Effect of Carbon Dioxide Laser on the Clinical Parameters and Crevicular IL-1β When used as an adjunct to Gingival Flap Surgery

Kyung-Hee Choi

The Graduate School
Yonsei University
Department of Dental Science
Effect of Carbon Dioxide Laser on the Clinical Parameters and Crevicular IL-1β When used as an adjunct to Gingival Flap Surgery

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Kyung-Hee Choi

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This certifies that the dissertation thesis
of Kyung-Hee Choi is approved.

Thesis Supervisor: Chong-Kwan Kim

Seong-Ho Choi

Yun-Jung Yoo

The Graduate School
Yonsei University
June 2003
감사의 글

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실험 결과 분석에 많은 도움을 주신 최홍규 교수님과 생물학 교실 강의의 선생님께서도 감사드립니다.

본 연구 내내 많은 도움을 준 치주과 교실원 여러분과 민아 언니, 그리고 정유에게도 고마운 마음을 전하며, 또한 통계처리에 도움을 주신 명성민 선생님께 도 감사의 마음을 전합니다.

모든 분들에게 진심으로 감사드립니다.

2003년 6월

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Abstract

Effect of Carbon Dioxide Laser on the Clinical Parameters and Crevicular IL-1β When used as an adjunct to Gingival Flap Surgery

The objective of the present study was to evaluate the effect of a carbon dioxide (CO₂) laser treatment on the clinical parameters and crevicular Interleukin-1β (IL-1β) levels when used in combination with gingival flap surgery.

Twelve patients with moderate to advanced periodontitis were selected for this study. Three quadrants of each patient were randomly assigned to one of the following study groups: 1) flap surgery only as the (control); 2) flap surgery and laser treatment using an energy level of 0.8 W as (group 1); 3) flap surgery and laser treatment using an energy level of 0.5 W as (group 2). The gingival crevicular fluid (GCF) was collected at the baseline and biweekly for 6 weeks and the amount of IL-1β concentration in sulcular fluid was measured using an enzyme-linked immunosorbent assay (ELISA). The clinical parameters such as the probing pocket depth, the clinical attachment level, the
gingival recession and the bleeding on probing were recorded at baseline, 3, 6 months.

The results were as follows; marked reductions of the bleeding on probing, the probing pocket depth, the clinical attachment level and a reduction in the crevicular IL-1β concentration were found in all groups. However, the differences between the groups in terms of bleeding on probing and the probing pocket depth were not significant (p<0.05). The clinical attachment level and the crevicular IL-1β level were significantly lower in group 1 (0.8 W) than in the control (p<0.05).

In conclusion, additional use of a Carbon Dioxide laser on the root surface during gingival flap surgery may enhance the clinical attachment and reduce crevicular IL-1β concentration.

Key words : Carbon dioxide laser; periodontitis; gingival flap surgery; interleukin-1β; clinical attachment level
Effect of Carbon Dioxide Laser on the Clinical Parameters and Crevicular IL-1β When used as an adjunct to Gingival Flap Surgery

Kyung-Hee Choi, D.D.S.
Department of Dental Science, Graduate School, Yonsei University
(Directed by Prof. Chong-Kwan Kim, D.D.S., M.S.D., PhD.)

I. Introduction

Removing calcified deposits, microorganisms, microbial products from a diseased root surface is essential in periodontal therapy in order to achieve biologically acceptable root surface (Zander et al., 1976; Patters et al., 1982; O’Leary, 1986). Scaling and root planing are widely used for such purposes.

It is difficult to completely remove plaque and calculus by scaling and root planing with or without surgical access (Jones and O’Leary, 1978; Waerhaug, 1978; Stambaugh et al., 1981; Buchanan and Robertson, 1987; Kepic et al., 1990). The remaining calculus may act as a foundation for bacterial recolonization and the accumulation of metabolic by-product. This type of
microbial growth caused bad result in therapeutic aspect and can be the cause of a recurrence of the disease and a failure of the therapy (Waerhaug, 1978; Patters et al., 1982). Therefore, there needs to be a more effective means of removing residual plaque and calculus. Some reports suggested using lasers in addition to the conventional scaling and root planing (Iwase et al., 1989; Myers, 1991). In theory, it is possible to remove the residual organic debris including microbial plaque and calculus without causing any damage to the adjacent root surfaces with a laser.

The most widely used lasers in dentistry are the CO₂ laser, the Nd:YAG laser, the Er:YAG laser and the argon laser. Lasers have several uses to periodontal treatment such as sterilization by the ablation of the dental deposits and root conditioning by the ablation of the diseased root surface.

Several researchers have reported the application of laser in periodontal therapy. White et al. (1991) and Cobb et al. (1992) suggested the laser as an adjunctive procedure for periodontal treatment. They reported that a laser could remove calculus and be used in subgingival root planing. In addition, it was reported that the number of periodontal pathogens were reduced and Yamaguchi et al. (1997) reported the elimination of endotoxin.
Besides these effects, it has also been reported that the laser radiation effectively exposes the dentinal tubules by removing the smear layer which is related to the attachment of the connective tissue. Morlock et al. (1992) showed that when a laser was used together with conventional root planing, the smear layer that was observed when root planing alone was performed was eliminated and the dentinal tubules were effectively exposed. Ito et al. (1993) also reported the exposure of the dentinal tubules and collagen fibers.

Interleukin-1 (IL-1) is one of the cytokines produced by the activated mononuclear phagocytes derived from the peripheral blood or tissue and the β form has an important catabolic effect on the bone tissue (Grower et al., 1983; Gowen and Mundy, 1986).

Some reports have shown that interleukin-1β (IL-1β) plays a crucial role in the destruction of the periodontal tissues (Page, 1991; Stashenko et al., 1991; Jandinski et al., 1991). IL-1β is found in the periodontal tissue and gingival crevicular fluid (GCF) of patients with periodontal disease (Charon et al., 1982; Mergenhagen, 1984; Masada et al., 1990; Wilton et al., 1992) and its levels decrease after the appropriate treatment (Honig et al., 1989; Masada et al., 1990; Hou et al., 1995). It was reported that there is a correlation between the total amount of crevicular IL-1β concentration and both the gingival index
and the probing depth (Hou et al., 1995; Liu et al., 1996). These findings suggest that measuring the total amount of crevicular IL-1β level is very useful for monitoring the periodontal disease activity.

The purpose of this study was to evaluate the effects of a carbon dioxide laser treatment on the root surfaces when used in combination with traditional gingival flap surgery using different power levels by measuring the crevicular interleukin-1β level and several other clinical parameters in patients diagnosed with adult periodontitis.
II. Materials & methods

A. Clinical Sampling and Design

Twelve patients (5 males and 7 females) ranging from ages 29 to 52 years of age (mean: 44 years) with moderate to advanced periodontitis were selected for periodontal treatment at the Dept. of Periodontics, Dental Hospital, Yonsei University Medical Center. Informed consent was obtained from all participants. The criteria for patient selection were: 1) no history of periodontal therapy within 6 months; 2) at least 3 sites with a probing depth of 4 mm or more in each quadrant; 3) the first premolar, second premolar, first molar were retained in each of the 3 quadrants. GCF samples were collected from the site with greatest initial pocket depth of the quadrant for IL-1β analysis. Thirty-six quadrants from 12 patients were examined and three quadrants from each patient were randomly assigned to one of the following study groups: 1) flap surgery only (control); 2) flap surgery and laser treatment using an energy level of 0.8 W (group 1); 3) flap surgery and laser treatment using an energy level of 0.5 W (group 2).
Scaling and basic oral hygiene education including instructions in tooth brushing, flossing and the use of an interdental brush were given at the start of the study and the instructions were reinforced at all subsequent visits. The clinical parameters such as the probing pocket depth, the clinical attachment level, the gingival recession and the bleeding on probing were recorded at the baseline (1 month after scaling), 3 and 6 months and the GCF samples were collected at the baseline and biweekly for 6 weeks (Table 1).

Table 1. Flow diagram showing the experimental procedure

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>2 week</th>
<th>4 week</th>
<th>6 week</th>
<th>3 month</th>
<th>6 month</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PD</td>
<td>PD</td>
</tr>
<tr>
<td>Rec</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rec</td>
<td>Rec</td>
</tr>
<tr>
<td>CAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CAL</td>
<td>CAL</td>
</tr>
<tr>
<td>BOP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BOP</td>
<td>BOP</td>
</tr>
<tr>
<td>GCF</td>
<td>GCF</td>
<td>GCF</td>
<td>GCF</td>
<td>GCF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PD: Pocket depth  Rec: Recession  CAL: Clinical attachment loss
BOP: Bleeding on probing  GCF: Gingival crevicular fluid
B. Clinical Parameters

1. Bleeding on probing

The presence or absence of bleeding was recorded 5 seconds after removing the periodontal probe when measuring the pocket depth and attachment level. The proportion of the bleeding points out of the total number of points examined was calculated.

2. Probing pocket depth and probing attachment level

The probing pocket depth and the probing attachment level were measured to the nearest of 1 mm using a Marquis color corded probe (0.5 mm in diameter). During probing, the probe was directed to the long axis of the tooth. The probe was moved twice towards the base of the pocket to find the pocket base. The distance from the pocket base to the gingival margin (probing pocket depth) and to the cementoenamel junction (probing attachment level) was recorded.
3. **Gingival recession**

The location of the gingival margin was assessed by subtracting the figure for the pocket depth from the figure for the attachment level.

**C. Surgical Procedure**

Gingival flap surgery was employed in one side of the 3 quadrants. The two remaining quadrants were treated with a gingival flap surgery and 0.8 W/0.5 W CO₂ laser irradiation to the root surface after root planing. The char layer was eliminated through curettage after the laser irradiation. The wound was covered with a periodontal dressing. The patients were instructed to rinse with a 0.2% chlorhexidine digluconate solution twice daily during the first 2 weeks after surgery. They were then recalled every 2 weeks for professional tooth cleaning as described by Axelsson and Lindhe (1974).

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§ Coe Pak™, GC America Inc, USA
D. Application of Laser

The laser-treated sites were irradiated with a CO2 laser† using a focused beam (2 mm from target surface), a 0.4 mm diameter focal spot, wavelength of 10.6 μm. The laser parameters were 0.8 W (group 1) / 0.5 W (group 2) of power delivered at 50 Hz in a continuous mode. The contact optic fiber was held parallel to the root surface and moved in a back and forth motion in order to cover the entire root surface with overlapping strokes until a confluent char layer could be seen. The laser was irradiated on the alveolar bone adjacent to the root surface and the flap. When using the laser, of the smoke needs to be eliminated effectively and it is recommended that both the patient and the operator wear protective glasses to reduce the risk of eye damage, as a result of the laser and the refraction of the beam.

† OPELASER O3SII, Yoshida Dental MFG. CO., Japan.
E. Collection and Assay of IL-1β

The GCF samples were collected by inserting paper strips‡ into the gingival crevice until mild resistance was felt. The paper strips were kept in place for 30 seconds (Wilton et al., 1992). The fluid was sampled from a single site in each quadrant where the pocket depth measured 5-6 mm. The fluid was collected from the same site 2, 4 and 6 weeks after surgery. Each paper strip was then placed in 100 µl of Hank's buffered salt solution (HBSS) containing 0.5% bovine serum albumin, and stored frozen at -80°C until needed. The amount of IL-1β levels in the GCF sample were assessed by an enzyme-linked immunosorbent assay (ELISA) with a recombinant IL-1β monoclonal antibodies¶. All the assay procedures were carried out according to the manufacturer's protocol and the optical densities were measured using a spectrophotometer at 450 nm.

‡ Periopaper, HARCO Electronics, Irvine, CA.
¶ Biotrak, Amersham Pharmacia Biotech UK Limited.
F. Statistical Analysis

A one-way ANOVA with a Tukey's test was used to determine the statistical significance of the IL-1β levels and the clinical parameters between the different treatment groups at the baseline and at indicated time points after treatment. Repeated Measures ANOVA was used to determine the statistical significance of the IL-1β level and the clinical parameters within the groups in comparison to the baseline.
III. Results

A. Bleeding on probing

The percentage of the bleeding on probing decreased in all of the groups after the treatment. The baseline of the percentage of bleeding on probing were 80.2±19.9%, 76.2±21.5%, 86.8±21.4% respectively in group 1, group 2 and the control, respectively. It was 9.7±9.2%, 8.7±8.6%, 19.1±9.4% after 3 months and 13.6±5.2%, 15.1±4.2%, 17.5±4.8% after 6 months of treatment, respectively showing a consistent decrease every month after the treatment (p<0.05). However there were no differences among the 3 treatment groups (p>0.05). (Table 2, Figure 1)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3 months</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>80.2±19.9</td>
<td>9.7±9.2 *</td>
<td>13.6±5.2 *</td>
</tr>
<tr>
<td>Group 2</td>
<td>76.2±21.5</td>
<td>8.7±8.6 *</td>
<td>15.1±4.2 *</td>
</tr>
<tr>
<td>Control</td>
<td>86.8±21.4</td>
<td>19.1±9.4 *</td>
<td>17.5±4.8 *</td>
</tr>
</tbody>
</table>

Data are represented as the proportion of bleeding site out of the total number of examined sites (%)

* Statistically significant differences compared to baseline (p<0.05).
Figure 1. Bleeding on probing (%)

* Statistically significant differences compared to baseline ($p<0.05$).

**B. Probing pocket depth**

The probing pocket depth also decreased in all of the groups after 3 and 6 months after treatment. The baseline pocket depth was 5.0±0.6 mm, 5.2±0.6 mm, and 4.8±0.5 mm respectively in group 1, group 2 and the control respectively. It was 2.5±0.3 mm, 2.5±0.4 mm, and 2.6±0.3 mm respectively, with an approximately 2.3-2.6 mm decrease in the pocket depth after 3 months and it was 2.6±0.3 mm, 2.6±0.4 mm, and 2.8±0.3 mm respectively showing an approximately 2.1-2.6 mm decrease in the pocket depth after 6 months. All of
the groups showed a consistent decrease after the treatment. However there were no differences among the 3 groups (p>0.05). (Table 3, Figure 2)

**Table 3. Probing pocket depth (mm)**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3 months</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>5.0±0.6</td>
<td>2.5±0.3 *</td>
<td>2.6±0.3 *</td>
</tr>
<tr>
<td>Group 2</td>
<td>5.2±0.6</td>
<td>2.5±0.4 *</td>
<td>2.6±0.4 *</td>
</tr>
<tr>
<td>Control</td>
<td>4.8±0.5</td>
<td>2.6±0.3 *</td>
<td>2.8±0.3 *</td>
</tr>
</tbody>
</table>

* Statistically significant differences compared to baseline (p<0.05).

**Figure 2. Probing pocket depth (mm)**

* Statistically significant differences compared to baseline (p<0.05).
C. Clinical attachment level

The clinical attachment level in all the groups decreased after 3 and 6 months after treatment consistently compared to the baseline. The results after 3 months were 3.2±1.0 mm for group 1, 3.5±1.3 mm for group 2 and 3.8±1.3 mm for the control. Group 1 and the control showed statistically significant differences in attachment gain (p<0.05), while there were no differences between group 2 and the control as well as between group 1 and group 2 (p>0.05). It was 3.3±1.0 mm, 3.7±1.4 mm and 4.0±1.3 mm in group 1, group 2 and the control after 6 months, respectively and group 1 and the control showed statistically significant differences (p<0.05), but there were no differences between group 2 and the control, group 1 and group 2 (p>0.05). (Table 4, Figure 3)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3 months</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>5.3±0.8</td>
<td>3.2±1.0 *†</td>
<td>3.3±1.0 *†</td>
</tr>
<tr>
<td>Group 2</td>
<td>5.5±0.7</td>
<td>3.5±1.3 *</td>
<td>3.7±1.4 *</td>
</tr>
<tr>
<td>Control</td>
<td>5.0±0.5</td>
<td>3.8±1.3 *</td>
<td>4.0±1.3 *</td>
</tr>
</tbody>
</table>

* Statistically significant differences compared to baseline (p<0.05).
† Statistically significant differences compared to control (p<0.05).
D. Concentration of IL-1β in crevicular fluid

The crevicular IL-1β levels prior to the treatment for group 1, group 2 and the control were 174.6±34.2 pg/ml, 136.1±54.1 pg/ml and 188.5±92.7 pg/ml respectively. However there was a decrease after 2, 4 and 6 weeks of treatment in all of the groups (p<0.05). When comparing each group according to time, there was a similar difference between group 1 and the control after 2, 4 and 6 weeks of treatment, whereas there were no similar differences between group 2 and the control, and group 1 and group 2 (p>0.05). (Table 5, Figure 4)
Table 5. Changes of crevicular IL-1β (pg/ml) from baseline to 6 weeks

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>2 weeks</th>
<th>4 weeks</th>
<th>6 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>174.6±34.2</td>
<td>22.5±14.9 †</td>
<td>28.5±29.0 * †</td>
<td>20.3±24.4 * †</td>
</tr>
<tr>
<td>Group 2</td>
<td>136.1±54.1</td>
<td>70.8±53.2 *</td>
<td>64.0±49.9 *</td>
<td>49.9±29.9 *</td>
</tr>
<tr>
<td>Control</td>
<td>188.5±92.7</td>
<td>110.2±72.1 *</td>
<td>98.2±64.5 *</td>
<td>82.6±43.4 *</td>
</tr>
</tbody>
</table>

* Statistically significant differences compared to baseline (p<0.05).
† Statistically significant differences compared to control (p<0.05).

Figure 4. Concentration of IL-1β in crevicular fluid (pg/ml)

* Statistically significant differences compared to baseline (p<0.05).
** Statistically significant differences compared to control (p<0.05).
IV. Discussion

The purpose of periodontal therapy is to make a regeneration of the connective tissue of the root surface with periodontitis in order to reproduce the periodontal tissue to allow the tooth to function normally. However, conventional scaling and root planing have some limitation in making a regeneration because it is difficult to completely eliminate plaque and calculus from the root surface. For this matter, alternatives have been examined in order to compensate for the limitations inherent in mechanical root therapy. Recently, lasers have been recommended as an alternative or adjunctive therapy in the periodontally diseased root surfaces (Iwase et al., 1989; Myers, 1991; White et al., 1991; Cobb et al., 1992). It has been suggested that a laser might be capable of sterilizing the diseased root surface and thus, and ultimately promote cell reattachment (Myers, 1992).

There have been studies comparing root planing and laser in vivo (Cobb et al., 1992; Ito et al., 1993) but there are few studies investigating the effect of the laser used in gingival flap surgery.

Myers et al.(1992) reported that at energy levels of 50 mJ or more, the melting temperature of hydroxyapatite (700°C) is reached, evaporation begins,
steam forms and microexplosions occur. A series of related studies published in 1992 evaluated the effects of Nd:YAG irradiation on root specimens in vitro (Morlock et al., 1992; Spencer et al., 1992; Trylovich et al., 1992). Collectively, they reported that energy levels of 80 mJ or more resulted in the formation of craters, melting and resolidification of the surface mineral, carbonization, surface porosity and peeling of the cementum. The power of the laser used in this study was 0.5 W and 0.8 W. The power recommended by the manufacturer was 0.8 W. The laser was irradiated approximately 5 times back and forth per second. Therefore, if the laser were irradiated for 0.2 second with an energy level being 0.8 W, it would be approximately 160 mJ, and 100 mJ for 0.5 W. According to a previous study, this is the amount that causes change in the root surface, which is less than what the product company recommended. Therefore, this study aimed to determine if there were any effects of a lower energy level as well. Therefore, laser used with a 0.5 W power was also used in the experimental group.

The results evaluated by measuring the changes in the clinical parameters. There was a decrease in the percentage of bleeding on probing, the decrease in pocket depth, and a gain of clinical attachment level in all of the 3 groups –
group 1, group 2 and control after 3 and 6 months of treatment and a decrease in the crevicular IL-1β levels after 2, 4 and 6 weeks of treatment.

Bleeding on probing is a significant clinical factor demonstrating an inflammatory lesion in the base of the connective tissue of the gingival crevice (Meitner et al., 1999). In addition, this has been acknowledged by many investigators (Hancock, 1981; Polson and Caton, 1985) that gingival bleeding acts as an indicator of the activity of the periodontal diseases. In this study, the percentage of those exhibiting bleeding on probing decreased in all of the groups after 3 and 6 months of treatment but there were no differences among the groups.

The decrease in the pocket depth and the gain in the clinical attachment level play an important role in evaluating a successful treatment in patients with periodontitis. Kaldahl et al. (1988) reported that there was an average of 2.39 mm decrease in the periodontal pocket depth 3 months after flap surgery in a patient with periodontitis with a pocket depth of 5-6 mm. Becker et al. (1988) also reported that there was an average of 1.78 mm decrease, 6 months after the flap surgery in a patient with periodontitis with a pocket depth of 4-6 mm. In this study, there was a 2.26 mm and 2.05 mm decrease in the control group 3 and 6 months after the flap surgery, respectively, which was a similar
to the result reported in previous studies. There was a decrease of 2.44 mm, 2.62 mm after 3 months and 2.41 mm, 2.58 mm after 6 months in the groups using the laser with 0.8 W, 0.5 W, which showed no statistical difference from the control group. For the clinical attachment level, there was a decrease after 3 and 6 months compared to the baseline in all of the groups and in a comparison of the groups, there was a greater decrease statistically in the 0.8 W laser group than the flap surgery only group. This shows that there is no difference in the pocket depth, but there is a greater gain in the new attachment level when the 0.8 W laser is used compared to the flap surgery alone.

These results were different from the previous studies. Trylovich et al. (1992) reported that when using 80 mJ Nd:YAG laser on an endotoxin-treated root surface, the laser changed the biocompatibility of the cementum surface and prohibited fibroblast attachment. Gopin et al. (1997) in a histological study reported that there was a decrease in soft tissue attachment on the root surface treated with CO₂ laser in histologic study. These results seem to be due to the char layer after laser irradiation.

The intense, localized heat produced when the laser comes into contact with surface debris, organic materials or a pigmented surface causes the charring. It includes remnants of ammonia, cyanate and cyanamide. It appears
that the residual char layer is a significant barrier to soft tissue reattachment. Trylovich et al. (1992) reported that in the case of a char layer in vitro, there was a suppression of fibroblast attachment. Thomas et al. (1994) reported that there was a fibroblast attachment when root planing and an air-powder abrasive slurry were used on the lased root surface in vitro.

In this study, considering the results of a previous study, the char layer on the laser-treated root surface was eliminated by curettage. However, caution should be taken so as not to remove excessive cementum and dentin but to only remove the char laser gently. During the process of eliminating the char layer, it might also be effective in eliminating the areas with incomplete curettage.

It is believed that one of the reasons that the laser-treated group had a greater gain in clinical attachment than the control group is due to accessibility. Irradiating the laser on a narrow intrabony defect where the curette cannot be accessed can have both a mechanical and antibacterial effect.

Theoretically, a laser can eliminate plaques and calculus by ablating and vaporizing them, have access to spots where the instruments cannot reach and disinfect the pocket sulcular lining (Cobb et al., 1992; Morlock et al., 1992; Ando et al., 1996). This notion appears to be supported by our findings in that
laser (0.8 W) combined flap surgery (group 1) produces more reduction in the
crevicular IL-1β and gain in clinical attachment than flap surgery only
(control). The 0.5 W laser irradiation had a more decreasing effect than flap
surgery only, but there did not appear to be sufficient difference.

In this study, the IL-1β levels were significantly lower following CO2 laser
(0.8 W) irradiation combined with flap surgery procedure than flap surgery
only. Conflicting results have been reported regarding the effect of periodontal
treatment on the IL-1β levels. Some studies have demonstrated that the
crevicular IL-1β levels decreased remarkably after basic periodontal therapy
(Masada et al., 1990; Hou et al., 1995; Honig et al., 1995). However,
Reinhardt et al. (1993) reported no significant differences in the IL-1β levels
after scaling and root planing in addition to significant increases after
periodontal surgery. The reasons for the difference between the different
studies remains to be determined.

Liu et al. (1990) also reported that in terms of the IL-1β decrease, there
were no differences between the 2 groups i.e. the group that had scaling and
root planing performed and the group that used laser additionally after scaling
and root planing. Miyazaki et al. (2003) reported that the Nd:YAG laser alone
was as effective as ultrasonic scaling alone in reducing the crevicular IL-1β
levels. However, the CO₂ laser treatment had a lesser effect on removing subgingival plaque and reducing the IL-1β level. This is because the CO₂ laser was used in a non-contact mode, superficially over the gingival tissue.

In conclusion, this study demonstrated that a CO₂ laser (0.8 W) combined with flap surgery produces a greater reduction in the crevicular IL-1β level and clinical attachment loss than flap surgery alone.
V. Conclusion

The objective of the present study was to evaluate the effect of CO₂ laser treatment on the clinical parameters and crevicular IL-1β level when used in combination with gingival flap surgery. 36 quadrants from twelve patients were examined and 3 quadrants of each patient were randomly assigned to one of the 3 groups. The experimental groups received laser irradiation at 0.8 W/0.5 W in combination with conventional gingival flap surgery and control group received gingival flap surgery only. The results are as follows.

1. The bleeding on probing decreased in all of the groups after treatment. There were no differences among the 3 groups.

2. The pocket depth reduced in all of the groups after treatment. All of the groups showed a consistent decrease after treatment and no significant difference was found among the 3 groups.

3. The clinical attachment level decreased in all of the groups. When comparing each group, 0.8 W laser combined group showed significant decrease comparable to flap surgery only group.

4. When comparing in the crevicular IL-1β level each group according to time, 0.8 W laser combined group showed significant decrease
comparable to flap surgery only group at 2, 4 and 6 weeks after treatment.

These results suggest that using 0.8 W CO$_2$ laser additionally on root surface during the gingival flap surgery has effect on gain of clinical attachment and decrease of IL-1β level.
References


Polson AM, Caton JG: Current status of bleeding in the diagnosis of


Clinical photos (I)

Figure 5-a.

Figure 5-b.

Figure 5-c.
Clinical photos (II)

Figure 5-d.

Figure 5-e.

Figure 5-f.
국문 요약

치은 판막술에 CO2 레이저를 부가적으로 사용했을 때의 IL-1β와 임상 지수의 변화

연세대학교 대학원 치의학과

(지도 김종관 교수)

최정희

치주 질환의 가장 중요한 원인인 치세 및 치석의 세균는 치주 치치에 있어서 핵심이 되는 부분이다. 그러나 기계적인 방법만으로 이를 완전히 제거하는 것은 많은 시간이 소요될 뿐만 아니라 기술이 요구되며 일반적으로는 수행하기 어렵다. 이에 몇몇 연구자들은 부가적인 방법으로 레이저의 사용을 제안하였다. 이 연구는 Y대학교 치과대학 부속병원 치과과를 대상으로 한 치온판막술 시 치근면에 CO2 레이저를 부가적으로 사용하였을 때 IL-1β level과 여러 임상지수를 측정함으로써 그 임상적인 효과를 평가하였다. 각 환자의 3약 중 치온판막술을 시행한 부위를 대조군, 치온판막술과 0.5W로 레이저 치료를 시행한 부위를 실험군 1, 치온판막술과 0.8W로 레이저 치료를 시행한 부위를 실험군 2로 설정하여 숭후 2주, 4주, 6주에 GCF를 채취하고 3개월.
6개월에 출혈지수 변도, 치주낭 깊이, 임상부착수준을 측정하여 다음과 같은 결론을 얻었다.

1. 출혈지수의 변도는 술 후 모든 군에서 감소하였다. 술전의 출혈지수의 변도는 실험군 1, 실험군 2, 대조군에서 각각 80.2±19.9%, 76.2±21.5%, 86.8±21.4%였으며 술 후 3개월시는 9.7±9.2%, 8.7±8.6%, 19.1±9.4%, 6개월시는 13.6±5.2%, 15.1±4.2%, 17.5±4.8%로 술전과 비교시 각 개월의 출혈지수의 변도가 유의성 있게 감소하였다 (p<0.05). 각 군간 비교시에는 유의한 차이를 보이지 않았다 (p>0.05).

2. 치주낭 깊이는 모든 군에서 술후 3개월, 6개월에 감소를 보였다. 숭전의 치주낭 깊이는 실험군 1, 실험군 2, 대조군에서 각각 5.0±0.6mm, 5.2±0.6mm, 4.8±0.5mm였고 술후 3개월에는 각각 2.5±0.3mm, 2.5±0.4mm, 2.6±0.3mm로 약 2.3~2.6mm 가량의 치주낭 깊이 감소를 보였으며, 술후 6개월에는 2.6±0.3mm, 2.6±0.4mm, 2.8±0.3mm로 2.1~2.6mm 가량의 치주낭 감소를 보였다. 모든 군에서 술전과 비교시 유의성 있는 감소를 보였으며 (p<0.05), 군 간에는 유의성 있는 차이를 보이지 않았다 (p>0.05).

3. 임상부착수준도 모든 군에서 술전과 비교시 술후 3개월, 6개월에 유의성 있는 감소를 보였다. 군 별로 비교해 보면 술후 3개월, 6개월시 실험군 1이
대조군에 비해 유의성 있는 부작 반응을 보였다 (p<0.05). 실험군 1과 실험군 2, 실험군 2와 대조군 간에는 유의성 있는 차이를 보이지 않았다 (p>0.05).

4. 씨진 crevicular IL-1β는 실험군 1, 실험군 2, 대조군에서 각각 174.6±34.2pg/ml, 136.1±54.1pg/ml, 188.5±92.7pg/ml으나 숭후 2주, 4주, 6주에 모든 군에서 유의성 있는 감소를 보였다 (p<0.05). 시간별로 각 군을 비교해 보면 숭후 2주, 4주, 6주에서 모두 실험군 1과 대조군간에는 유의한 차이를 보였으나 (p<0.05) 실험군 1과 실험군 2, 실험군 2와 대조군 간에는 유의성 있는 차이를 보이지 않았다 (p>0.05).

이상의 결과에서 저온 광학술시 치근면에 0.8W로 CO₂ 레이저를 부가적으로 사용하였을 때 IL-1β 감소, 부작 반응의 항상에 효과가 있는 것으로 사료된다.

*해석되지 않음: CO₂ 레이저, 성인성 치주염, Interleukin-1β(IL-1β), 저온 광학술.*

임상부작수준