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### Evaluating the Use of Diode Laser for the Treatment of Recurrent Aphthous Stomatitis (RAS)

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#### Abstract

**Objectives:** to assess the efficiency of diode laser in the treatment of recurrent aphthous stomatitis – RAS. **Method:** conduct control clinical trials on 2 groups: group A (not use laser) and group B (use laser). **Results:** \**Post-treatment pain:* In group A, 34 patients (92%) suffered from pain on the first day after treatment, 30 patients (81%) suffered from pain on the 2<sup>nd</sup> day; on the third day, 24 patients still felt painful (65%); on the fourth day 8 patients still felt painful (22%); on the fifth day, there was still 1 patient who suffered from pain (2.7%) and from the 6<sup>th</sup> day onwards, no more patients had to suffer from pain. There is no difference of statistical significance in the ratio % between male and female patients who suffered from pain after treatment ( $p > 0.05$ ). In Group B, 29 patients (78.4%) felt painful on the first day after treatment, in addition 17 patients (46%) suffered from pain on the second day, from the third day, 5 patients still suffered from pain (13.5%), and from the fourth day, no patients claimed to feel painful. \**Level of pain:* observations from the two research groups have shown that when used in treatment, diode laser has led to obvious pain relief, specifically, in group B, only 29 patients suffered from pain at level 1 and 8 patients suffered from mild pain at level 2 and no patients had pain at level 3. In group A, 1 patient suffered from pain at level 1 and 36 patients were reported to suffer from pain at level 2 or level 3. \**Healing:* in group A, 28 ulcers were healed on the fifth day, accounting for 27.5%; on the sixth day, 31 ulcers were healed, equivalent to 83.8%; on the seventh day, there were 35 ulcers which were healed, equivalent to 95.6%. In group B: 18.9% of ulcers were healed after the fourth day; on the fifth day, that number was 34 ulcers (91.9%); on the sixth day, all ulcers were healed. \**Patients' satisfaction level:* we recorded that up to 94.6 % of patients were very satisfied of the treatment result, only 02 patients were not satisfied with the new treatment method (8.3%) and no dissatisfaction was recorded.

**Conclusion:** from the above results, we can see that among patients who received RAS treatment using diode laser, there was a high rate of satisfaction and there was an obvious improvement in pain level and healing process with no functional complication ( $p < 0.05$ ), patients can functionally normally immediately after treatment.

**Keywords:** diode laser, recurrent aphthous stomatitis.

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## 1. Introduction

Recurrent aphthous stomatitis (RAS) is the ulcer condition with unknown causes; some researchers suggest that main causes are physical trauma, bacteria or virus infection, fungus or allergy to medicine. Clinical symptoms are swelling, hot feeling, redness, ulcers which cause discomfort for daily routines. This disease is usually found in patients 10-40 years old and more frequently seen in female than male. The disease can develop in 7-10 days and can heal by itself; however, big ulcers usually last longer and recur, which cause pain and affect patients' daily lives ([Apthuos Ulcer, 2010](#)).

Laser energy was first used in 1960s in ophthalmology. In 1980, non-intrusive laser or soft laser was applied in medical field. The advantages of laser over traditional techniques have been recorded in medical literature, including: antiseptic, hemostatic, injury-healing promotion. For injury healing process, studies show that laser energy speeds up healing process through promoting epithelial proliferation process, differentiating fibroblasts, increasing protein synthesis, reducing inflammatory process, increasing extracellular matrix products and organization of collagen bundles ([Papazolou et al., 2006](#)).

Thanks to these supreme features, in Vietnam, laser is also widely applied in many medical fields to cure many different kinds of diseases. However, there have not been any researches conducted to assess the efficiency of laser energy in the treatment of RAS. Therefore, we would like to conduct this study to assess the efficiency of diode laser in the treatment of RAS.

## 2. Research objects and methodology:

### 2.1. Research objects:

Choose convenience sample including 37 patients who were diagnosed with RAS, and having at least 2 ulcers with similar size.

### 2.2. Study site:

Department of Odonto-Stomatology, Binh Duong Medical College and clinics of Odonto-Stomatology in Binh Duong and Ha Noi, Vietnam.

### 2.3. Study period:

From February 2015 to November 2015

### 2.4. Selection criteria:

- Be co-operative in the study.
- Being diagnosed with RAS.
- Have at least 2 ulcers with diameter  $\leq 3$ mm.
- Not having systemic diseases: heart disease, high blood pressure, diabetes, allergy, blood diseases and etc.
- Not having mental diseases.

### 2.5. Elimination criteria:

- not meeting above selection criteria
- Research equipment: Diode Laser Picaso Lite capacity 2.0W ([Dr. Glenn A. van As](#)).
- Intraoral examination tools.
- Survey questionnaires.

### 2.6. Methodology

Research design: longitudinal study, controlled clinical trials.

### 2.7. Description of research method

Patients who meet all selection criteria were given explanation and information about the purpose of the study, regulations. Patients must agree to participate in the study and signed their names in consent forms. Patients were given general health examination and regular medical tests.

Patients with ulcers were divided into two equal groups:

- + Group A: receive instructions to rinse their mouths with Hydrogen peroxide 1 % and have Vitamin group B supplements (B12, B6), apply topical cream with Orabase.
- + Group B: same treatment as group A combined with phototherapy with diode laser energy provided by Diode laser 2.0W equipment, the type with intermittent rays and increasing capacity from 0.7-0.9 watt. Laser is shined 3 times on each ulcer, each time 60 seconds with an interval of 30 seconds between each time. This procedure is repeated for 3 days.

After treatment: Each patient was given an assessment sheet and was required to supply all information regarding pain level, diameter of ulcers, and satisfaction level within 07 days after treatment. Patients were observed to measure the level of pain, diameters of ulcers and healing time within 07 days after treatment.

To ensure all information collected was accurate and sufficient, patients were provided with a phone number to call whenever they have inquiries and they would also be given a reminder phone call within 07 days after treatment. After 07 days, treatment journal would be collected.

**2.8. Assessment of results**

*Assessment criteria:* All research objects must supply sufficient information on the provided treatment journal to be included in the research sample.

*Data to be assessed:*

- Gender
- Feeling of pain: information about pain, the highest level of pain was assessed with a 6-point Likert scale from “not painful” to “unimaginably painful” (Likert, 1932).
- Pain relief day is when patients reported “a little painful or not at all painful” (corresponding to grade 0-not painful or grade 1-a bit uncomfortable on Likert scale).
- Satisfaction level: to be assessed through a three-level scale (Very satisfied – Satisfied – Not satisfied)
- Healing time: (calculated from the moment when there were no ulcers seen on mucosa)

**2.9. Data processing and analysis**

Collected information and data were analyzed and processed by SPSS version 19.0 and other medical statistic methods.

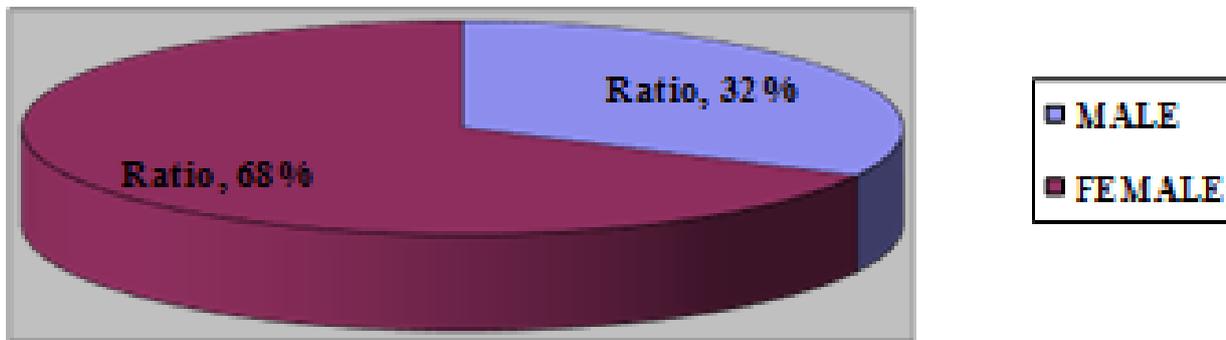
**2.10. Research ethics:**

- The study was conducted on patients who agreed to participate in the study under no pressure.
- Patients may exit the study at any time during the study time.
- All information regarding the research methodology must be read and explained clearly to patients.

**3. Results and discussion**

There was a total number of 37 patients (12 male, 25 female) who met all criteria to participate in the study.

**3.1. Male and female proportion:**



**Fig. 1.** Male and female proportion

### 3.2 Post-treatment pain:

**Table 1.** Percentage of patients who suffered from pain from aphthous stomatitis after treatment (day x after treatment) in group A

<b>Time</b> <b>Gender</b>	<b>Day 1</b>	<b>Day 2</b>	<b>Day 3</b>	<b>Day 4</b>	<b>Day 5</b>	<b>Day 6</b>	<b>Day 7</b>
<b>Male (n=12)</b>	11 (92%)	9 (75%)	7 (58%)	3 (25%)	0 (0%)	0 (0%)	0 (0%)
<b>Female (n=25)</b>	23 (92%)	21 (84%)	17 (68%)	5 (20%)	1 (4%)	0 (0%)	0 (0%)
<b>Total (n=37)</b>	34 (92%)	30 (81%)	24 (65%)	8 (22%)	1 (2.7%)	0 (0%)	0 (0%)

Regarding post-treatment pain in group A, we discovered that 34 patients (92 %) suffered from pain on the first day after treatment; 30 patients (81 %) suffered from pain on the second day, and that figure on the third day was 24 patients (65 %), the figure for the fourth day was 8 patients (22 %) and for the fifth day was 1 patient (2.7 %) and from the 6<sup>th</sup> day there were no patients who suffered from pain (Table 1).

**Table 2.** Percentage of patients who suffered from pain from aphthous stomatitis after treatment (day x after treatment) in group B with the supplement of diode laser

<b>Time</b> <b>Gender</b>	<b>Day 1</b>	<b>Day 2</b>	<b>Day 3</b>	<b>Day 4</b>	<b>Day 5</b>	<b>Day 6</b>	<b>Day 7</b>
<b>Male (n=12)</b>	8 (66.7%)	3 (25%)	1(8.3%)	0 (25%)	0 (0%)	0 (0%)	0 (0%)
<b>Female (n=25)</b>	21 (84%)	14 (56%)	4 (16%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<b>Total (n=37)</b>	29 (78.4%)	17 (46%)	5 (13.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Regarding post-treatment pain in group B, we discovered that 29 patients (78.4 %) suffered from pain on the first day after treatment; 17 patients (46 %) suffered from pain on the second day, and that figure on the third day was 5 patients (13.5 %), and from the 4<sup>th</sup> day there were no patients who suffered from pain.

### 3.3. Level of pain after treatment:

**Table 3.** Percentage of patients by pain level after treatment (pain level classified by Likert scale) in group A

<b>Level</b> <b>Gender</b>	<b>Level 0</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>	<b>Level 5</b>	<b>Level 6</b>
<b>Male (n=12)</b>	0 (0%)	0 (0%)	9 (75%)	3 (25%)	0 (0%)	0 (0%)	0 (0%)
<b>Female (n=25)</b>	0 (0%)	1 (4%)	19 (76%)	5 (20%)	0 (0%)	0 (0%)	0 (0%)
<b>Total (n=37)</b>	0 (0%)	1 (2.7%)	28 (75.6%)	8 (21.7%)	0 (0%)	0 (0%)	0 (0%)

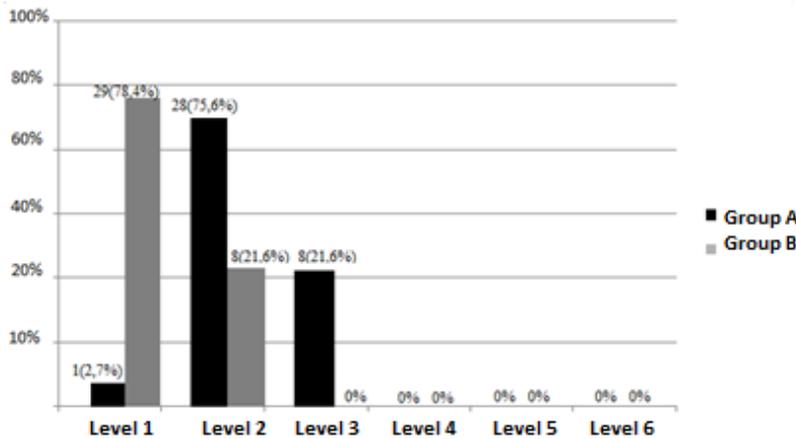
Results show that there are two patients (2.7 %) with pain level 1 (very mild pain), 28 patients with pain level 2 (mild pain), equivalent to 75.6 %, and 8 patients at pain level 3 (moderate pain) (21.7 %), no patients suffered from pain level 4 to pain level 6 (unimaginably painful) (Table 3).

**Table 4.** Percentage of patients by highest pain level after treatment (pain level classified by Likert scale) in group B

Level	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
<b>Gender</b>							
<b>Male (n=12)</b>	0 (0%)	10 (83.4%)	2 (16.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<b>Female (n=25)</b>	0 (0%)	19 (76%)	6 (24%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<b>Total (n=37)</b>	0 (0%)	29 (78.4%)	8 (21.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Results show that there are 29 patients (78.4 %) with pain level 1 (very mild pain), 8 patients with pain level 2 (mild pain), equivalent to 21.6 %, and no patients suffered from pain level 3 to pain level 6 (unimaginably painful) (Table 4).

Observations from the two study groups show that the use of diode laser in treatment has led to considerable pain relief, specifically in group B, only 29 patients were reported to suffer from pain level 1 and 8 patients suffered from mild pain (level 2) and no patients suffered from pain level 3. In group A, 1 patient suffered from pain level 1 and 36 patients reported to suffer from pain level 2 to level 3. There is no statistical difference between male and female proportion ( $p > 0.05$ ).

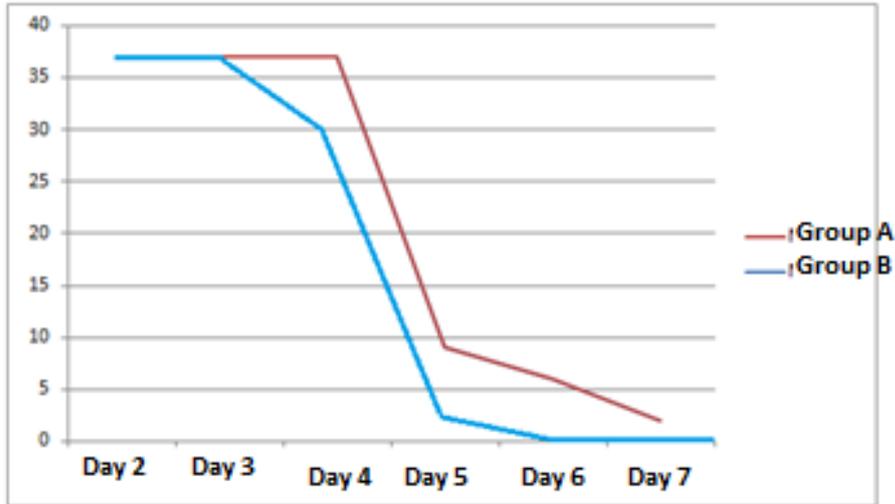


**Fig. 2.** Comparing pain levels classified by Likert scale between the two study groups

**3.4. Healing after treatment:**

**Table 4.** Distribution of proportion and number of patients who recovered after treatment

Time	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	After day 7
<b>Group</b>							
<b>Group A</b>	0 (0%)	0 (0%)	0 (0%)	28 (75.7%)	31 (83.8%)	35 (95.6%)	37 (100%)
<b>Group B</b>	0 (0%)	0 (0%)	7 (18.9%)	34 (91.9%)	37 (100%)		



**Fig. 3.** Comparing healing time between the two treatment groups

In terms of healing time, we recognize that in group A, the number of ulcers healed after the fifth day was 28, equivalent to 27.5 %; on the sixth day there was 31 ulcers, equivalent to 83.8 %, on the 7<sup>th</sup> day, there were 35 healed ulcers, equivalent to 95.6 %). In group B, which diode laser was used to support the healing process, the number of ulcers healed after the 4<sup>th</sup> day was 7, accounting for 18.9 %; on the fifth day, 34 ulcers were healed, which accounted for 91.9 %); on the sixth day, all ulcers were completely healed.



**Fig. 1.** Before treatment

**Fig. 2.** shine laser on RAS

**Fig. 3.** 4 days after treatment

**3.5. Patients' satisfaction level after treatment:**

**Table 5.** Percentage of satisfied customers after being treated with Diode laser machine

Level	Very satisfied	Satisfied	Dissatisfied	Total
<b>Gender</b>				
<b>Male</b>	11 (91.7%)	1 (8.3%)	0 (0%)	24
<b>Female</b>	24 (96%)	1 (4%)	0 (0%)	19
<b>Total</b>	35 (94.6%)	2 (5.4%)	0 (0%)	43 (100%)

Through the survey with 37 patients about their satisfaction when being treated with diode laser (Diode laser AMD Picaso Lite 2.0w), we have found that up to 94.6 % of patients were very satisfied with treatment results; 02 patients were satisfied with the new treatment method (8.3 %) and not patients were dissatisfied.

In short, using diode laser in the treatment of RAS has proved to be useful and effective and is a reliable method for soft tissue treatment. Laser energy is more effective on soft tissues than other methods. Evidence on histology has shown that injuries treated with laser energy contain very few fibroblast (Zeinoun et al., 2001). This means that injuries treated with laser will contract less and leave fewer scars. In addition, laser energy has antiseptic power on injuries during

treatment process, thus reducing requirement for injury care and antibiotics, contributing to bring comfort and satisfaction for patients. Using diode laser in treating RAS also avoid swelling and pain because heat from laser energy helps close capillaries, lymphatic system due to modification of proteins, and stimulates blood clotting factors (VII) to promote healing process (Pie-Sanchez, 2011).

#### 4. Conclusion

From the study on the 37 objects receiving treatment for RAS. In the first stage, we draw some conclusions as follows:

##### 4.1. Post-treatment pain:

In group A, we have found that 34 patients (92 %) suffered from pain on the first day after treatment, in addition 30 patients (81 %) suffered from pain on the second day; the figure for the third day was 24 patients (65 %), 8 patients on the fourth day (22 %), 1 patient on the fifth day (2.7%) and from the sixth day, there were no patients reporting pain. (Table 1)

In group B we have found 29 patients (78.4 %) who suffered from pain one day after treatment, in addition 17 patients (46 %) suffered from pain two days after treatment, and 3 days after treatment, 5 patients were still painful (13.5 %), and from the fourth day onwards no patients were reported to feel painful (Table 2).

**4.2. Pain level:** 29 patients (78.4 %) suffered from pain level 1 (mild pain), 8 patients had pain level 2 (mild pain), equivalent to 21.6 %, and no patients suffering from pain level 3 (average pain) to pain level 6 (unimaginably painful). There was no statistical difference in proportion of male and female patients ( $p > 0.05$ ). (Table 3)

**4.3. Healing time:** we have found that in group A, the number of ulcers healed after the fifth day was 28, equivalent to 27.5 %, on the sixth day 6 there was 31 ulcers healed, which accounted for 83.8 %, on the 7<sup>th</sup> day, 35 ulcers were healed, equivalent to 95.6 %. In group B, which used diode laser, the number of ulcers healed after the fourth day was 7, accounting for 18.9 %; on the fifth day, 34 ulcers were healed, equivalent to 91.9 %, on the sixth day all ulcers were healed.

**4.4. Patients' satisfaction level:** we have found that up to 94.6 % of patients were very satisfied with treatment results; 02 patients were satisfied with the new treatment method (8.3 %) and not patients were dissatisfied.

In short the treatment of RAS using diode laser has been efficient.

There was no statistical difference in the proportion of male and female patients during the study ( $p > 0.05$ ).

From above results, we can see that patients who were treated RAS with diode laser show a high satisfaction level; pain relief and healing has shown improvement and there is no functional complication ( $p < 0.05$ ), patients can have normal routine immediately after treatment.

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