

The Versatility of 980 nm Diode Laser in Dentistry: A Case Series



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Abstract

Introduction: Laser surgery has been considered a popular alternative over conventional modalities in dentistry during the last few years. Among different types of lasers, diode lasers have gained special attention in oral soft tissue surgery.

Case Reports: Five patients were referred to a private office. After careful evaluation of medical history and oral examination, oral diagnosis and treatment plan of each patient was established as follows: (1) A 21-year-old female with ankyloglossia (tongue-tie); (2) A 65-year-old female with a poor denture fit needing vestibuloplasty and frenectomy; (3) A 10-year-old male patient with pigmented gingiva in mandible and maxilla; (4) A 14-year-old female needing exposure of maxillary right canine for bracket bonding; and (5) A 25-year-old female patient who has a gingival maxillary frenum with a nodule. The treatment plan for all the patients was laser surgery with diode laser at 980 nm, in continuous mode.

Results: All the patients experienced normal healing process with no postoperative complications. Favorable outcomes of laser surgery were observed on follow-up sessions.

Conclusion: Considering the versatility of the 980 nm diode laser in oral soft tissue surgeries and the advantages of laser surgery, this study suggests the use of 980 nm diode laser in this regard.

Keywords: diode laser; oral soft tissue; surgery; frenectomy; depigmentation; vestibuloplasties; ankyloglossia

Introduction

Over time, various laser types (neodymium-doped yttrium aluminium garnet [Nd:YAG], erbium family, carbon dioxide [CO₂], diode) with different wavelengths were developed and became available in dentistry.¹ Among the various lasers, diode lasers are the most frequently used in dentistry.² Several advantages of diode lasers are as follows: extreme compactness, affordability, ease of operation,³ simple setting-up, versatility² and small size.¹ The active medium of the diode laser is a solid state semiconductor made of aluminum, gallium and arsenide, which produces laser wavelengths in the near-infrared spectral region, between 808 and 980 nm.⁴ The diode wavelengths are highly absorbed in hemoglobin and melanin and have little absorption in dental hard tissue.⁵ This gives the diode laser the ability to act selectively, and precisely cut, coagulate, ablate or vaporize the areas around dental structure with less damage and better post-operative healing.^{1,2} In addition, applying diode lasers decreases the need of anesthesia; significantly controls hemostasis; provides a relatively bloodless surgical and postsurgical course, and generally does not require sutures.^{1,6}

Diode lasers utilize an optical flexible fiber ranging from

200 to 600 μ m to deliver the treatment beam to the target area, and the radiation emission can be continuous or pulsed.¹ Thanks to above-mentioned characteristics, diode lasers have demonstrated excellent clinical benefits. The beneficial effect of using diode laser in dentistry has been investigated in different studies.⁶⁻⁸ For instance, Romanos and Nentwig used diode lasers in a variety of oral soft tissue surgeries and observed numerous intra-operative and postoperative clinical advantages including sufficient hemostasis, precise incision margin, lack of swelling, bleeding, pain or, scar tissue formation, and good wound healing.⁹

Given the incredible characteristics of diode laser and its versatility in soft tissue treatment, we aim to report five successful cases treated by a 980 nm diode laser in different clinical situations.

Case 1

A 21-year-old female presented at dental private office and reported that she has difficulty in speech and restricted mobility of tongue. The patient's medical history was unremarkable. On oral examination, the patient was confirmed to have ankyloglossia (tongue-tie) with limit-

ed tongue movements. She was unable to touch the roof of her mouth (classic type, heart-shaped tongue) (Figure 1A-1B). Lingual frenectomy by diode laser was decided for the patient. The operation took place with infiltration of local anesthesia. Diode laser was applied with 980 nm wavelength (Wiser, Doctor Smile, Italy), a power of 1.5 W, CW mode and in contact mode. The surgery tip of the laser with 400 μ m was first initiated and then moved from the apex of the frenum to the base in order to completely separate the fibers (Figure 1C-1D). Neither surgical suture, nor wound dressing was used after surgery. Recovery was achieved by second intention and good initial healing was observed after 10 days (Figure 1E). The patient reported increase in tongue mobility and normal speech.

Case 2

A 65-year-old female patient was referred to a private office for vestibuloplasty and frenectomy. The patient's history was non-contributory. She informed of wearing full dentures for the last 18 years, but now she was not able to wear her lower denture. The oral examination revealed that on the right side of the mandible, a frenum was interfering with the fit of a denture due to the resorption of lower ridges (Figure 2A). We decided to perform a frenectomy of the lower lip along with a narrow vestibuloplasty from mandibular right lateral to mandibular right second molar. After anesthesia was found to be effective, the surgery began with diode laser. The characteristics of the diode laser are as follows: 980 nm, 1.5 W, CW, 400 μ m initiated tip. As shown in Figure 2B, the laser was moved parallelly to the bone in order to avoid unwanted side effects. No suture was done (Figure 2C). The post-operative period was uneventful. A favorable outcome of the surgery was

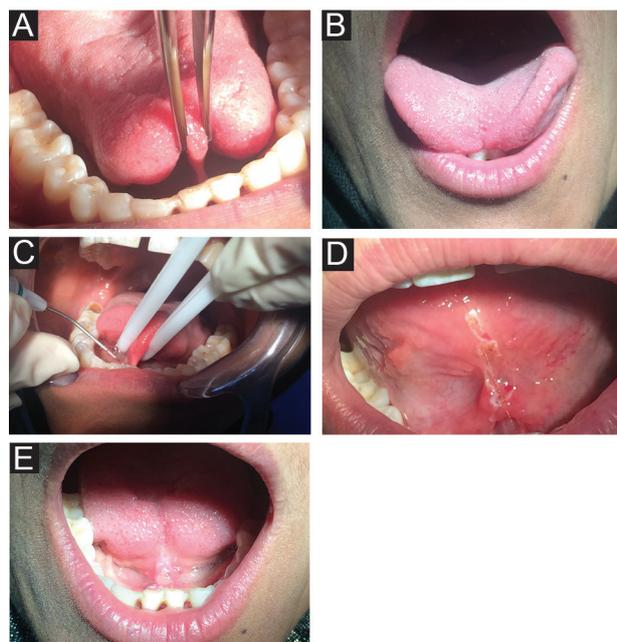


Figure 1. (A) The Frenum Before Treatment; (B) The Heart-Shaped Tongue; (C) During Surgery by 980 nm Diode Laser; (D) Immediately After Treatment; (E) Follow Up Session After 10 Days.

observed after 3 and 10 days (Figures 2D-2E).

Case 3

A 10-year-old male patient attended the office with a chief complaint of "dark gingiva." On oral examination, the patient was found to have pigmented gingiva from right canine to left canine in the mandible and maxilla (Figure 3A). In the clinical examination, the patient indicated that he had no systemic disease. The treatment plan suggested was to treat the pigmentation with diode laser in two sessions. In the first session, after patient preparation (application of local anesthetic), diode laser with wavelength of 980 nm was applied in a slowly sweeping motion in contact mode with an output power of 1.5 W in continuous mode (Figure 3B). The initiated tip with 400 μ m diameter was used. Minimal bleeding was observed during surgery. The healing is shown after 10 days in Figure 3C. The second session went in the same way as the first session but in the mandible (Figure 3D). Figure 3E shows the healing of the mandible after 10 days and an extremely satisfied patient with normal gingiva color. The patient reported a little burning sensation in the first day after surgery.

Case 4

A 14-year-old female was referred from an orthodontist to uncover impacted maxillary right canine (Figure 4A). Exposure of the tooth allows an orthodontist to attach a bracket to the tooth. After taking general and specific history, treatment with diode laser (980 nm) was proposed. The patient's history was non-contributory. Local anesthesia was applied. Then, the 400 μ m initiated tip of diode laser was used in contact mode to cut the gingiva with an output power of 1.5 W in CW mode and to expose the tooth with no bleeding. Thus the bracket could be bonded immediately after surgery (Figure 4B). In the

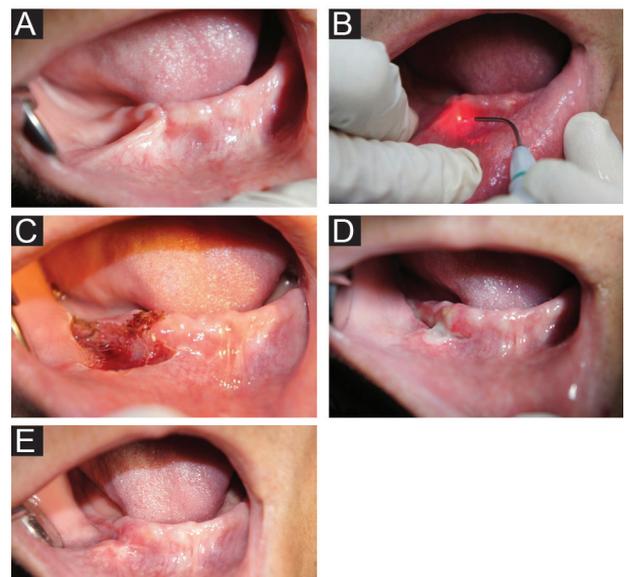


Figure 2. (A) The Surgery Site Before Treatment; (B) Surgery by 980 nm Diode Laser; (C) Immediately After Treatment; (D) Follow Up Session After 3 Days; (E) Follow Up Session After 10 Days.

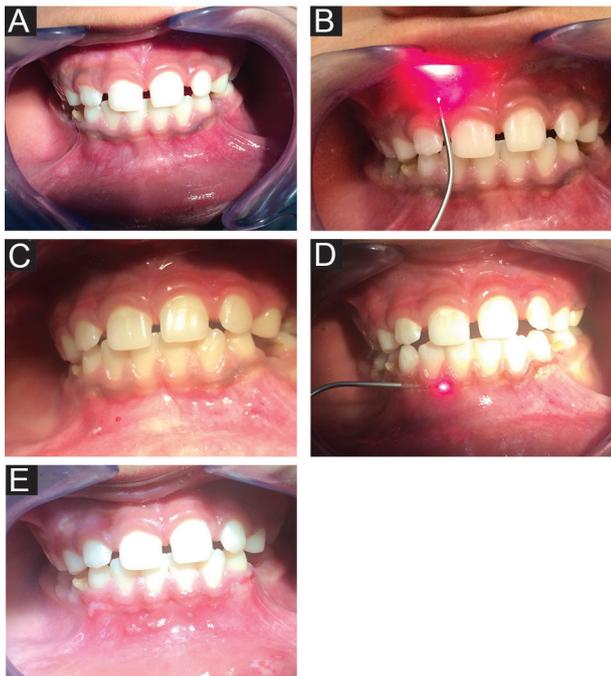


Figure 3. (A) The Pigmented Gingiva; (B) Depigmentation of Upper Jaw by 980 nm Diode Laser; (C) Healing of Upper Jaw After 10 Days; (D) Depigmentation of Lower Jaw by 980 nm Diode Laser; (E) Healing of Lower Jaw After 10 Days.

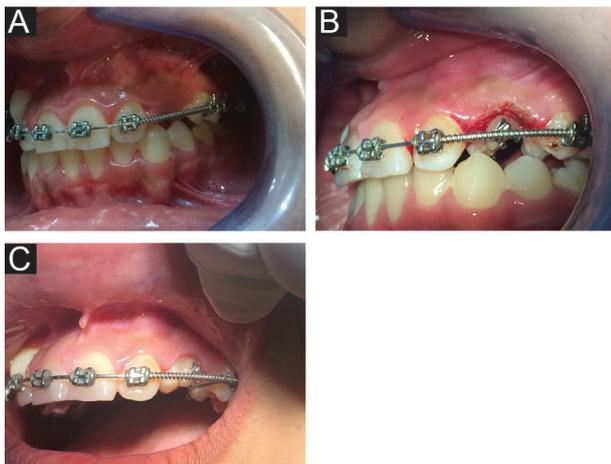


Figure 4. (A) The Impacted Maxillary Canine; (B) Immediately After Uncovering by 980 nm Diode Laser; (C) Follow Up Session After 10 Days.

follow-up visit (10 days after the surgery), the progress of tooth eruption was observed and the crown of the tooth was surrounded by healthy gingiva (Figures 4C).

Case 5

A 25-year-old female patient referred to private practice with a chief complaint of "I am dissatisfied with the appearance of my upper frenum." On oral examination, a gingival maxillary frenum with a nodule was found (Figure 5A-5B). In the clinical examination, the patient indicated that she had no systemic disease. The treatment plan was designed with a diode laser (980 nm diode laser

with a power of 1.5 W in CW mode using an initiated tip of 400 μm). The procedure started with infiltration of local anesthesia. Afterwards, the diode laser was used in contact mode and parallel to the tooth axis moving from the interdental space towards the apex direction to reposition the frenum apically (Figures 5C-5D). Owing to the hemostasis caused by the diode laser, suture was not required. Normal healing resulting in firm scar-like tissue formation occurred in 3 days (Figure 5E) and complete healing in 10 days (Figure 5F).

It is worth mentioning that analgesics (ibuprofen, three times daily for 3 days) were prescribed for all the patients in case of pain. Antibiotic was not prescribed to the patients.

In all the cases, safety glasses were provided to the patients, dentist and dental assistant to prevent possible eye damage by the laser irradiation. After explaining the procedure, an informed consent form was obtained from the patient. For a minor (anyone under the age of 18), the informed consent form was taken from their parents.

Discussion

This paper presents different soft tissue surgeries in dentistry, which were successfully performed by the 980 nm diode laser. Although these procedures could have been done with conventional surgery and the use of scalpel and suture, we preferred the diode laser surgery thanks to its advantages, which resulted in shorter operative time, faster recovery and increased patient satisfaction.^{10,11} The advantages of using laser surgery are as follows: less or

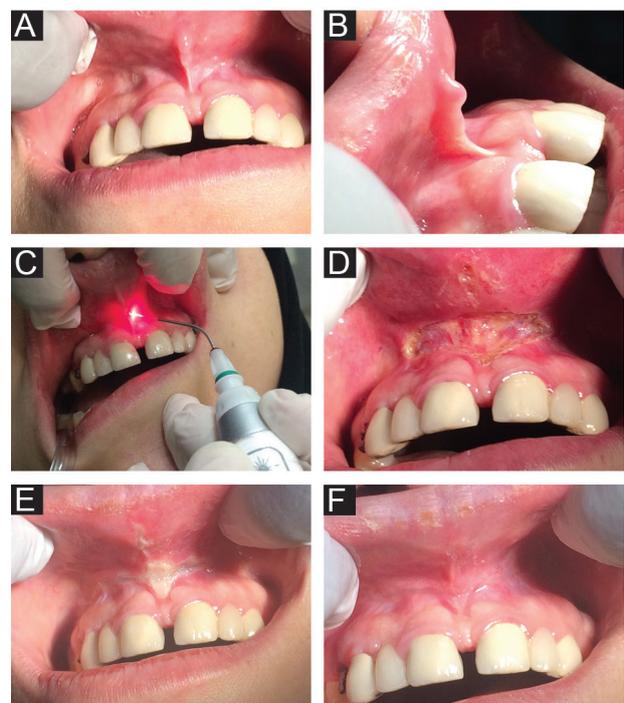


Figure 5. (A) The Labial Frenum Before Treatment; (B) The Lateral View of Frenum; (C) Surgery by 980 nm Diode Laser; (D) Immediately After Surgery; (E) Follow Up Session After 3 Days; (F) Complete Healing After 10 Days.

no post-operative pain due to the sealing of the sensory nerve endings with the heat of the laser beam¹²; more precise and visible cuts¹¹; diminished hemorrhage which provides better vision for operator²; little post-operative edema; minimal or no suturing; less anesthesia and minimal risk of infection due to the laser's capability of sterilization.¹³ In the current study, patients generally reported little discomfort during the post-operative course. Also, no signs of local infection were seen on follow-up sessions. Other studies demonstrated the clinical advantages of using diode lasers in dentistry.^{2,7-9,14,15} For example, a clinical study compared the use of diode laser with conventional surgery in the management of soft tissue mucogingival problems associated with orthodontic treatment.¹¹ The authors reported that patients treated with the diode laser required less infiltration anesthesia and had rapid post-operative hemostasis with no sutures and an improved postoperative comfort and healing. Moreover, Stubinger et al showed that the intraoperative and postoperative clinical findings of utilizing diode laser in patients needing oral soft tissue surgery were excellent due to sufficient cutting abilities, good coagulation effect and extremely small zone of thermal necrosis of surrounding tissue.¹⁶ They recommended diode laser as an alternative solution to conventional electrosurgery and scalpel.

However, choosing appropriate parameters during diode laser surgery is still one of the main concerns. In some cases choosing gated pulse mode can be beneficial to reduce the thermal effects on tissue.

Conclusion

This paper casts light on the versatility of 980 nm diode laser due to the variety of oral soft tissue procedures that can be performed successfully with the 980 nm diode laser. We suggest the use of diode laser as an alternative to conventional surgery in the field of oral soft tissue surgery.

Ethical considerations

The informed consent was obtained from patients prior to each procedure.

Conflict of Interests

The authors declare that they have no conflict of interests.

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