migration...clot establishment

Advantages of Lasers in Surgical Procedures

- Laser Cut More Visible To Eye / Dry Field
- Laser Sterilizes Wound As It Cuts
- Decreased Post Operative Pain And Edema
- Decreased Post Operative Infection
- The theory of “Sealing” and “Sterilizing” the wound?
- Less Wound Contraction And Scarring

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
The “Ideal” Subgingival Restoration

- One must consider:
  - Health of the sulcus
  - Local anatomy
  - Management of the tissue
  - Location of the margin
  - Integrity of the margin
  - Contour of the restoration

“Biologic Width”

Procedures for Pocket Reduction

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

Gingivectomy --- NO!!

- Access to osseous is critical
- Minimal or no attached gingivae

Gingivectomy -- Yes!!

- Supraboney pockets-Access top osseous not important
- Gingival enlargement
- Fibrotic gingivae
- Adequate attached gingivae

6 Key Decisions
Cosmetic Crown Lengthening

1. Sound the osseous crest (3.0 mm osseous crest-proposed GM)
2. Zone of keratinized gingiva
   Scallop desired lengths if >=3mm will be retained
3. Bevel papilla areas (later you can apically position and adjust levels)
4. Leave papilla intact base
5. Thin osseous crest but leave minimum of 1mm thickness
6. Will Dentin / Root Surfaces be exposed?
   Treatment Plan Restorative Procedures

Bobby Butler
Practical Procedures and Aesthetic Dentistry Vol 18 #3 - May 2006

Introducing Chu's Aesthetic Gauges

Alveolar Process
- 3 Components
  - Alveolar bone
  - Compact bone
  - Trabecular and cancellous

Soft Tissue
- De-epitheliazation
- Degranulation
- Denature proteins
- Gingivectomy
- Inhibit epithelial migration...clot establishment

Hard tissue
- Tooth
  - Cementum
  - Calculus
  - Dentin
- Bone
  - Removes
  - Biostimulates

Access
- Hemostasis
- Visualize site
Antibacterial…

- Bio-films
- Bactericidal


- Limited studies evaluating the effect
- Results using laser as an adjunct to SRP or replacing SRP as first tx option, should be interpreted with caution
- Need independent studies with power
- Conclusion: To date, no evidence exists on the significance of laser treatment as an adjunct to non-surgical periodontal treatment in adults with chronic periodontitis.

Influence of laser therapy on peri-implantitis


Thoughts……

- Minimal advantage of laser therapy in non surgical periodontal treatment
- Possible laser applicability to early to moderate periodontitis, horizontal bone resorption, single rooted teeth
- Some applicability to moderate to severe periodontitis, multiple roots, furcations, angular defects, but technique sensitive and may require augmentation

Thoughts…

- Learn laser physics and effects on tissue
- Embrace generic CE laser courses
- Decide your needs...then purchase
- Acquire loops >4X
- Use anesthesia
- When in doubt ...flap....

And some more....

- Dentistry: Suggest laser certification by state boards of dentistry
- Corporate: Cease encouraging marketing to patients as a cure for periodontitis until science
- Periodontics: Be open and guide new discoveries