


CASE REPORT

Diode laser chairside frenectomy in orthodontics: A case series (DIODE LASER FRENECTOMY: CASE SERIES)

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Abstract

Offering the whole orthodontic and surgical treatment to the patient as a single package in a one office can save them considerable time and the trouble. Diode laser enables orthodontists to do so while enjoying its benefits over the scalpel.

KEY WORDS

diastema, diode laser, frenectomy, orthodontic, relapse

1 | INTRODUCTION

Frenectomy is the procedure of obliterating the frenum and its attachment onto the underlying bone. Using laser for frenectomy is an effective way to reduce pain and bleeding and achieve better healing. We performed diode laser frenectomy on 10 orthodontic patients and evaluated their perception of comfort during the surgery and postoperative pain, as well as the use of analgesics or antibiotics. Patients reported minimal discomfort or pain right after the surgery and on the follow-up sessions. None of the patients needed to take any analgesics or antibiotics. Diode laser frenectomy is a safe and effective approach for treating high-attached frenum, providing a bloodless intra-operative field, eliminating the need to use sutures, and minimizing patient discomfort during and after the surgery.

The frenum is a mucous membrane fold including muscle and connective tissue fibers that connect the lips and the cheeks to the alveolar mucosa, the gingiva, and the underlying periosteum.¹⁻³ Excessive frenum attachment can

result in many problems, such as inadequate dental plaque removal, poor oral hygiene, and sulcus replacement due to the tension on the frenum. Therefore, surgical removal of the frenum is necessary among cases with diastema (to prevent relapse),⁴ gingival recession, difficulties in oral hygiene, interference in labial movements, and prosthetic or orthodontic needs.⁵⁻⁸

The frenectomy is the procedure of removing the frenum altogether, including its attachment to the underlying maxillary or mandibular bone.⁶ The frenectomy procedure can be accomplished with a scalpel (the conventional technique), an electrical scalpel (electro-surgery), or using a laser (laser surgery).⁹ Laser treatment can be used as an efficient alternative technique to conventional methods.¹ Some of its advantages over conventional techniques include accurate and selective interaction with the injured tissue, minimized damage to adjacent tissues, reduced scarring and contraction,^{2,10} and perfect hemostasis. In addition to a considerable decrease in the need for suturing,¹¹ this method reduces the stress level of patients.¹²

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Among the studies comparing laser surgery and conventional techniques, some indicated more postoperative comfort, no or minimal pain, and better chewing and speaking in the patients undergoing laser frenectomy.^{1,13,14} For instance, Yadav et al.,¹⁵ in a study conducted in India, showed that this method had more benefits, such as less bleeding and requiring less amount of analgesics, though they found similar outcomes for the other method. According to De Santis et al.,¹⁶ other benefits of laser surgery can be providing a clear operative field, lack of need for sutures, less time consuming, lack of postsurgical infection, no need for antibiotics, and faster recovery and healing process. Nammour¹⁷ suggests that the laser surgery method be replaced by the conventional method for orthodontic purposes.

Several studies have highlighted the importance of frenectomy of excessive frenum and the orthodontic process. It has been shown that labial frenectomy is necessary in orthodontic cases to prevent maxillary midline diastema relapse.^{18–20} Moreover, a study that examined the effect of CO₂ laser on the frenectomy and reopening of the diastema suggested that other researchers investigate the effect of other types of lasers on the success of frenectomy through case report studies.¹⁸

Due to the importance of frenectomy in the orthodontic process and the confirmed superiority of laser frenectomy, this study aimed at taking a closer look at laser frenectomy as well as orthodontic process and outcomes among several patients in a case series study, evaluating patients' comfort and pain during and after the surgery.

2 | METHODS

2.1 | Materials

A 0.022" MBT pre-adjusted bracket system (3M Unitek) was used for fixed orthodontic treatment in both arches. Soft tissue surgery was performed by a diode laser device (Doctor Smile) with a 600 μ tip diameter, 980 nm wavelength, and power of 1.3–1.5 watts.

2.2 | Subjects

Ten two-jaw fixed orthodontic patients, eight females and two males ranging in age from 13 to 24 years (mean age of 16.8), were admitted to a private practice in Sari, Iran. They had spacing in the upper arch resulted from high-attached labial frenum and mild to moderate crowding in the lower arch; both were evaluated in this study (Figure 1A). Demographic and clinical data, including the patients' age, sex, clinical presentation, and past dental and medical history, were recorded. To assess the orthodontic treatment need, the researchers used the Index of Orthodontic Treatment Need

(IOTN; Table 1). Inclusion criteria were (a) IOTN grade 2 or higher, (b) midline diastema >3 mm, and (c) high-attached labial frenum indicating surgical removal. Exclusion criteria contained patients with: (a) any systemic disorders, (b) conditions contraindicating local anesthetic administration and surgery, (c) skeletal malocclusion. The study was carried out following relevant institutional, national, and international guidelines, and the protocol was approved by the Ethics Committee of Mazandaran University of Medical Sciences (Sari, Mazandaran, Iran). All the patients gave written informed consent both for participating in the study and the publication of the data.

2.3 | Treatment

All cases received equal treatments, consisting of an orthodontic phase and a surgical phase. The details of the procedures were explained to the patients verbally before the treatment.

2.3.1 | Orthodontic phase

The orthodontic treatment consisted of alignment and leveling, space closure, and detailing and finishing during an average of 18 months. Laser frenectomy was done after the accomplishment of the detailing stage and before the debonding session. Maxillary and mandibular fixed retainers with twisted 0.0175" wire (American Orthodontics) were placed using orthodontic adhesive (Transbond XT, 3M Unitek) immediately after the debonding to prevent relapse. Additionally, vacuum-formed (Essix) maxillary retainers were given to the patients.

2.3.2 | Surgical phase

As the local anesthetic, half a cartridge of lidocaine 2% (epinephrine 1:80,000) was infiltrated in the base of the frenum and partly in the vestibule for each patient. Fifteen minutes after the injection and the patient's confirmation of complete lack of sensation to a pinprick, frenum removal surgery was performed. First, the laser tip was initiated with a power of 0.5 W using dark blue articulating paper. Then, the laser was brought to the power of 1.3–1.5 W (Figure 1F). To allow optimal access, the patient's upper lip was retracted upwards by an assistant using a retractor. Diode laser fiber tip was then used to remove the frenum tissue through a gentle touching motion from the base to the top without applying any pressure. The movement was done so that all fibrous adhesions and hyperactive and hypertrophic tissues were completely removed. No

FIGURE 1 (A) High-attached frenum at the end of the orthodontic treatment and before the surgery. (B) Immediately after diode laser frenectomy. (C) Twenty-four hours, (D) Five days, and (E) Three weeks after the surgery. (F) Diode laser configurations



TABLE 1 Demographical and medical information of the patients

	Sex	Age	Index of Orthodontic Treatment Need
1	Male	17	3
2	Female	14	2
3	Female	15	3
4	Male	21	2
5	Female	13	2
6	Female	19	2
7	Female	17	3
8	Female	18	2
9	Female	13	4
10	Female	21	2

sutures were used; the wound was left open but covered with the coagulative layer for secondary healing to happen (Figure 1B).

2.4 | Post-operative instructions

The patients were trained on how to maintain oral hygiene (specifically in the site of the surgery) and instructed to rinse their mouths with normal saline to promote more desirable healing. They were warned about possible infections and complications, and were asked to visit the dentist if any symptoms manifested. No antibiotic was prescribed for the patients; they were advised to take over-the-counter analgesics if needed.

2.5 | Evaluation

All patients were initially interviewed before the beginning of the surgery about any discomfort or pain at the site of the planned surgery. A visual analog scale (VAS) with equal units from 0 to 10 (on a 20-cm line) was employed for assessing the patients' perceived pain during and after the surgery by an interview, with 0 showing no discomfort or pain and

10 indicating severe excruciating discomfort or pain.²¹ Pain assessments were done right after the surgery and on follow-up sessions (i.e., 24 h [Figure 1C], 5 days [Figure 1D], 2, 3 weeks [Figure 1E], 6 weeks, 3 months, and 6 months after the treatment); the patients' perception of comfort during the surgery was only assessed right after the surgery. Using the VAS, the patients charted their perceived postoperative pain over the time between the last visit (or the surgery) and the present one in each follow-up visit. The patients were asked if they had needed to take any medication (analgesics, antibiotics, etc.) as a result of the surgery.

3 | RESULTS

None of the patients reported any discomfort or pain in the site before the surgery. No bleeding or edema was observed in the examination right after the surgery. Patients reported minimal discomfort, swelling, or pain right after the surgery as well as on the follow-up sessions (Table 2). Moreover, no bleeding or edema was observed on any follow-up sessions. Tissue healing was optimal, and no relapse occurred during the 6-month follow-up. None of the patients took any analgesic or antibiotic in any form related to the surgery.

4 | DISCUSSION

The basis of the surgical function of laser is the photothermal interaction with tissue. That is, light is converted to heat within the tissue, changing its structure, which can be described as rather a denaturation than merely cutting.¹⁶ Consequently, this interaction can be used to achieve incision and coagulation.^{22,23} The tissue at the wound edges is coagulated by the generated heat resulting in hemostasis. The lack of need for sutures can be attributed to the coagulated layer formed over the raw area.^{24,25} Several studies have shown the advantages of different types of laser over the conventional techniques in soft tissue surgeries, pointing out less bleeding,^{12,14–16,21,26–32} less or no pain/need for analgesics,^{13–16,21,26,27,29,32–35} less

or no need for sutures,^{12,16,26,31} and better healing^{12,16,27–29} among others. However, Júnior et al.³¹ found no significant difference regarding pain between patients who underwent frenectomy by the Nd: YAG laser and those who experienced conventional surgery. On the other hand, a meta-analysis including seven studies highlights less pain and discomfort during speech and chewing on the first and the seventh days after the surgery as well as lower average surgery time in the laser surgery in comparison to the scalpel.² Performing frenectomy with no infiltrated anesthesia in a 9-year-old patient has also been reported.³⁶ Pié-Sánchez et al. compared the CO₂ laser with the Er, Cr: YSGG laser in frenectomy for 50 pediatric patients, two of whom required a single dose of analgesic. Despite not utilizing the diode laser, they have pointed out that it is suitable for soft tissue surgery regardless of its significant thermal effect on the tissue.³⁷ Two other studies have indicated that there is no difference between the groups treated with the diode laser and those treated by other techniques, one at 2.5 W (wavelength not specified)²⁷ and the other at 10 W (980 nm)²⁹ after 3 months. No significant difference has also been reported in healing after frenectomy using the Nd: YAG laser at 4 W (1064 nm) in comparison to the surgical technique.¹⁵

Diode lasers have a high hemoglobin affinity due to their wavelength (808–980 nm).^{38–40} Ize-Iyamu et al. conducted a study comparing the diode laser with a conventional technique concerning the soft tissue procedures associated with orthodontics. They employed an 810 nm diode laser,²⁶ and the laser frenectomies were performed by an orthodontist, similar to this series. It is worth noting that when the whole orthodontic and surgical treatment is offered to the patient as a single package in a single office,⁴¹ it can save their time and the trouble of being referred to another clinician for part of their treatment.

A study by Suter et al. assessed the maxillary midline diastema closure after frenectomy by CO₂ laser. They advised an interdisciplinary approach to the maxillary midline diastema. Although the results were satisfactory, they expressed the lack of case series using other frenectomy methods in the literature.¹⁸ In the present study, we have used the diode laser because its irradiation is minimally absorbed by the tooth structure close to the enamel.^{42,43} Furthermore, it increases surgical precision and accuracy, improves the operator's view of the surgical field, eliminates the need for postoperative sutures, and shortens operation time.^{25,44,45}

5 | CONCLUSION

Our case series supports the use of diode laser for safe and easy frenectomy in orthodontic patients. Diode laser is easy to use and provides excellent hemostasis, results in a bloodless intra-operative field, and eliminates the need to use sutures or

TABLE 2 Mean of visual analog scale values on each interview

	Discomfort	Pain
Immediately after the surgery	2.5	2.7
24 h after the surgery	2	2
5 days after the surgery	1.4	1.3
2 weeks after the surgery	0.8	0.6
3 weeks after the surgery	0.5	0
6 weeks after the surgery	0	0
3 months after the surgery	0	0
6 months after the surgery	0	0

take analgesics and antibiotics. It also minimizes patient discomfort during and after the surgery. Diode laser frenectomy is a safe and effective approach to treat high-attached frenum in orthodontic patients.

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CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

FS examined and diagnosed the patients and performed the surgical phase of the treatment. SD performed the orthodontic phase of the treatment. AMS and NS evaluated the patients for inclusion in the study, performed postsurgical assessments and evaluations, and prepared the manuscript. All authors discussed the cases and commented on the manuscript at all stages and gave their final approval of the version to be published in clinical case reports.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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