

Case Report

Er,Cr:YSGG laser for the treatment of ankyloglossia

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Abstract

Ankyloglossia or tongue-tie is the result of a short and tight lingual frenum causing difficulty in speech, feeding problems in infants due to the limitation of tongue movement. This report presents a case of a 22-year-old female with tongue-tie who complained of difficulty in speech following which she underwent frenectomy procedure with erbium, chromium: ytterbium-scandium-gallium-garnet laser without any complications. She was referred to the speech therapist after the procedure.

Key words: Ankyloglossia, erbium, chromium: ytterbium-scandium-gallium-garnet laser, erbium lasers, frenectomy

INTRODUCTION

“Tongue-tie” or “ankyloglossia” is commonly used to describe a condition in which the band of tissue or frenum connects the under-side of the tongue to the floor of the mouth in a manner that restricts the range of motion (ROM) of the tongue. The term free-tongue is defined as the length of the tongue from the insertion of the lingual frenum into the base of the tongue to the tip of the tongue. Clinically acceptable, normal range of free-tongue is > 16 mm. Ankyloglossia can be classified into 4 classes based on Kotlow’s assessment^[1] as follows; Class I: Mild ankyloglossia: 12–16 mm, Class II: Moderate ankyloglossia: 8–11 mm, Class III: Severe ankyloglossia: 3–7 mm, Class IV: Complete ankyloglossia: < 3 mm. Class III and IV tongue-tie category should be given special consideration because they severely restrict the tongue’s movement.^[2] The prevalence of ankyloglossia reported in the literature varies from 0.1% to 10.7%.^[3,4]

A lingual frenectomy is a surgical procedure used to remove the band of lingual tissue and release the tongue to move more freely. Important considerations are based not so much on age as on the location, degree of restriction to motion of the tongue and related functional limitations. Procedures most commonly employed to resolve the condition include a simple clipping of the frenulum done only for a

newborn, a frenectomy or a Z-plasty lengthening procedure. Tools used include scalpel, CO₂ laser, diode laser, erbium: ytterbium-aluminium-garnet laser (Er: YAG laser) and erbium, chromium:ytterbium-scandium-gallium-garnet laser (Er, Cr: YSGG laser).^[5] CO₂ lasers, He-Ne and Excimers have been evaluated for soft tissue excision and has shown some deleterious effect on tissues such as carbonization, melting and denaturation of proteins with subsequent formation of toxic substances as well as compositional changes in the irradiated tissues.^[6] Instruments such as the pulsed Nd: YAG at 1064 nm and the continuous wave or gated pulsed diode work at wave lengths that cut soft tissue, but are not effective on hard tissues. In the Nd: YAG lasers beam absorption varies with the color of the tissue exposed. These lasers are good for treatments involving pigmented soft tissue and are absorbed by hemoglobin in the blood and, therefore, are effective hemostatic devices.^[7] With the development and introduction of the Er family of lasers, the dentist has a safe and efficient laser to treat hard and soft tissue of the oral cavity. The Er laser’s shallow depth of tissue penetration, high affinity for water, lack of thermal damage, and minimal reflective property make it ideal laser for dentistry. There are two wavelengths, Er, Cr: YSGG at 2790 nm and Er: YAG at 2940 nm, that are similarly effective in treating soft tissue and hard tissue lesions.^[8,9] Hard tissue procedures are performed in noncontact using water spray on the tissue. The water spray may or may not be used for soft tissue surgery; most treatments are in both noncontact and contact with the tissue. The

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benefits of treating patients with the Er family of lasers include the bactericidal effects,^[10] which can sterilize the area, and the numbing or analgesic effect on the target tissues, similar to the Nd: YAG devices.^[11,12] Er lasers have higher water absorption coefficient, which causes rapid vaporization and microexpansions that creates high pressure on the surrounding cells.

This report aims to present a case of lingual frenectomy using Er, Cr: YSGG laser.

CASE REPORT

A 22-year-old female reported in the Out Patient Department of Periodontics, Maulana Azad Institute of Dental Sciences, New Delhi with difficulty in speech since birth. The patient was systemically healthy. On intraoral examination, she was found to have thick lingual frenum (tongue-tie) as she was able to protrude the tongue up to the lower lip and was classified as Class III according to Kotlow's assessment [Figures 1 and 2]. Malocclusion or lingual recession to mandibular incisors was absent. Informed consent was obtained from the patient.

The patient was undertaken for a frenectomy procedure by using a Er, Cr: YSGG^{*} laser (wavelength 2780 nm). Local infiltration anesthesia was applied (2% lignocaine with epinephrine 1:100,000). Protective eye glasses were used by the patient, staff, and operator. The frenum was incised using Er, Cr: YSGG laser at short pulse "H" mode with 600 µm sapphire tip at 1.5 W power, 13% air and 9% water in contact mode [Figure 3]. The intervening frenum was removed, and a diamond shaped wound was formed [Figure 4]. The muscle fibers were also released from their attachment from the interior surface of the mandible by laser tip. A laser bandage was applied with 0.5 W power with air and water switched off. No analgesics and antibiotics were prescribed. Patient was advised to avoid smoking, alcohol, and spicy food. The postoperative period was uneventful with no delayed hemorrhage. Wound healed normally and showed no scar tissue formation following which the patient was sent for speech therapy sessions. After a follow-up of 3 months, the tongue showed good healing, protrusion 16 mm beyond the lower lip [Figure 5] and normal speech. No recurrence was observed at 1-year period.

DISCUSSION

Ankyloglossia is an uncommon congenital oral anomaly, which may contribute to problems in speech, although adaptations for chewing and

*C 100 manufactured by Biolase Tech.



Figure 1: Preoperative view showing ankyloglossia



Figure 2: Preoperative extra-oral view showing extension of tongue



Figure 3: Frenectomy incision using laser

swallowing may be necessary as well. A restricted frenum may contribute to speech difficulties,^[13] especially for sounds that require tongue elevation such as: "S, z, t, d, l, r." Although, some individuals are able to use a tongue down production for these



Figure 4: Immediate postoperative diamond shaped wound with minimum bleeding

sounds, which are acoustically acceptable, many are not able to make the necessary accommodations. Saliva management may also be a problem during speech and or eating. Some individuals have difficulty when the tongue attempts to move forward in the mouth with the frenum scraping against the lower central incisors, and at times becoming pinched between these teeth. In an attempt to compensate for the lack of tongue movement, some children demonstrate an increase in lateral or forward mandibular movement.^[14] Localization of the frenum insertion on the gingiva seemed to be of importance for gingival sequelae because insertion of the lingual frenulum in the area of the papilla had the highest association with gingival recession. Individuals with ankyloglossia may also experience an increase in dental caries due to the lack of ability to sweep the maxillary and mandibular dentition to remove food particles.

Some individuals, however, benefit from surgical intervention: frenotomy, frenectomy or frenuloplasty for this condition.^[5] Patients should be educated about the possible long-term effects of tongue-tie so that they may make an informed choice regarding possible therapy.^[2] In general, the benefits of a lingual frenectomy focus on creating an increased ROM for the tongue. Surgical techniques for the therapy of tongue-ties can be classified into three procedures. Frenotomy is a simple cutting of the frenulum. Frenectomy is defined as complete excision, that is, removal of the whole frenulum. Frenuloplasty involves various methods to release the tongue-tie and correct the anatomic situation. There is no sufficient evidence in the literature concerning surgical treatment options for ankyloglossia to favor any one of the three main technique.



Figure 5: Postoperative view 3 months showing adequate extension of tongue

Frenectomies done with a scalpel often have a disadvantage of profuse bleeding, postoperative discomfort and long healing times. Lasers provide a valuable option considering these problems.

All Er lasers share a common characteristic of an affinity for the wavelengths to be highly absorbed by water, hydroxyl-apatite, and collagen. The Er: YAG wavelength at 2940 nm exactly matches the absorption peak of water; moreover, the absorption coefficient in water for the 2940 nm Er: YAG wavelength is significantly higher than of the 2780 nm Er, Cr: YSGG. The optical penetration depth of the Er lasers (Er: YAG and Er, Cr: YSGG) are only a few micrometers. For the Er: YAG laser, the actual depth of penetration is around 5 μm when using a 300 μs pulse. It is now accepted that the mechanism of action for laser ablation in enamel is basically the same for all lasers that fall within the Er family: the rapid subsurface expansion of the interstitially trapped water within the mineral substrate causes a massive volume expansion, and this expansion causes the surrounding material to be exploded away. Due to the water spray and the short pulse duration, there is a minimal amount of heat transferred to the remaining and adjacent tooth structure.^[15] A feature of all Er lasers is a popping sound when the laser is interacting with dental tissues. This popping sound, in fact, is a very quick shock wave that is created when the laser energy dissipates explosively. This popping sound is called the photoacoustic effect. This photoacoustic effect is characteristic of a short pulse duration (100–250 μs) and a high energy density. In addition the Er laser has bactericidal effect,^[16,17] the Er wavelength is absorbed by water in the bacterial cells, and the cells undergo the same liquid-to-steam vaporization that is seen during ablation of hard tissue.^[18] This destruction of bacteria is one of the additional advantages of using

lasers for soft or hard tissue dental procedures. The depth of penetration of an Er laser using a 200 to 400 μs pulse width is in the range of 5–40 μm . There is as little as 5 μm of residual thermal damage.^[19] The collateral damage produced by the Er laser is minimal because the energy is absorbed in water, and thermal damage is small (no charring), which may result in improved healing of the area. Neev *et al.* discovered that there is less collagen remodeling and in turn, faster healing with minimal scar tissue presenting after Er laser soft tissue surgeries.^[20]

CONCLUSION

To conclude, using laser for the lingual frenectomy to relieve tongue-tie is a viable option with minimum patient discomfort, faster healing and minimum scar formation.

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