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Case report

Evaluation of Wound Healing and Pain Perception After Frenectomy Using 810 Nm Diode Laser in A Young Patient: A Case Report

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Abstract
To assess the pain perception, wound healing, and advantages of 810 nm diode laser in the treatment of pediatric patients with highly attached upper labial frenum. A 16-year-old female patient was referred from a pedodontist for highly attached upper labial frenum removal. During examination, the distance between the upper two central incisor gingival margins and the upper labial frenum was less than 2 mm. The patient was advised of a frenectomy, which was done on Monday, 27.11.2023, using an 810 nm diode laser in contact and in continuous wave mode with an output power of 1 W and initiated 400 µm tip diameter. The total time of the procedure was 15 min, and the time of laser application was approximately 90 s. The patient was advised to avoid hot drinks and spicy foods on the day of the procedure, and paracetamol tablets were prescribed to the patient if needed. The patient was recalled after one week, two weeks, one month, and 4 months for follow-up. Complete wound healing was within two weeks, and optimal healing was noted after three months. After 4 months of follow-up, there is no relapse with normal mucosa. As well as no pain (on the procedure day and days after), prescribed depending on the patient's own words and Wong-Backer faces pain rating scale (in which she chose the first expression in many sessions, which indicated that there is no pain), and therefore, no need for analgesics. An 810 nm diode laser is an effective tool for frenectomy, as it provides fast healing with no bleeding, no pain during or after the procedure, and without the need for dressing, antibiotics, or analgesics.
Keywords. *Highly Attached Labial Frenum, Frenectomy, Diode Laser, 810 nm, Wound Healing, Pain Perception.*

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Introduction

Frenum is a fibrous mucosal fold that connects the upper and lower lips to the alveolar mucosa and/or gingiva and underlying periosteum [1]. It contains connective tissue and muscle fibers. It can be diagnosed by pulling the lip, resulting in papillary tip movement or tissue blanching [2]. Usually, in some cases, a frenum extends to reach the gingival margin and may include the interdental papilla, resulting in a partially bony defect (V shape) [1, 2]. This extension will result in some problems like midline diastema, restriction in lip movement, and gingival recession [1, 3]. The most common sites of highly attached frenum are the upper and lower labial frenum as well as lingual frenum [1, 3] (which restrict tongue movement and, in turn, lead to speech difficulties).

There are 4 types of frenal attachment according to Placek et al., classification [2, 4]: 1) Mucoosal, where the frenal attachments extend anteriorly to the mucogingival junction. 2) Gingival, where the frenum attachments enter the attached gingiva. 3) Papillary, where the frenal attachments extend into the papilla. 4) Papillary penetrating, where the frenal attachments cross the alveolar bone and extend to the palatal papilla.

To solve the resulting problems of a highly attached frenum, a frenectomy is indicated to restore and treat such deformities [1, 5]. That can be done by a conventional surgical method to remove the interdental tissue, including its fibrous attachment to the underlying periosteum and tension reduction [1, 6]. Moreover, a laser, which is an alternative tool, can be used for frenectomy as it has many beneficial effects when compared to the conventional technique including: regarding to the local anesthesia, the procedure just with an infiltration, no bleeding or oedema during and immediately after, no need of dressings, antibiotics or analgesics related to the frenectomy [1, 6]. Many laser wavelengths that can be used for frenectomy, including diode, neodymium doped yttrium aluminum garnet (Nd: YAG), carbon dioxide (CO2), erbium doped yttrium aluminum garnet (Er: YAG), and erbium chromium doped yttrium scandium gallium garnet (Er, Cr: YSGG) lasers [6-9].

Case presentation

A 16 years old young female patient was referred from a pedodontist to remove a highly attached upper labial frenum (Figure 1). During examination, the distance between the upper two central incisor gingival margins and the upper

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labial frenum was less than 2 mm. Moreover, no gum disease nor abnormality was observed. The patient was systemically healthy, and she is not under any medication. She is advised to undergo a frenectomy.

Frenectomy and gingivoplasty to the upper two centrals (three weeks later) were done using 810 nm diode laser (SOL ® Laser from DenMat - USA) in contact and continuous wave mode with a power of 1 W and initiated 400 µm fiber tip diameter. Just 1/3 of a cartridge of lidocaine 2% (epinephrine 1:80,000) was infiltrated into the area of the procedure. The time required for this procedure was 15 minutes, and the time of tissue exposed to the laser was approximately 90 seconds. The procedure began with tissue tension by pulling the upper lip upward (where the greater the amount of tension placed on the frenum achieved by pulling the lip, the faster the frenectomy proceeds) and the incision started coronally at the top of labial frenum parallel to the gum surface and extend apically until obtaining a diamond or rhomboidal shape and releasing all related fibers (Figure 2a). To avoid the possibility of later relapse and retraction of the tissue when she doesn't follow the instructions related to the procedure, just single knot of polypropylene suture was done (Figure 2b). No dressing was required as the laser-induced coagulation, as well as antibiotics, were not prescribed. The patient was advised to avoid hot drinks and spicy foods on the day of the procedure, and rinse her mouth with 10 ml of 0.06% chlorohexidine (Paroex-Sunstar-GUM) twice daily for 15 days. Just 500 mg of paracetamol was prescribed to the patient if needed. The patient was recalled after 7 days (Figure 3a), two weeks (Figure 3b), three weeks (Figure 4), and 4 months (Figure 5) for follow-up. All safety measures were taken into consideration for the operator, nurse, and patient.

Evaluation of wound healing and pain perception after frenectomy using 810 nm diode laser in a young patient - Figures (1-5)

Figure 1. Less than 2 mm distance between the real gingival margin and the upper labial frenum

Figure 2. Immediately after frenectomy using an 810 nm diode laser. (Figure 2a - Left) There is no bleeding at the operation site, and (Figure 2b - Right) one knot of suturing was done to ensure relapse avoidance

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(Figure 3a - Left) 7 days and (Figure 3b - Right) 2 weeks after frenectomy

Figure 4. Three weeks after frenectomy and the day of gingivoplasty

Figure 5. Four months after frenectomy and gingivoplasty to the upper two centrals

Results

The patient reported no discomfort or pain in the surgical site immediately after the frenectomy and for days after. No bleeding was observed during and after the procedure, as well as at the follow-up sessions (Figures 2 & 3). Complete healing was at the third session (after two weeks) (Figure 3b), and optimal healing was noted at the fourth session (after three weeks) (Figure 4). The patient had no discomfort with eating, drinking, or speech, and she behaved normally

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during the operation day and days after it. After 4 months of follow-up, there is no relapse with normal mucosa, and the patient did not take any analgesics or antibiotics related to the frenectomy (Figure 5).

Discussion

Many deformities, like gingival recession, midline diastema between two central incisors, speech difficulty, and restricted lip movement, result from a highly attached labial frenum or tongue tie. To treat these deformities, a surgical procedure named frenectomy should be done, which aims to remove the whole frenum, including that connected to the underlying periosteum, and in sequence reduce tension [1]. This type of procedure can be done by a conventional surgical procedure using a scalpel or by a recent type of treatment, which is a laser therapy (such as a diode laser or Nd: YAG laser) [1].

In the present study, an 810 nm diode laser was used to relocate the frenum to its normal position away from the gingival margins of the upper two centrals, which was less than 2 mm [10]. During the surgical excision of the frenum, there is no bleeding as the laser induces coagulation and hemostasis by sealing the small blood vessels [11]. As well as there is no pain during the procedure and days after, and the patient did not need any type of analgesics related to this type of surgery. That's because the laser has an excellent effect on pain relief by sealing the nerve ending on the operation site [12-14]. Moreover, there is no inflammation, and the healing was within 2 weeks, due to the simultaneous sterilization property of the laser [15].

This result is confirmed by many studies related to the use of lasers in removing a highly attached upper or lower frenum, as well as a lingual frenum. Regarding the pain perception, many studies suggested that there is no pain or less than when using other techniques for frenectomies [16-18]. Regarding the bleeding during a procedure, there is no intra-operative bleeding, which allows the operator to complete the procedure without any interference, as well as no post-operative bleeding as reported by Sobouti et al. [14]. The time of operation and healing period are better and faster when compared with using a scalpel for frenectomies [14]. On the other hand, some laser wavelengths appear to provide faster healing when used in cases of highly attached frenum removal than others, as reported by Sirin Guner [18], who found that using Er, Cr: YSGG laser provides faster healing than the 940 nm diode laser.

When a conventional technique (Scalpel) is used for frenectomies, bleeding during the procedure is present and interferes with the operating field, as reported by Achom et al. [16]. Moreover, postoperative pain, which is an important issue for the operator and the patient themselves, and delayed wound healing were noticed when using a scalpel for frenectomy as suggested by Achom et al. [16], Protásio et al. [17], and Sirin Guner [18].

So, when comparing the use of a laser in the treatment of highly attached labial frenum with a conventional surgical procedure, as reported by many authors [19, 20, 21, 22], the 810 nm diode laser is the best alternative tool for frenectomy depending on its beneficial properties (Table 1).

Table 1. Comparison between the main properties of frenectomy using the 810 nm diode laser and the scalpel

Property	810 nm diode laser	Conventional surgery using a scalpel
Anesthesia	No need or just infiltration (1/3 of a cartridge)	Need anesthesia
Bleeding	No bleeding during and after the procedure	There is bleeding during the procedure
Dressing	No need because there is no bleeding	Need a dressing in some cases
Suturing	No need for suturing or just a single knot of suture at the middle in cases where they cannot follow the related instructions.	Suturing is necessary
Pain	No or less pain than the laser relief pain perception	Painful
Analgesics	No need	Must be prescribed
Antibiotics	No need, as the laser has a simultaneous sterilization property	May needed
Tissue damage	Minimally invasive	More tissue is involved during the procedure

Conclusion

An 810 nm diode laser is an effective alternative tool to remove a highly attached labial frenum, as well as it provides fast healing with no pain, no bleeding, and without the need for dressing, antibiotics, and analgesics.

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Human Ethics and Consent
Written informed consent was obtained from the patient for publication of this study and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Conflict of interest. Nil

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