

Evaluating the Efficiency of Conservation Treatment of Diode Laser on Periodontal Disease

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ABSTRACT----

Objectives: to assess the effectiveness of conservative treatment of periodontal disease by diode laser.

Method: cross sectional study.

Results: clinical attachment loss reduction after 1 and 4 weeks was $0,19\pm 0,15\text{mm}$ and $0,17\pm 0,19\text{mm}$, respectively. Periodontal pocket depth reduction after 1 and 4 weeks was $0,14\text{mm}$ and $0,29\text{mm}$, respectively. After 1-4 weeks the GI index: good 60%, moderate 32,7% and bad 7,3%. OHI-S index was well improved after 1 and 4 weeks of treatment. After 1-4 weeks: good 70,3%, moderate 20,5% and bad 9,2%.

Conclusion: Conservative treatment of periodontal disease using diode laser is significantly effective in improving periodontal indexes such as reducing the level of periodontal pocket depth, improving gingival indexes and dental hygiene indexes at the defined period of time after treatment compared with those before treatment.

Keywords---- periodontal disease, diode laser

1. BACKGROUND

Laser energy was first invented by Albert Einstein in 1917 and first used medically to freeze retina injuries in 1963. Not until 1980, non-invasion laser or soft laser were widely applied in medicine. The benefits of laser in general and semiconductor laser in particular in medicine compared with traditional techniques are: sterilization, hemostatic, or promoting healing process. For healing process, studies show that laser energy increase the pace of healing through the development of chemical epithelial proliferation, differentiation of fibroblasts, increased protein synthesis, reduce inflammatory processes, increases the extracellular matrix products and the organization of collagen bunches [1]. The operating environment of laser diode is the semiconductor substance made from Aluminum, gallium, arsenic and sometimes indium, creating a wavelength from 810 nm to 980 nm [2]. Thanks to the superior feature, semiconductor laser is also widely used in Vietnam in many medical fields [3][4]. However, with periodontitis, there have been any studies to evaluate the efficiency of semiconductor laser energy in the support of disease treatment. Because of this reason, we conduct this study with the aim of assessing the efficiency of semiconductor laser treatment on periodontitis.

1.1. Selection criteria: participation in the research; do not have mental illness; at least 18 years old; is being diagnosed with periodontitis (gum bag > 3 mm.)

1.2. Exclusion criteria: use antibiotics in the recent 3 months; is having a developing disease; can't open mouth wide open; uncooperative people.

1.3. Location: Clinical medicine department, Department of Odonto-Stomatology-Binh Duong Medical College, Nu Cui Duyen Odonto-Stomatology Clinical Centre-Binh Duong

1.4. Period: From April 2015 to December 2015

2. METHODS

2. Research method: cross-section comparison, description.

2.2. Sample size

$$\text{Formula for calculating sample size: } n = Z_{(1-\alpha/2)}^2 \frac{p \cdot q}{d^2}$$

Sample size of each group is 71 people; we choose for the research 141 objectives

2.3. Means of research: Dental chair, machines; Dental examination toolkit including: tray, mirror, cotton pick, explorer brooch, handheld tooth explorer, ultrasonic dental plaque remover; Máy Diode laser Picaso Lite 2.0 watt [5].

2.4. Description of research methods

Step 1: Record patients' information (full name, age, gender, medical history...) Examine and record all clinical features of periodontitis.

Step 2: Evaluate and compare according to set indicators: Gum indicator: Good (<1); Average (1-2); Poor (>2); OHI-S indicator: Good (<1.3); Average (1.3-3); Poor (>3).

Step 3: Treatment method: clean dental plaque by ultrasonic plaque remover, we use semiconductor laser energy (Diode laser 2.0W), interrupted ray with increasing power from 0,5-0,7 watt with suitable tip (10mm-300µm) deep into tissues surrounding tooth activating ray, each time shine in 60 seconds, break time is 30 seconds between shines. Repeated regularly in re-examination, attached with proper instructions to patients about dental hygiene.

Step 4: All patients are given re-examination appointments after 1 week, after 4 weeks, intervene, examine and re-assess indicators to evaluate treatment results after each re-examination.

2.5. Evaluation criteria: Gum indicator: Good (reduce 2 degree); Average (reduce 1 degree); Poor (no decrease). Depth of gum bag: good (reduce more than 0.8mm); Average (reduce 0.3-0.7mm); Poor (reduce <0.3mm). Tooth tack level: Good (increase more than 0.8mm); Average (increase 0.3-0.7mm); poor (increase <0.3mm).

2.6. Data processing: Collected data is processed by medical statistical method with EPI-INFO 6.04 program. Calculate averages, compare median values (using test t student). Calculate proportion %, comparing proportions (using test χ^2).

3. RESULTS

3.1. Clinical features of patients with periodontitis

3.1.2. Depth of tissues surrounding tooth by age group

Table 3.1. Depth of tissues surrounding tooth by age group (n=141)

Age group	N	Proportion %	Depth of tissues surrounding tooth mm ($\bar{X} \pm SD$)	p*
≤34 years old	43	30.50	2.82±0.11	0.000
35 → 49 years old	49	34.75	3.08±0.13	
≥ 50 years old	49	34.75	3.36±0.22	
Total	141	100.00	3.10±0.27	

*ANOVA test

Of the 141 objects, the age group of under 34 accounts for the lowest proportion (30.50%). Depth of tissues surrounding tooth increase with age. The difference is statistically significant ($p < 0.05$).

3.1.3. Loss of tack level by age group

Table 3.2. Loss of tack level by age group (n=141)

Age group	n	Loss of tack (mm) ($\bar{X} \pm SD$)	p*
≤34 years old	43	3.89±0.24	0.970
35 → 49 years old	49	3.86±0.23	
≥ 50 years old	49	3.83±0.24	
Total	141	3.86±0.23	

*ANOVA test

There is no statistically significant difference about the loss of tack level by age group ($p > 0.05$)

Table 3.3. Depth of tissues surrounding tooth with indicator OHI-S and GI (n=141)

Age group	TQR (mm) $\bar{X} \pm SD$	OHI-S $\bar{X} \pm SD$	GI $\bar{X} \pm SD$
≤34 years old	2.82±0.11	2.74±0.15	2.06±0.25
35 → 49 years old	3.08±0.13	2.76±0.15	1.96±0.22
≥ 50 years old	3.36±0.22	2.87±0.14	1.99±0.24
Total	3.09±0.27	2.79±0.15	2.15±0.24
p*	0.000	0.884	0.641

***ANOVA test**

In age group of higher than 50 years old, the depth of tissues surrounding tooth is always higher than the under-34 group and 35-49 group. There is no statistically significant difference in OHI-S indicator and GI indicator by age group ($p>0.05$)

3.1.4 Depth of tissues surrounding tooth by age

Table 3.4. Depth of tissues surrounding tooth of subjects (n=141)

Gender	n	%	Depth of tissues mm ($\bar{X} \pm SD$)	p(t-test)
Male	66	46.81	3.07±0.25	0.2540
Female	75	53.19	3.12±0.29	
Total	141	100.00	3.10±0.27	

Male accounts for 53.19%, which is higher than women with 46.81%. The average depth of tissues surrounding tooth in male is 3.07±0.25 lower than that of women with 3.12±0.29. However, the difference is not statistically significant ($p>0.05$).

3.1.5 Dental plaque level by gender

Table 3.5. Dental plaque level (n=141)

Gender	n	%	Dental plaque mm ($\bar{X} \pm SD$)	p(t-test)
Male	66	46.81	3.86±0.22	0.8199
Female	75	53.19	3.85±0.25	
Total	141	100.00	3.86±0.23	

The average depth of dental plaques in male and female is not statistically significant ($p>0.05$).

3.1.6 The depth of tissues surrounding tooth with Oral hygiene indicator (OHI-S) and gum indicator (GI)

Table 3.6. The depth of tissues surrounding tooth with OHI-S and GI (N=141)

Gender	OHI-S $\bar{X} \pm SD$	GI $\bar{X} \pm SD$
Male	2,77±,15	1,82±0,13
Female	2,76±,14	2,17±0,18
Total	2,76±,15	2,00±0,24
p(t-test)	0,6885	0,0000

The difference in OHI-S indicator between male and female is not statistically significant ($p>0.05$)

3.2. Evaluation of post-treatment:

3.2.1. The changes of GI indicator post-treatment

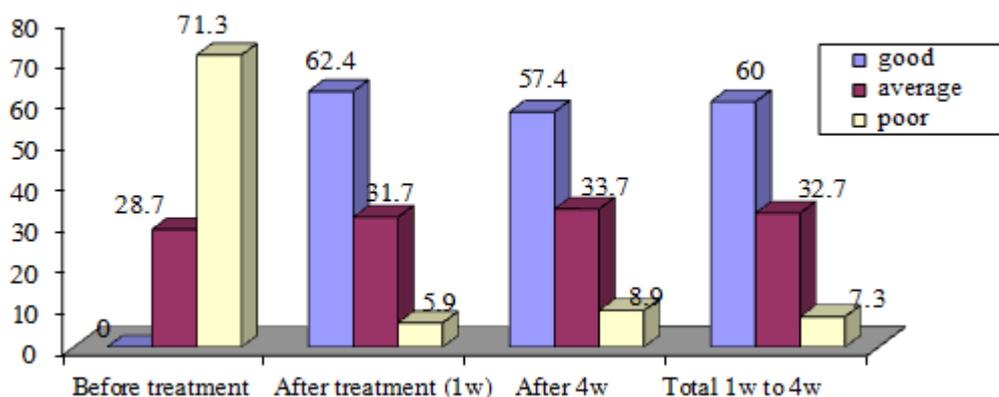


Chart 3.2.1. Improvement of GI indicator post-treatment

- The number of patients with good condition after treatment. After 1- 4 weeks, 60% has good changes, 32.7% average and 7.3% poor.

- Comparing the results after 1 week, 4 weeks shows that the proportion of patients with good gum condition increases from 0% to 62.4% after 1 week and has the tendency to decrease after 4 weeks (57.4%). The difference in the proportion of patients with good result after 1 week and 4 weeks compared with initial time has statistical significance with $p < 0.001$.

- The difference in gum indicator improvement at week 4 is lower than that of week 1, but no statistical significance, with $p > 0.05$.

3.2.2. Variation of OHI-S indicator post-treatment

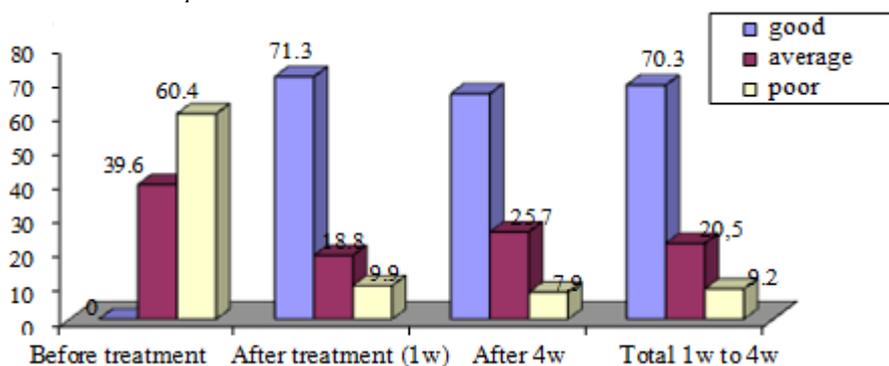


Chart 3.2.2. Improvement of OHI- S indicator post-treatment

- OHI-S indicator is clearly improved after 1 week and 4 week treatment. After 1- 4 week, the good efficiency is 70.3%, average is 20.5% and poor is 9.2%.

- Comparing treatment result after 1 week, 4 week shows that the number of patients with good OHI-S indicator increases from 0% to 71.3% after 1 week and have a downward tendency after 4 weeks (66.3%). The difference in patient proportion with good results after 1 week and 4 weeks compared with initial time is statistically significant with $p < 0.001$.

- The differences in OHI-S improvement at week 4 are lower than that at week 1 but is not statistically significant with $p > 0.05$.

3.2.3. The decrease in depth of tissues surrounding tooth after treatment

Table 3.7. The decrease in depth of tissues surrounding tooth after treatment (n=141)

Gender	Time	Before treatment (1)	After 1 week (2)	After 4 weeks (3)	P1-2	P1-3
Male		3.07±0.25	2.91±0.32	2.77±0.36	0.0000	0.0000
Female		3.12±0.29	3.00±0.29	2.85±0.31	0.0000	0.0000
General		3.10±0.27	2.96±0.31	2.81±0.34	0.0000	0.0000

t-test

After treatment, the depth of tissues surrounding tooth decreases, with a level of 0.14mm after 1 week and 0.29mm after 4 weeks. In male, the decrease in depth of tissues surrounding tooth after treatment is the most considerable. There is a statistically significant difference in the decrease in depth of tissues surrounding tooth after 1 week of treatment and after 4 weeks of treatment between male and female ($p < 0.05$)

Table 3.8. Decrease level of dental plaque after 1 week and 4 weeks of treatment (n=141)

Gender \ Time	Decrease after 1 week	Decrease after 4 weeks	p(t-test)
Male	0.21±.22	0.17±0.19	0.3751
Female	0.17±0.04	0.17±0.19	0.8901
Both	0.19±0.15	0.17±0.19	0.5069

There is no statistically significant difference in the decrease of dental plaque at 1 week and 4 weeks after treatment between female and male ($p < 0.05$)

Table 3.9. Decrease in depth of tissues surrounding tooth after treatment, by age group (n=141)

Gender \ Time	Before treatment (1)	After 1 week (2)	After 4 weeks (3)	P ₁₋₂	P ₁₋₃
≤34 years old	2.82±0.11	2.69±0.11	2.52±0.22	0.0000	0.0000
35 → 49 years old	3.08±0.13	2.95±0.14	2.83±0.17	0.0000	0.0000
≥ 50 years old	3.36±0.22	3.20±0.35	3.04±0.35	0.0000	0.0000

t-test

There is statistically significant difference in decrease in depth of tissues surrounding tooth after 1 week and 4 weeks of treatment between female and male ($p < 0.05$)

Table 3.10. The decrease level of dental plaque after 1 week and weeks of treatment by age group (n=141)

Gender \ Time	Decrease after 1 week	Decrease after 4 weeks	p(t-test)
≤34 years old	0.18±.04	0.20±0.21	0.5989
35 → 49 years old	0.18±.04	0.15±0.16	0.2554
≥ 50 years old	0.21±.26	0.18±0.21	0.5746

There is no statistically significant difference in decrease level of dental plaque after 1 week and 4 weeks of treatment, by age group ($p < 0.05$)

4. DISCUSSION

4.1. Variation of gum indicator after treatment:

Proportion of patients with good gum indicator: before treatment, this proportion was 0 but after 1 week was 62.4% and after 4 weeks, 57.4%; proportion of patients with poor gum indicator was 71.3% before treatment, reducing to 5.9% after 1 week of treatment and 8.9% after 4 weeks of treatment.

Therefore, the improvement in gum indicator post-treatment is very positive compared with before treatment, proportion of patients with good gum indicator after 1 week. This result with decrease with time.

However there is no statistically significant difference between gum indicator at 1 week and 4 weeks ($p > 0.05$). We think because some patients who do not have good treatment results do not come for re-examination after 4 weeks or because they do not follow proper dental hygiene after their gum conditions have been partly improved.

4.2. The variation of dental hygiene indicator after treatment

Similar to gum indicator, the improvement of OHI-S indicator after 4 weeks compared with after 1 week: the proportion of patients with good OHS –I indicator reduces, and proportion with average indicator increases: after 1 week it reached 71.3% but after 4 weeks it was 66.3%. Average OHI-S: after 1 week it was 18.8% and 25.7% after 4 weeks. Poor OHI-S: after 1 week this was 9.9% and 7.9% after 4 weeks.

Therefore, the efficiency of dental hygiene treatment at 4 weeks start to decrease compared with that of 1 week.

However, the difference is not statistically significant at reliability 95% ($p > 0.05$). Our results are similar to research of Le Thi Hang [6].

4.3. Decrease in the depth of tissues surrounding tooth after treatment

On average tissues surrounding tooth has an increase in depth of 0.14mm after 1 week and 0.29mm after 4 weeks. Therefore, average depth of tissues surrounding tooth after treatment decreased considerably compared with before treatment. However, different age groups have different level of decrease. Older people with deeper tissues surrounding tooth will have lower decrease in depth of tissues surrounding tooth.

4.4. The level of dental plaque loss after treatment

The loss in dental plaque on average after 1 week is 0.19 ± 0.15 mm, and 0.17 ± 0.19 mm after 4 weeks. There is no statistically significant difference.

The loss of dental plaque at 1 week and 2 weeks compared with before treatment has no statistically significant difference with $p > 0.05$.

5. CONCLUSION

Conservation treatment of periodontitis combined with semiconductor laser energy and instruction of proper dental hygiene is obviously effective in improving tooth indicators such as decreasing the depth of tissues surrounding tooth, improving gum indicator and dental hygiene indicator at post-treatment compared with before treatment:

- Decrease in the depth of tissues surrounding tooth after treatment: after 1 week: 0.14mm and after 4 weeks 0.29mm.

- Gum indicator improvement: after treatment efficiency: good 59.9%, average 32.7% and poor 7.4%.

- Dental hygiene indicator improvement: after treatment efficiency: good 68.8%, average 22.3% and poor 8.9%.

- First results of treatment show that the loss level of dental plaque after treatment has decreased compared with before treatment, after 1 week was 0.19 ± 0.15 and after 4 weeks was 0.17 ± 0.19 .

6. REFERENCES

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