







Patient exclusion criteria:

1. Generalized pocket depths  $\geq 7$  mm
2. Poor overall health
3. Unwillingness or inability to keep all appointments required
4. Habitual cigarette smoker
5. Uncontrolled diabetic
6. Received any type of periodontal treatment within the preceding 12 months

For each patient, one quadrant was chosen to receive SRP alone (the control) while all remaining quadrants received SRP-plus-laser treatment. Due to the small number of patients (n=10), control quadrants were chosen such that they were representative of the whole mouth—neither better nor worse than all other quadrants. Five of the patients received treatment using the Deka CO<sub>2</sub> laser, while the other 5 received treatment using the Lares Er-Nd:YAG laser. One patient was lost at three months. This patient belonged to the Er-Nd:YAG group.

Each patient received several Periodontal Susceptibility Tests (PerioID PST, Oral DNA Laboratories, Brentwood, TN 37027) administered at random different times throughout the study. It has been claimed that patients with a positive PST result may be more prone to inflammatory diseases and may respond less successfully to periodontal treatment. Of the 9 patients who completed the 1-year outcome study, 4 had positive results consistently and 4 had negative results consistently. Of the 4 with positive results, 2 were treated with the CO<sub>2</sub> laser and 2 were treated with the Nd:YAG laser. One CO<sub>2</sub> laser patient was excluded from the PST data analysis because both a positive and a negative PST result was received. Although only one PST test in a lifetime is recommended by the test directions, it was of interest to determine if the results were consistent over time during treatment.

Pocket depth measurements were taken independently by each clinician and by one TRAC researcher before treatment, 6 months, and 1-year post-treatment. The same TRAC Researcher took all measurements throughout the study and always worked using 3.5x magnification and a headlamp. Pocket depths were recorded for 6 locations on each tooth along with information about whether or not there was bleeding and/or suppuration upon probing. The periodontal probe used was the PCP-12 by Hu-Friedy. This was chosen because it was the one used routinely by most of the clinicians in the study.

To assess the effect of the lasers on microorganisms, microbial data was collected using the following 3 different methods:

1. Site-specific sterile paper points (microIDent plus, Hain Diagnostics, Nehren, Germany) were used to collect DNA samples to measure presence and concentrations of the 11 periodontal pathogens listed below. Samples were taken for each of the four quadrants separately using 5 to 7

sterile paper points per quadrant. Using this method results were separable by SRP alone and SRP-plus-laser for statistical analyses.

- |   |  |
|---|--|
| 1. Aa = Aggregatibacter actinomycetemcomitans | 7. Fn = Fusobacterium nucleatum/periodonticum                      |
| 2. Pg = Porphyromonas gingivalis              | 8. Cr = Campylobacter rectus                                       |
| 3. Tf = Tannerella forsythia                  | 9. En = Eubacterium nodatum  |
| 4. Td = Treponema denticola                   | 10. Ec = Eikenella corrodens                                       |
| 5. Pi = Prevotella intermedia                 | 11. Cs = Capnocytophaga spec.<br>(gingivalis, ochracea, sputigena) |
| 6. Pm = Peptostreptococcus micros             |  |

2. A saliva sample (My Perio Path, Oral DNA Laboratories, Brentwood, TN 37027) was collected to analyze for the presence and concentrations of the same 11 periodontal pathogens listed above. Results of the saliva sample apply to the whole mouth, so results were not separable by SRP alone and SRP-plus-laser for statistical analyses.

3. Site-specific sterile brushes (Black Handle Short 40-45, NanoBrush, Denbur, Oak Brook, IL 60522) were used to collect biofilm samples from pockets for culturing and computing total numbers of microorganisms present within pockets. Five to eight brushes were used per quadrant. Aliquots of the total count samples were cultured aerobically and anaerobically for each quadrant separately, so results were separable by SRP alone and SRP-plus-laser for statistical analyses.

Microbial samples were taken before treatment; after each phase of the treatment on treatment day (ultrasonic scaling, hand scaling, laser treatment); and at five post-treatment times: (1 month, 2 months, 3 months, 6 months and 12 months).

## **2. Treatment protocols used in this study as specified by the two laser companies:**

### **A. Deka PerioPulse CO<sub>2</sub> laser**

#### Treatment Technique

- 2.0-2.32 watts; 50 Hertz (Level 5)
- 1-2 mm crest epithelium removed buccal and lingual
- Insert tip into pocket 1-2mm and trace slowly using 16 seconds for molars; 8 seconds for smaller teeth
- Perform the above treatment four times at 10-14 day intervals

#### Post-op Follow-up Technique

- Recall at 3 month intervals and remove deposits using ultrasonic and hand instruments, and standard tooth polishing procedures

- Trace pockets at moderate speed, with attention to unresolved sites using 1.8 watts; 50 Hertz (Level 4)

## **B. Lares PowerLase AT and Nd:YAG laser**

### Treatment Technique

- Use Nd:YAG laser at 2.5-3.0 Watts; 20 Hertz
- Insert into pocket to 1mm of pocket base (to remove epithelium and improve access)
- Use Er:YAG laser with the 600µm straight quartz tip at 40 Hertz; 20 millijoules; 50µs; level 4 H<sub>2</sub>O; level 1 air (to remove calculus to 1mm of pocket base)
- Use Er:YAG laser with the 600µm radial quartz tip at the same settings as above (to detoxify and biostimulate root surface and dissect periodontal attachment to bone)
- Corticate with endodontic explorer (to release growth factors)

### Post-op Follow-up Technique

- Use Nd:YAG laser at 2.0 watts; 20 Hertz for biostimulation.
- Move tip ~2 minutes over the area to be treated at a 2-3 inch distance from the tissue (patient feels slight warmth). Perform on days 2-4-7-14 post-op
- Recall at 2 month intervals and remove deposits using ultrasonic and hand instruments , and standard tooth polishing procedures to 3mm depth

## **3. Alphabetical listing of clinicians who advised and/or treated patients in the two studies**

- Robert Barr, DDS
- Mark Colona, DDS
- Enrico DiVito, DDS
- Rob DiVito, DDS
- Laurie King, RDH
- Edison Louie, DDS
- Michael Skinner, DDS
- Gail Smith, RDH
- Mary Lynn Smith, RDH
- Kalie Wagner, RDH
- Jen Walker, RDH

## **4. Appointment intervals and Procedures performed at each of 7 TRAC Research Data Gathering Appointments**

### **Included 7 TRAC researcher visits**

- Appt 1 = Data Gathering
- Appt 2 = Treatment Day
- Appt 3 = 1 month Post Treat (Antibiotic-use check)
- Appt 4 = 2 month Post-Treat
- Appt 5 = 3 month Post-Treat
- Appt 6 = 6 month Post-Treat
- Appt 7 = 1 year Post-Treat

### **Procedures performed at Appointments 1& 7**

1. Explanation of periodontitis and study
2. Patient signed consent
3. Health history recorded
4. Radiographs – FM periapicals, and panoramic
5. Thorough examination and recording of pocket depths, bleeding and suppuration, and clinical observations (color, texture, architecture, recession, lesions, etc.). Full mouth clinical photographs made using a single lens reflex camera.
6. Saliva sample for DNA analysis
7. Sterile paper point samples for DNA analysis
8. Sterile brush samples for total counts assays
9. Homecare directions and demonstration of products provided for post treatment use

### **Procedures performed at Appointments 2 through 6**

1. Post-treatment day survey of patient's rating of pain and treatment experience
2. Saliva sample for DNA analysis
3. Sterile paper point samples for DNA analysis
4. Sterile brush samples for total counts assays
5. Thorough examination and recording of clinical observations (color, texture, architecture, recession, lesions, etc.), but pocket depths, bleeding, and suppuration performed at appointment 6 and not at appointments 2 through 5. Clinical photographs were made of sites with particular interest.

## **5. Statistical analyses performed by Brigham Young University statistical team.**