



# Reduced Need of Infiltration Anesthesia Accompanied With Other Positive Outcomes in Diode Laser Application for Frenectomy in Children

Do Hoang Viet<sup>1†</sup>, Vo Truong Nhu Ngoc<sup>1†</sup>, Le Quynh Anh<sup>1</sup>, Le Hoang Son<sup>2</sup>, Dinh-Toi Chu<sup>3\*</sup>, Phung Thi Thu Ha<sup>4</sup>, Thien Chu-Dinh<sup>5\*</sup>

<sup>1</sup>School of Odonto Stomatology, Hanoi Medical University, Hanoi, Vietnam

<sup>2</sup>VNU University of Science, Vietnam National University, Hanoi, Vietnam

<sup>3</sup>Faculty of Biology, Hanoi National University of Education, Hanoi, Vietnam

<sup>4</sup>Department of dentistry, Viet Nam - CuBa Ha Noi Friendship Hospital, Hanoi, Vietnam

<sup>5</sup>Institute for Research and Development, Duy Tan University, Danang, Vietnam

## \*Correspondence to

Dinh-Toi Chu,

Email: [chudinhtoi.hnue@gmail.com](mailto:chudinhtoi.hnue@gmail.com);

Thien Chu-Dinh,

Email: [chunguyendinh.t@gmail.com](mailto:chunguyendinh.t@gmail.com)

<sup>†</sup>They are co-first authors

Published online February 25, 2019



## Abstract

**Introduction:** The abnormal maxillary labial frenum is common in children during the primary or mixed dentition stage. A conventional surgery for this abnormality usually requires infiltration anesthesia which leads to fear in children and consequent noncooperation during the surgery. The aim of present study was to evaluate the reduction in the need of infiltration anesthesia, intraoperative bleeding control and postoperative pain and wound healing in children when using the diode laser for abnormal labial frenum in the maxilla.

**Methods:** The present study was carried out among 30 children attending the Hanoi Medical University, Vietnam. A Diode Laser with 810 nm wavelength and power of 0.8 W was used for frenectomy.

**Results:** The proportion of procedures without any need of infiltration anesthesia was 70%, while 93.34% of children demonstrated positive and very positive behavior. Proportion of indolence on the first day after surgery was 83.3%. While 83.3% of children did not take any analgesics, not a single child complained of any pain 3 days after surgery.

**Conclusion:** Our results indicated that the use of diode laser showed several benefits in maxillary labial frenectomy in children. These included reducing the need of infiltration anesthesia, increasing the children's cooperation as well as decreasing the postoperative pain.

**Keywords:** Labial frenum; Diode Laser; Frenectomy.

## Introduction

A labial frenum is a fold of mucous membrane connecting the lip to the alveolar mucosa and periosteum. The frenum consists of connective tissues, elastic and collagen fibers, vascular structures, thin peripheral nerve, and a layer of epithelium.<sup>1</sup> Labial frenum has been classified by Mirko et al depending on the location of attachment as follows<sup>2-4</sup>: Mucosal (attachment at the mucogingival junction), Gingival (attachment within attached gingiva), Papillary (attachment at interdental papilla), Papilla penetrating (attachment at palatine papilla). An abnormal frenum that is closely attached to the gingival margin would be associated with loss of papilla, gingival recession, diastema, and difficulty in tooth brushing.<sup>2,5</sup> Both frenotomy and frenectomy can be used to correct the abnormal frenum. Frenotomy is the relocation of the frenal attachment, while frenectomy is the complete removal of the frenum

and frenal attachment to the underlying bone.<sup>6</sup>

Conventional frenectomy requires the use of scalpel and sutures, both of which are the source of fear and anxiety in pediatric patients.<sup>6</sup> Infiltration anesthesia is also required during a conventional surgery. Nowadays, lasers such as CO<sub>2</sub>, Nd:YAG and Diode have been more popular in minor oral surgery. Application of diode laser provides many clinical benefits, including control of bleeding, reduction in the requirement of infiltration anesthesia, and minimization of the postoperative pain and swelling.<sup>7-9</sup> Laser-assisted frenectomy can be performed without or with minimal use of infiltration anesthesia; this encourages the cooperation of children during surgery.

In Vietnam, diode laser has been used in oral surgery for 2 years, but there is no study on its effects in frenectomy of Vietnamese pediatric patients. Several studies were done on the application of diode laser in frenectomy

around the world, however with variable obtained results. Therefore, the aim of this study is to evaluate the effects of diode laser application on the requirement for local anesthesia, bleeding control, behavioral rating and degree of postoperative pain after frenectomy in children.

## Methods

The present study was carried out between September 2015 and August 2016 in the department of pediatric dentistry, School of Odonto-Stomatology, Hanoi Medical University, Vietnam.

### Patient Selection

Thirty subjects aged 7 to 14 years, who had gingival or papillary types of labial frenum attachments and required frenectomy were selected.

### Inclusion Criteria

Patients who had gingival or papillary types of labial frenum attachments causing gingival recession and/or diastema formation.

### Exclusion Criteria

Patients who had papilla penetrating type of frenum or wide and thick frenum, as they required repositioning of muscle fibers.<sup>10</sup>

### Surgical Protocol

Surgeries were performed using a diode laser of 810 nm wavelength at the power of 0.8 W, in continuous mode (Figure 1). Before the laser excision procedure, surface was anesthetized with 10% lidocaine spray. For the patients who still had pain complaint during the surgery, a small amount of local anesthetic (2% lidocaine without adrenaline) was injected to the frenum. The laser fiber tip



**Figure 1.** Picasso, AMD LASERS®, Wavelength 810 nm, Power 0.8 W.

was used in a contact mode and moved from the base to the apex of the frenum, thereby excising it. Any remaining fiber over the periosteum was removed by gently sweeping the laser tip. Sutures were not given in any cases. All the procedures were performed by a single operator who was trained in laser assisted oral surgery.

### Method of Scoring Visual Analog Scale

The patients were asked to rate the pain on a 10 cm visual analog scale (VAS). They were explained that zero (0) cm: no pain; 2 cm: mild pain which can be ignored; 4 cm: moderate pain which can be ignored when studying; 6 cm: moderate pain which can be ignored when concentrating; 8 cm: severe pain affects basic needs; 10 cm: cannot talk or do anything. VAS was recorded on the first, third and seventh day after surgery. A single operator recorded patients' behavioral rating (Frankl behavioral rating scale: 1: definitely negative, 2: negative, 3: positive, 4: definitely positive),<sup>11</sup> severity of bleeding (1: None, 2: Slight, 3: Moderate, 4: Severe), and wound healing (1: Complete epithelization, 2: Incomplete epithelization, 3: Ulcer, 4: Tissue defect or necrosis) on the seventh day, 2 weeks and 1 month after operation. The numbers of analgesic tablets used were also recorded.

### Statistical Analysis

Data was analyzed using IBM Statistical Program for Social Sciences version 16.0 (SPSS Inc, Chicago Illinois, USA). The statistical significance of data for intragroup comparison was determined by Fisher exact test.  $P < 0.05$  was considered as significant.

## Results

A total of 30 subjects were enrolled in the study including 20 males and 10 females. The average age was  $10.5 \pm 2.3$  years. There was no significant association among genders ( $P > 0.05$ ). Most patients (70%, 21 out of 30 patients) only required topical anesthesia to perform diode laser frenectomy.

There was no bleeding in 24 procedures (80%) during the surgery, 6 procedures (20%) were carried out with a grade 1 on the World Health Organization (WHO) bleeding scale. All 30 cases (100%) did not have any postoperative bleeding.

In addition, our results show 93.34% of patients with definitely positive and positive behavior and 6.66% of patients with negative and definitely negative behavior (Table 1).

Furthermore, we analyzed frequency distribution of VAS scores for postoperative pain on the first, third and seventh days after operation (Table 2). Our data indicated that 83.3% of patients had a grade 0 of postoperative pain on the first day, and all patients had a grade 0 of postoperative pain from the third day. There were 5 (16.67%) patients who needed analgesic on the first day. Moreover, on the third and the seventh day, no patient

**Table 1.** Frequency Distribution of Behavioral Rating

Gender	Behavioral Rating								P Value <sup>a</sup>
	Definitely Positive		Positive		Negative		Definitely Negative		
	No.	%	No.	%	No.	%	No.	%	
Male	10	50.00	8	40.00	1	5.00	1	5.00	0.86
Female	4	40.00	6	60.00	0	0.00	0	0.00	
Total	14	46.67	14	46.67	1	3.33	1	3.33	

<sup>a</sup>Fisher's exact test.

**Table 2.** Frequency Distribution of VAS Scores of Postoperative Pain and Wound Healing After Diode Laser Surgery

Gender	VAS Scores of Postoperative Pain					
	1st day					
	0		1		2	
	No.	%	No.	%	No.	%
Male	17	85.0	2	10.0	1	5.0
Female	8	80.0	1	10.0	1	10.0
Total	25	83.3	3	10.0	2	6.7
Mean ± SD	0.23±0.57					

  

Stage of Healing	Wound Healing After Diode Laser Surgery					
	7th day		After 2 Weeks		After 4 Weeks	
	No.	%	No.	%	No.	%
Complete epithelization	1	3.33	23	76.67	30	100
Incomplete epithelization	29	96.67	7	23.33	0	0

reported to have used any analgesic.

At seventh day visit, complete epithelialization was found in 1 case (3.33%) and After 2 weeks, there were 23 (76.67%) cases with complete epithelialization. After 4 weeks, all cases were completely reepithelialized as showed in Figure 2.

**Discussion**

Abnormal maxillary labial frenum is common in children with primary or mixed dentition. A frenectomy is indicated for abnormal frenum associated with diastema, gingival recession or difficulty in oral hygiene. Diode laser often

leads to a successful frenectomy. However in the case of papilla penetrating attachment, the Z-plasty technique has more advantages. Because papilla penetrating attachment consists of the frenal fibers extending to palatine papilla and is usually associated with short vestibule, the Z-plasty technique can accomplish both the removal of fibrous bands and lengthening of the vestibule.<sup>10</sup> Therefore, in this study, we only performed diode laser frenectomy for abnormal maxillary labial frenum with gingival attachment and papillary attachment.

In this study, 70% of procedures were performed without infiltration anesthesia. Topical anesthesia was used for almost all the diode laser procedures. This was in line with the result reported by Olivi et al<sup>12</sup> that 112 of 156 procedures (71.79%) used Er, Cr:YSGG laser to perform frenectomy without infiltration anesthesia. Ize-Iyamu et al<sup>7</sup> compared diode laser with conventional scalpel surgery in orthodontic soft tissue procedures and reported that 100% of conventional procedures needed infiltration anesthesia, while only 9.1% of laser procedures required infiltration anesthesia.

It was observed in our study that 93.34% of patients had positive and definitely positive behavior during the procedures. Children are very sensitive to pain, and sharp object such as needles and sutures. By using diode laser to perform frenectomy, operator does not have to use needle, scalpel and sutures which help to eliminate pain and mental trauma during the procedure. Previous experience of pain in dental clinic can affect the children's behavior during any clinical procedure. Performing



**Figure 2.** A Case of Abnormal Maxillary Labial Frenum Before and After Treatment Using Diode Laser.

surgery without infiltration anesthesia helps in getting positive behavior especially in children. In this study, 2 patients had negative and definitely negative behavior because they had bad previous experiences with doctors and were scared of any kind of treatment. However, after frenectomy using diode laser, they were pleased with the result as they did not have to meet the doctor again to remove stitches.

In the current report, 24 cases (80%) were performed without bleeding. Obviously, intraoperative bleeding is reduced by the coagulating effect of diode laser. Coluzzi reported that all of diode laser wavelengths were highly absorbed by pigments in soft tissues such as hemoglobin and poorly absorbed by bone structures, enamel, dentin and cementum which made it a safe hemostatic technique in oral surgery.<sup>13</sup> Controlled bleeding helped doctors perform surgery more easily. 100% of the patients in our study only used chlorhexidine 0.12% oral rinse after operation without taking antibiotics.

In the present study, 83.33% of patients did not suffer from postoperative pain. On the first day, there were only 16.67% of patients who had postoperative pain of grade 1 and grade 2 according to VAS and on the third day, all patients were free of pain. Kaur et al<sup>14</sup> reported that the mean score of pain on the first day after diode laser frenectomy was  $3.00 \pm 1.58$  which is significantly higher than our findings. Furthermore, Patel et al<sup>15</sup> also reported a high mean score of pain on the first day after diode laser frenectomy. Both mentioned studies used 1.0 W energy level of diode laser to perform procedures, but we used 0.8 W energy level. Thus, we suggest that the power setting of diode laser may affect the postoperative pain as high energy level could lead to more lateral damage to tissues. Less postoperative pain makes children comfortable with the treatment and decreases the amount of analgesic they need to take.

All the frenectomy wounds in our cases healed with secondary intention. After 2 weeks, 76.67% of the cases achieved complete reepithelialization and after 1 month, all frenums completely epithelialized. Similar results were reported by Ahad et al.<sup>16</sup> who used the Diode Laser of the same wavelength for the management of mucus extravasation cysts in different parts of oral cavity and achieved complete healing with secondary intention after 2 to 4 weeks depending on the size of open wound. However, they also used low-level laser therapy to enhance the wound healing and to reduce the postoperative pain.

Although the present study evaluated the use of diode laser for frenectomy in children and collected significant evidence, a controlled clinical trial involving conventional technique could not be performed due to ethical reasons.

## Conclusion

Within the limitations of our study, it may be concluded that Diode Laser in frenectomy for children reduces

the requirement of local anesthesia and increases the positive behavior of children during the procedures. The postoperative healing is mostly uneventful. It is also convenient for the clinicians as a bloodless field is maintained. More studies need to be done to find out the outcomes with various energy levels and wavelengths.

## Ethical Considerations

The study protocol was approved by Hanoi Medical University Ethical Committee according to the regulation No. 187/HDĐHYHN dated 20/2/2016. The study has been performed in accordance with the ethical standards of Ministry of Health in Vietnam. Written informed consent was obtained from the parents.

## Conflict of Interests

The authors declare no conflict of interest.

## Acknowledgements

We would like to thank the medical staff, patients and their families for their cooperation at the School of Odonto-Stomatology, Hanoi Medical University. We also would like to thank Ms. Pham Minh Thuong (Faculty of English Language Teacher Education, University of Languages and International Studies, Hanoi, Vietnam) for editing the manuscript.

## References

1. Henry SW, Levin MP, Tsaknis PJ. Histologic features of the superior labial frenum. *J Periodontol.* 1976; 47(1):25-28. doi:10.1902/jop.1976.47.1.25
2. Mirko P, Miroslav S, Lubor M. Significance of the labial frenum attachment in periodontal disease in man. Part II. An attempt to determine the resistance of periodontium. *J Periodontol.* 1974;45(12):895-897. doi:10.1902/jop.1974.45.12.895
3. Mirko P, Miroslav S, Lubor M. Significance of the labial frenum attachment in periodontal disease in man. Part I. Classification and epidemiology of the labial frenum attachment. *J Periodontol.* 1974; 45(12):891-894. doi:10.1902/jop.1974.45.12.891
4. Priyanka M, Sruthi R, Ramakrishnan T, Emmadi P, Ambalavanan N. An overview of frenal attachments. *J Indian Soc Periodontol.* 2013;17(1):12-15. doi:10.4103/0972-124X.107467
5. Takei H, Azzi R, Han T. Periodontal plastic and esthetic surgery. *Carranza's Clinical Periodontology.* 10th ed. St Louis, Missouri: Saunders/Elsevier; 2006: 1005-26.
6. Fiorotti R, Bertolini M, Nicola J, Nicola E. Early lingual frenectomy assisted by CO2 laser helps prevention and treatment of functional alterations caused by ankyloglossia. *Int J Orofacial Myology.* 2004;30:64-71.
7. Ize-Iyamu I, Saheeb B, Edetanlen B. Comparing the 810nm diode laser with conventional surgery in orthodontic soft tissue procedures. *Ghana Med J.* 2013;47(3):107-111.
8. Chawla K, Lamba AK, Faraz F, Tandon S, Ahad A. Diode laser for excisional biopsy of peripheral ossifying fibroma.

- Dent Res J.* 2014;11(4):525-530.
9. Butchibabu K, Koppolu P, Mishra A, Pandey R, Swapna LA, Uppada UK. Evaluation of patient perceptions after labial frenectomy procedure: A comparison of diode laser and scalpel techniques. *European J Gen Dent.* 2014;3(2):129. doi:10.4103/2278-9626.134839
  10. DeviShree SKG, Shubhashini P. Frenectomy: A review with the reports of surgical techniques. *Journal of clinical and diagnostic research. JCDR.* 2012;6(9):1587. doi:10.7860/JCDR/2012/4089.2572
  11. Clinical Affairs Committee-Behavior Management Subcommittee, American Academy of Pediatric Dentistry. Guideline on behavior guidance for the pediatric dental patient. *Pediatr Dent.* 2015;37(5):57-70.26531077
  12. Olivi G, Chaumanet G, Genovese MD, Beneduce C, Andreana S. Er, Cr: YSGG laser labial frenectomy: a clinical retrospective evaluation of 156 consecutive cases. *Gen Dent.* 2010;58(3):e126-33.
  13. Coluzzi DJ. Fundamentals of dental lasers: science and instruments. *Dent Clin North Am.* 2004;48(4): 751-70. doi:10.1016/j.cden.2004.05.003
  14. Kaur P, Dev Y, Kaushal S, Bhatia A, Vaid R, Sharma R. Management of the upper labial frenum: A comparison of conventional surgical and lasers on the basis of visual analogue scale on patients perception. *J Periodontal Med Clin Pract.* 2014;1:38-46.
  15. Patel R, Varma S, Suragimath G, Abbayya K, Zope S, Kale V. Comparison of labial frenectomy procedure with conventional surgical technique and diode laser. *J Dent Lasers.* 2015;9(2):94. doi:10.4103/0976-2868.170565
  16. Ahad A, Tandon S, Lamba AK, Faraz F, Anand P, Aleem A. Diode laser assisted excision and low level laser therapy in the management of mucus extravasation cysts: a case series. *J Lasers Med Sci.* 2017;8(3):155-159. doi:10.15171/jlms.2017.28.