Original article

LASER LABIAL FRENECTOMY IN PEDIATRIC PATIENTS

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Abstract

The paper presents the specifics of a laser-assisted labial frenectomy in a pediatric patient, with emphasis on the surgical technique, the laser parameters, patient's compliance and postoperative outcome. A 9-year-old girl was referred to the University Department of Oral Surgery for labial frenectomy for orthodontic reasons. The clinical examination and evaluation revealed the presence of an aberrant labial frenum (class IV according to Placeket *et al.*) and a 3 mm wide medial diastema. A penetrating frenum caused a significant problem in the closure of the diastema during the orthodontic treatment, and a frenectomy was indicated. A conventional frenectomy is carried out with a scalpel excision followed by placement of few stitches. Some degree of post-operative discomfort as well as the need for a return visit to remove the stitches can be anticipated. The patient was in good general health but anxious about the surgical intervention, and hence Er. YAG laser frenectomy was suggested. The surgery was performed with Er.YAG laser (Fotona Fidelis III) and a non-contact hand piece, working with long pulse mode (LP), energy (E) of 120 mJ, frequency of 15 Hz and power of 1.80 W. The surgery was fast and easy to perform. The cooperation with the patient during treatment was excellent. The bleeding was scarce and the visibility was not compromised. Sutures were not necessary. The postoperative period was uneventful, pain-free, without swelling or signs of infection. No painkillers or antibiotics were used. A fibrin coating was visible the following day. The wound healing process was completed three weeks after surgery, with minimal scar. This laser is suitable to be used in soft-tissue procedures in pediatric patients.

Keywords: labial frenum, frenectomy, laser, Er.YAG laser, pediatric patient

Introduction

The labial frenum is a fold of mucous membrane that

consists of connective tissue with elastic and collagen fibers and at times muscular fibers originating from the orbicularis oris. This fold contains vascular structures with thin peripheral nervous ramifications and is covered by stratified layered epithelium [1]. The insertion of the frenum should be at the mucogingival junction, so as not to interfere with the adhesion of the attached gingiva.

Based on its anatomical site of insertion the labial frenum was classified as mucosal, gingival, papillary, and penetrating [2,3]. A papillary, or penetrating frenum can cause a significant problem if tension from lip movement pulls the gingival margin away from the tooth, or if the tissue inhibits the closure of a diastema during orthodontic treatment. In such cases a frenectomy may be considered. The best time for a frenectomy is shortly after the beginning of the eruption of the permanent canines. Conventional frenectomy is carried out with a scalpel elliptical excision around the frenum with a muscle dissection from the periosteum, and a wound reapproximation with sutures. Some degree of postoperative discomfort as well as the need for a return visit to remove the stitches can be anticipated. Because many dental patients, in particular children would rather not suffer the pain and discomfort generally associated with conventional surgery, an alternative approach to traditional surgical procedure is warranted.

Lasers have been utilized in surgery because they are capable of executing precise surgical incisions and offer hemostatic control. The results of the laser interaction depend on the type of laser used and the targeted tissue (whether the tissue has a high collagen, hemoglobin, or water content) [4,5].

Er:YAG laser currently has the highest absorption peak in water of any commercially available, FDA-approved dental laser. The Er:YAG laser emits infrared optical energy at 2.94 microns in the mid-infrared electromagnetic spectrum. The high water content in the oral soft tissues makes Er:YAG a useful tool in oral soft surgery, while the finest low-pulse energy and high-repetition rates make this laser an extremely precise tool suitable for delicate procedures [6].

When operating in a pulsed mode with 200-400 ms pulse widths, 5-40 microns (1 micron=1,000 millimeters) of the thermal mechanical tissue ablation (tissue removal) with as little as 5 microns of residual thermal damage is the norm. These unique characteristics of the Er:YAG laser

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allow for very narrow layers of thermal mechanical tissue ablation with minimal collateral thermal consequences [7]. In this article the specifics of a laser-assisted labial frenectomy in a pediatric patient is presented, with emphasis on laser parameters, surgical technique, patient's cooperation and postoperative outcome.

A case presentation

A 9-year-old girl was referred to the University Department of Oral Surgery for upper labial frenectomy for orthodontic reason. The patient was in good health, but very anxious about the surgical intervention. The clinical examination and evaluation revealed existence of an aberrant labial maxillary frenum (class IV according to Placek *et al.*) and a 3mm wide medial diastema. The frenum was strong, wide-based and papilla penetrating (Figure 1).

Fig. 1. Upper labial frenum class IV and medial diastema

Keeping in mind our patient's sensitivity and fear of surgical treatment, we suggested Er:YAG laser surgery for frenum removal. Numbness of the surgical field was obtained with infiltrative terminal anesthesia. Small amounts (0.2-0.3ml) of scandonest 2% with epinephrine were injected bilaterally to the frenum, and on the palatal aspect. The surgery was performed with Er:YAG Fotona

Fig. 2. Laser display with actual parameters

Fidelis III laser, non-contact hand piece, long pulse mode (LP), energy (E) of 120 mJ, frequency of 15 Hz and power of 1.80 W (Figure 2).

Stretching the lip outwards distended the frenum and the laser ablation started at the lowest point of frenum insertion (Figure 3).

Fig. 3. Non-contact hand piece targeted the lowest point of the frenum attachment

As the tissue detached, further ablation alongside the frenum created a rhomboid-like wound, which extended towards the fornix vestibule. Careful inspection of the wound was followed by deeper ablation of the vertical fibers which run towards the periosteum (Figure 4 and 5).

Fig. 4. Rhomboid laser wound (lateral view)

To end with, the surgical site was coagulated with a very long pulse (VLP) used in defocused mode. The bleeding was scarce, and no sutures were placed. After surgery, the patient was advised to avoid hot and sour beverages, and to use pain killers if necessary. Usual daily oral hygiene was to be maintained, with avoidance of the treated area. Postoperative check-ups were conducted on the following day, seven and twenty-one days after surgery. The postoperative period was uneventful, pain-free, without swelling or signs of infection. No pain killers or anti-

biotics were used. A fibrin coating was visible the following day (Figure 6). The wound healing process was completed three weeks after surgery, with minimal scar (Figure 7).

Fig. 5. Rhomboid laser wound (anterior view)

Fig. 6. Surgical wound was covered with fibrin coating the following day

Fig. 7. Complete healing 21 days after surgery

Discussion

Labial frenectomies for orthodontic purposes are usually performed when hypertrophic labial frenum provokes diastema or hinders the orthodontic treatment with mobile appliances. Although the current trend seems to suggest that surgical intervention is indicated mainly for patients between the ages of 9 and 11, surgical treatment may also be recommended for younger children (aged 7-8 years) to prevent possible malpositioning of teeth during the final phase of maxilla development. While some may consider this approach to be overtreatment, it should be noted that a single laser intervention performed by experienced clinicians can reduce or minimize additional orthodontic treatment at a later age [8].

In the treatment of low and overactive labial frenulum Er: YAG laser surgery has an inherent characteristic outcome of minimal bleeding, a reduced need for anesthesia and an excellent healing process [9]. Postoperative findings showed no complications. The healing process was very fast, showing fibrin coating on the following day [10]. Venugopalan V. first described the erbium tissue ablation mechanism in 1995 [11]. If water is the dominant chromophore, the mechanical integrity of the extracellular matrix (collagen) is not targeted directly. To achieve material removal, the heated water (intracellular steam) must expand first straining and then fracturing the extracellular matrix components (collagen). Hence, because Er: YAG energy has such a high absorption peak in water, the thermal damage to the tissue is kept to a bare minimum as the thermal mechanical ablation takes place (i.e. no char). The healing capacity of the laser-irradiated tissue when looked at with this logic is profound. Neev J *et al.* [12] in a thermo-optical skin conditioning study stated that less thermally induced damage means less collagen remodeling is necessary. With less collagen damage and remodeling, faster and easier healing with minimal scarring is the norm. The main benefit of the Er: YAG frenectomy for the patient is its simplicity, speed and minimal discomfort both during and after surgery. Keeping in mind our patient's sensitivity, and after discussing other treatment options, we suggested the Er: YAG laser surgery as the most convenient one. The frenum's anatomy (strong and wide-based) required infiltrative anesthesia for painless surgery, but smaller amounts of scandonest were injected (0.2-0.3ml) in comparison to conventional frenectomy. Initially we started the frenectomy with long-pulse mode (LP) and energy of 120 mJ, and then we increased the energy to 150 mJ to speed up the treatment. The LP has cutting, coagulation and disinfection purposes. The surgery was fast and easy to perform. Because the frenum penetrated the interincisal papilla, this portion was ablated also (Figures 5 and 6). The scarce bleeding did not compromise the visibility. Sutures weren't necessary. The cooperation of the patient during treatment was excellent. Postoperative findings showed no compli-

cations. No bleeding, pain or swelling appeared. These can be due to certain reported properties of Er:YAG laser. C. Walkinski [13] reported that sealing of the blood and lymph vessels minimized the postoperative swelling, while sealing of the nerve endings reduced pain and discomfort. The healing was promoted.

There was no need of another surgery. To our great satisfaction we gained the patient's trust, because the intervention was concluded the way we predicted.

Conclusion

The Er:YAG laser-assisted frenectomy is a minimally invasive surgical procedure, easy to perform and very comfortable for the patient, during and after surgery. No pain, sutures or signs of infection were present in our patient. The postoperative recovery was uneventful with promoted healing. This is a particularly suitable laser to be used in soft-tissue procedures in pediatric patients.

Conflict of interest statement. None declared.

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