Advantages of Diode Laser (940 nm) over Surgical Blade in Management of Ankyloglossia: A Case Report

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Summary: The lingual frenum has been a topic of controversy for a long time. Ankyloglossia causes problems in eating, dyspnoea, and speech disturbances. Hence, it is necessary to perform a lingual frenectomy in cases where ankyloglossia is very severe. Various methods such as surgery, diathermy, and lasers have long been used. The advantages of laser include a bloodless operating field, no postoperative infection or pain, and no suturing is needed. All these advantages are highlighted in this case report comparing the surgical technique with 940 nm diode laser for complete ankyloglossia.

Keywords: ankyloglossia, diode laser, suture, hemostasis, Wharton's duct.

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In 1950, Miller defined a frenum as "a membranous fold which joins two parts and restricts the individual movement of each."[1] Partial ankyloglossia refers to congenital shortness of the lingual frenum or a frenal attachment extending to the tip of the tongue, binding the tongue to floor of mouth and restricting its extension.[2,3] It is more common in boys than girls.[4] Ankyloglossia is diagnosed in 3.2%[5] of pediatric patients and occurs in 2 to 3 of every 10,000 adults.[4]

Ankyloglossia is usually defined on the basis of inability to extend the tip of tongue beyond the vermillion border of the lips or a line joining the lip commissures, along with speech impairment.[6] Ankyloglossia is classified on the basis of "free tongue." Free tongue is defined as the length of tongue from the insertion of the lingual frenum into the base of the tongue to the tip of the tongue.[7]

Based on the length of free tongue, 5 categories can be distinguished (Table 1).[7]

Due to restricted movements, patients exhibit speech difficulties in pronunciation of certain consonants and diphthongs.[3] Speech defects include defects in the letters t, d, n and l, in sounds and words such as ta, te, time, water, and cat, and general unintelligibility of speech.[2] Ankyloglossia has also been associated with midline diastema,[8] oral motor dysfunction,[9] and gingival recession.[10] Ankyloglossia may also contribute to the development of anterior open bite due to the inability to raise the tongue to roof of mouth, which prevents the development of a normal swallowing pattern.[4] Some authors have also claimed that some ankyloglossia cases can be associated with upward and forward displacement of the epiglottis and larynx, resulting in various degrees of dyspnoea.[11,12]

Table 1 Classification of ankyloglossia[7]

Type	Description
Clinically acceptable	Normal, greater than 16 mm
Class I	Mild ankyloglossia: 12 to 16 mm
Class II	Moderate ankyloglossia: 8 to 11 mm
Class III	Severe ankyloglossia: 3 to 7 mm
Class IV	Complete ankyloglossia: less than 3 mm

Fig 1 Case 1, surgical frenectomy. Preoperative view, Class IV lingual frenum.

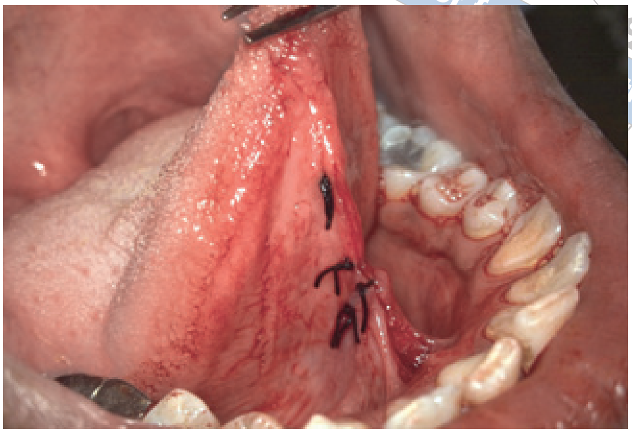

Fig 2 Case 1, surgical frenectomy. Two rows of interrupted suturing done and then frenum is excised.

Fig 3 Case 1, surgical frenectomy, postoperative view. Tongue is now freely moveable, but there is notching at the tongue's tip.

Pioneers in the field of periodontics and maxillofacial surgery have suggested many techniques to manage patients with ankyloglossia. Techniques include the use of a surgical blade,[1] bipolar diathermy,[13] and lasers.[5] Diode lasers have wavelengths ranging from 655 to 980 nm. They provide excellent wound sterilization[14] along with hemostasis and reduced postoperative pain.[5,15,16]

The present report compared surgical frenectomy[1] to diode laser-assisted frenectomy. The exclusion criteria were systemic diseases associated with wound healing problems, or disturbed wound healing such as occurs in diabetes, autoimmune diseases, and smoking. The surgical procedure was explained and informed consent was obtained. Inclusion criteria included Class IV frenum.[7]

CASE 1, SURGICAL FRENECTOMY

A 24-year-old male with difficulty in speaking and deglutition reported to the Department of Periodontics. Upon examination, ankyloglossia was detected and the patient could not protrude his lip due to frenal attachment at the tip of his tongue (Class IV frenum) (Fig 1).

After informed consent, lingual frenectomy was planned. Xylocaine with 1:200,000 adrenaline (Lignox Warren Pharma; Navi Mumbai Maharashtra, India) was used for local infiltration anesthesia. A few drops of anesthetic were deposited at the base of the tongue and into the frenum. A sling suture was passed through the tip of the tongue to facilitate tongue retraction. Three interrupted sutures using 3-0 silk were placed from the tip to the base of the frenum in a line. Two other interrupted sutures were placed just below the first line from the tip to the base of frenum (Fig 2) (Centisilk, Centennial; Thane, India). Then the frenum was severed between the two rows of sutures with a no. 15 surgical blade (Glassvan, HMD; Faridabad, India). The sling suture was removed from the tongue and protrusion of the tongue was checked to assess elimination of frenal tension (Fig 3). Analgesics and antibiotics were prescribed and sutures were removed after 1 week. Healing was uneventful.

Fig 4 Case 2, laser frenectomy, preoperative view. Lingual frenum restricting tongue protrusion and causing diastema.

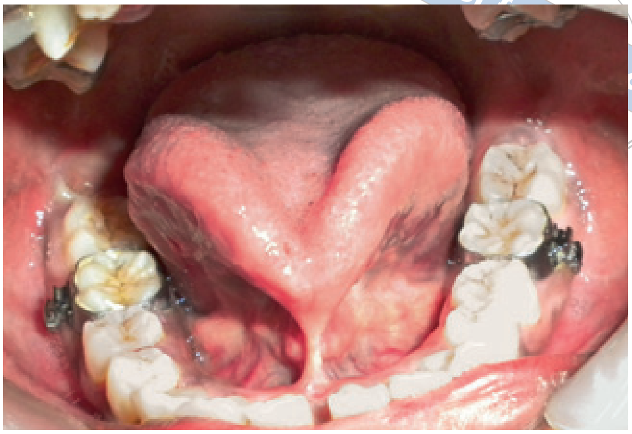

Fig 5 Case 2, laser frenectomy, preoperative view. Note the close attachment toward the alveolar ridge.

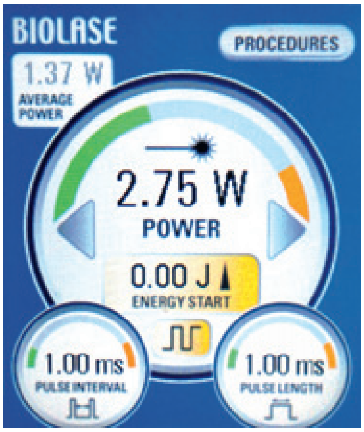

Fig 6 Laser parameters used.

Fig 7 Case 2, laser frenectomy. Immediate postoperative view.

CASE 2, LASER FRENECTOMY

A 19-year-old female was referred from the Department of Orthodontics for lingual frenectomy. Upon examination, she had speech problems, midline diastema, and an inability to protrude the tongue (Figs 4 and 5). It was diagnosed as a Class IV frenum. It was decided to excise the frenum using a diode laser (Ezlase 940 nm, Biolase; Irvine, CA, USA). A few drops of xylocaine (Lignox Warren Pharma) were injected into the frenum. The tongue was retracted with a mouth mirror. An initiated tip of 300 µm was used at a 2.75-W pulse interval, 1.0 ms and pulse length 1.0 ms, with an average power of 1.37 W in a pulsed mode (Fig 6). The tip was initiated by firing it at 1.4 W in continuous mode and allowing it to dip into the initiator device, which is a piece of cork. After initiation, the tip was carbonized. The tip was moved from the apex of frenum to the base in a brushing stroke, cutting the frenum. The attachment of the frenum to the alveolar ridge was also excised to prevent any further tension on the gingiva. High vacuum suction was used continuously to evacuate saliva and tissue plume. After excision, the area was cleaned and Vitamin E (Evion 400, Merck; Ponda Goa, India) was applied. Tongue movement was checked by protrusion to assess complete elimination of the frenum. No suturing was done; the patient was prescribed analgesics and was recalled after 1 week.

Fig 8 Case 2, laser frenectomy. One week postoperatively, tongue movements are free.

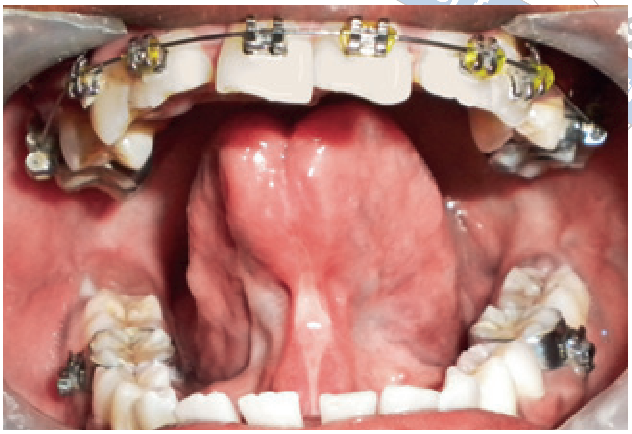

Fig 9 Case 2, laser frenectomy. Healing, 1 week postoperatively.

Fig 10 Case 2, laser frenectomy. One week postoperatively, note the cleft tip of tongue.

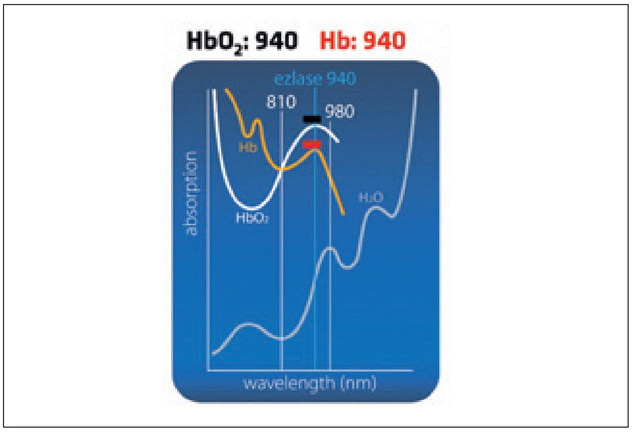

Fig 11 Schematic presentation showing absorption of 940-nm diode laser compared to other wavelengths.

DISCUSSION

Although the technique described by Hall[1] gives predictable results, it has a few drawbacks compared to laser-assisted frenectomy.

- The suturing on the ventral surface can at times lead to blockage of Wharton's duct, causing submandibular swelling.
- Surgical manipulations in the ventral tongue region may also damage the lingual nerve and result in numbness of the tongue tip.[18]
- Suturing can also cause contamination by a "wicking effect", causing secondary infection.[19] This makes it necessary to prescribe postoperative antibiotics.

In our case, we used a 940-nm diode laser because it has maximum absorption by hemoglobin and oxyhemoglobin, compared to 810 nm[20] (Fig 11). When compared to 980-nm diode lasers, the higher thermal effect of these wavelengths (< 100 µs) can very often cause necrosis.[21] The tip was initiated to facilitate formation of a small amount of carbon at the tip, referred to as the "hot tip effect". It focuses a large amount of energy at the contact point and allows accelerated tissue incision. However, then the tip must be inspected frequently to avoid it becoming a ragged branding iron due to the collection of ablated tissue.[5]

Laser-assisted lingual frenectomy is very easy to perform. The patient hardly noticed any discomfort and there was absolutely no bleeding (Fig 7). We used pulsed mode, as continuous wave mode causes a rapid rise in temperature in the target tissue. Pulsed mode provides time for the tissues to cool down and prevents the collateral tissue damage incident to excessive heat production.[5] The frenum was completely eliminated and the patient could protrude her tongue up to 10 to 12 mm (Fig 8). The excellent hemostasis and absence of postoperative swelling was attributed to increased platelet activation by lasers[22] and sealing of lymphatic vessels.[23]

Furthermore, by using near-infrared lasers on soft tissue, there is minimal or no bleeding due to a combination of sealing of small vessels through tissue protein denaturation and stimulation of factor VII production in clotting. The heat buildup also allows for the sealing of small lymphatic and blood vessels, which results in reduced postoperative bleeding and edema.[24] There was no need to suture, as there is complete hemostasis and improved wound healing (Fig 9). In addition, the laser's sterilization of the surgical wound reduces the need for postoperative care and antibiotics.[5] The patient who underwent laser frenectomy reported that she did not need analgesics beyond 24 h postoperatively. Although the lingual frenum was completely eliminated after 1 week, postoperative notching was seen at the tip of tongue, suggesting a permanent deformity of the tongue in both patients (Figs 3 and 10). Both patients were advised to undergo speech therapy for correction and improvement of their speech.

CONCLUSION

The presence of tongue clefting suggests that lingual frenum interventions should be performed at a very young age to prevent tongue deformity and speech problems. This case report clearly shows that diode laser definitely has an advantage over conventional methods of lingual frenectomy, as it prevents bleeding and swelling, and is associated with minimal or no postoperative pain. Thus, practitioners should consider integrating diode laser in soft tissue surgical procedures for the benefit and comfort of the patient.

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