#3591

Effectiveness of 1064 Diode Laser Therapy for Treatment of Periodontitis

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OBJECTIVE

To investigate the effectiveness of scaling/root planing (SRP) plus 1064 XLASE (Fotona LLC, Dallas, TX) diode laser therapy (SRP+LASER) compared to SRP only (SRP ONLY) in the treatment of moderate-to-severe (Stage II–III) chronic periodontitis by comparing clinical crown lengths (CCL), probing depths (PD), bleeding on probing (BOP), and bone level (CBCT scans) at pre-treatment and 12 to 18 months post-treatment.

METHODS AND MATERIALS

Subjects: The clinical protocol was approved by the IRB (#17-03) at the school. Twenty-seven subjects in the school's recall population met specific inclusion and exclusion criteria. Acceptance required good overall health, a diagnosis of moderate-to-severe (Stage II-III) chronic periodontitis with at least 2 sites with PD>5mm, BOP and radiographic bone loss. A separate consent form outlining procedures and possible risks was reviewed and signed.

Research Design: At the pre-treatment appointment (appt) at least 2 selected sites were randomly assigned to either the experimental (SRP+LASER) group or the control (SRP ONLY) group. CCL, PD, and BOP were measured using a North Carolina periodontal probe. Next, certified radiologic technicians performed CBCT imaging with a 3D Accuitomo 4cm x 4cm (J. Morita Mfg. Corp., Irvine, CA). Bone height was measured from the alveolar crest to the CEJ (or with a full crown restoration, to the crown margin) by a board certified oral and maxillofacial radiologist.

At the treatment appt the investigator providing therapy confirmed/verified areas to receive SRP+LASER or SRP ONLY, then local anesthesia (lidocaine with 1:100,000 epinephrine) was administered. For the SRP ONLY sites, the involved teeth were thoroughly instrumented using a Cavitron® Slimline® ultrasonic insert (Dentsply Sirona, Charlotte, NC) followed by hand SRP. The sites were rinsed and deemed smooth with a pigtail explorer. The gingival tissues were gently compressed using a 2"x2" gauze to control bleeding and adapt the marginal gingiva. For the SRP+LASER sites, the laser was set at 1.5 W in a pulsed mode (75 Hz), and the fiber tip was conditioned. Treatment was accomplished by placing the tip to the base of the sulcus and moving it circumferentially, removing the inflamed and ulcerated epithelial lining with care not to overheat the area. The fiber tip was cleaned frequently with a moist 2"x2" gauze. Following soft tissue curettage, root surfaces were thoroughly instrumented using the ultrasonic insert followed by hand SRP. The sites were rinsed and deemed smooth with a pigtail explorer. The laser tip was re-introduced to further disinfect the sulcus and expose the underlying connective tissue to laser energy with anticipation of further biostimulation. Interseptal bone was perforated with a periodontal probe to encourage vascularization, and marginal gingiva was de-epithelialized to a 3mm zone to delay re-epithelialization of the sulcus. This was to allow more time for healing from the underlying tissues. Gingiva was then compressed with a 2"x2" gauze. Subjects were given post-treatment instructions that included only light brushing. Post-treatment pain was expected to be minimal, and acetaminophen or ibuprofen was suggested prn. A 1-month post-treatment appt was scheduled to check healing and reinforce plaque control.

At the 3-, 6- and 9-month appts CCL, PD and BOP were measured followed by periodontal maintenance that included scaling and a rubber cup polish. Plaque control was re-emphasized.

At the final appt (12 to 18 months post-treatment), CCL, PD and BOP were measured and recorded, followed by a CBCT scan. Subjects then returned to their dental providers for follow-up care.

RESULTS

The results are based on 22 subjects who met all inclusion/exclusion criteria and completed the project (5 of the original 27 subjects were dropped for non-compliance). The average age of the 22 subjects (11 male and 11 female) was 57 years (range 32-80 years).

Every subject had at least 1 control (SRP ONLY) and 1 experimental (SRP+LASER) site, but several subjects had greater than 1 tooth involved per site area depending on the number of adjacent teeth per site. The treatment sites varied in size from a single tooth up to 4 adjacent teeth. As a result, 42 teeth were treated as SRP ONLY sites and 64 teeth as SRP+LASER sites. No post-treatment complications were reported.

Four variables were considered as outcomes. These included CCL, PD, BOP and bone height. BOP was scored dichotomously (yes/no), and the other 3 variables were measured in mm. There were 5 covariables including age of subject (yrs), time in treatment (days), arch (maxilla or mandible), tooth surface (mesial or distal), and defect angulation (vertical/infrabony or horizontal). Pre-treatment (T1) and post-treatment (T2) scores were used for analysis of outcome variables. Change score was calculated as T2 minus T1 for outcome variables.

The 5 covariables were analyzed as a group for their effect on the various outcomes. After fixing these covariables, treatment was added to the model to see whether it explained any additional variance. This approach identifies factors other than treatment and statistically controls them prior to analysis of the treatment effect. Adding the treatment factor after controlling for covariables showed no effect on 3 of the outcome variables (CCL, PD and BOP). Treatment did show a significant independent effect on bone height.

There were no statistically significant differences in pre-treatment variables between the SRP ONLY and SRP+LASER groups. This included CCL, PD, BOP and interproximal bone height as measured on the pre-treatment (T1) CBCT scan. The mean change in variables from T1 to T2 (post-treatment) is depicted in Table 1. There were no statistically significant differences between the SRP ONLY and SRP+LASER groups for CCL, PD and BOP (p>0.05); however, there was a significant increase in alveolar bone height for the SRP+LASER **(p=0.002)** group when compared to the SRP ONLY group.

TREATMENT	N		Clinical Crown Length (mm)	Probing Depth (mm)	Bleeding on Probing (%)	Bone Height (mm)
SRP ONLY	42	Mean / Std Deviation	-0.536 / 1.332	-2.214 / 1.001	-0.810 / 0.397	-0.162 / 0.523
SRP+LASER	64	Mean / Std Deviation	-0.438 / 1.413	-2.477 / 1.410	-0.797 / 0.443	-0.639 / 0.996
		t -value / *p* -value	0.358 / 0.721	1.119 / 0.266	0.153 / 0.879	3.180 / **0.002**

TABLE 1: Change (T2 minus T1) for SRP ONLY (Control) and SRP+LASER (Experimental) Groups

TREATMENT	N	DEFECT TYPES	N		T1 (mm)	T2 (mm)
SRP ONLY	42	Vertical	9	Mean / Std Deviation	6.236 / 2.313	5.973 / 2.166
		Horizontal	33	Mean / Std Deviation	3.855 / 1.308	3.720 / 1.175
SRP+LASER	64	Vertical	27	Mean / Std Deviation	6.021 / 1.928	4.863 / 1.741
		Horizontal	37	Mean / Std Deviation	3.452 / 1.418	3.213 / 1.388

TABLE 2: Change in Bone Height by Defect Type for SRP ONLY (Control) and SRP+LASER (Experimental) Groups

The mean bone height for T1 and T2 relating to defect type is in Table 2. For the SRP ONLY group, there were 42 sites total, 33 with horizontal defects and 9 with vertical defects. The SRP+LASER group had 64 total sites: 27 infrabony defects and 37 horizontal defects. Bone height changes from T1 to T2 for both treatment groups identified by defect morphology are depicted in Figure 1. Repeated measures ANOVA calculations demonstrated that infrabony defects showed significantly more bone fill (p=0.003) than horizontal defects. While both treatment groups showed increased bone height from T1 to T2, the degree of bone fill was greater in the SRP+LASER treated vertical defects (1.24 mm mean fill) compared to the SRP ONLY sites (0.29 mm mean fill). In comparing horizontal defects, the average gain was 0.1 mm for the SRP ONLY group and 0.22 mm for the SRP+LASER group.

The CBCT images (Figures 2 & 3) are SRP+LASER treatment examples showing bone height at pre-treatment and at post-treatment. While some images demonstrated significant increase in bone height after 12 to 18 months, none of the defects showed complete bone fill.

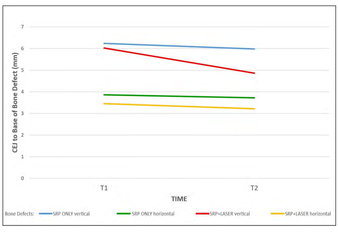

FIGURE 1: *Bone Height Changes from T1 to T2 for Treatment Type and Bone Angulation.*

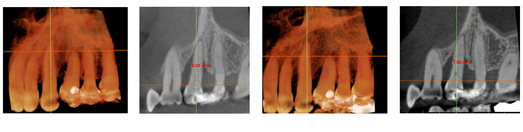

FIGURE 2: *(A) CBCT bony defect mesial aspect tooth 12 at T1, SRP+LASER. (B) CBCT defect measurement mesial aspect tooth 12 at T1, SRP+LASER. (C) CBCT bony defect mesial aspect tooth 12 at T2, SRP+LASER. (D) CBCT defect measurement mesial aspect tooth 12 at T2, SRP+LASER.*

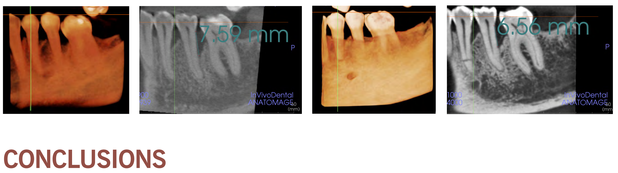

FIGURE 3: *(A) CBCT bony defect distal aspect tooth 20 at T1, SRP+LASER. (B) CBCT defect distal measurement aspect tooth 20 at T1, SRP+LASER. (C) CBCT bony defect distal aspect tooth 20 at T2, SRP+LASER. (D) CBCT defect measurement distal aspect tooth 20 at T2, SRP+LASER.*

CONCLUSIONS

(1) Both SRP ONLY and SRP+LASER treatments produced reductions in PD and marked reductions in BOP. (2) CCL were stable, and minimal gingival recession was observed for both treatment groups. (3) Both treatment groups showed slight improvement in horizontal bone levels from T1 to T2, which was not statistically significant. (4) Infrabony or vertical osseous defects treated with SRP+LASER showed statistically significant bone level improvement **(p=0.002)** over the SRP ONLY group.