DENTAL

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Diode Laser-Assisted Lingual Frenectomy in a School-Aged Child with Functional Ankyloglossia: A Case Report

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ABSTRACT

Background: Ankyloglossia is a developmental condition characterized by a restrictive lingual frenulum that may limit tongue mobility and contribute to functional difficulties in selected children. Diode laser-assisted lingual frenectomy is a minimally invasive surgical option; however, evidence regarding its comparative effectiveness and optimal parameters remains limited. This case report describes the clinical protocol and short-term outcomes of diode laser-assisted lingual frenectomy in a 7-year-old child with symptomatic ankyloglossia.

Case Presentation: A 7-year-old boy presented with restricted tongue elevation and protrusion, parent-reported oral-phase swallowing difficulties, and speech articulation concerns. Clinical examination revealed a short, thick, restrictive lingual frenulum, described as Kotlow class III. Frenectomy was performed using a 980-nm diode laser. The procedure lasted less than 4 minutes and was completed without suturing or intraoperative complications. Postoperative care included oral hygiene instructions and structured myofunctional exercises initiated 48 hours after surgery. No postoperative analgesic medication was required. At 2 weeks, the patient reported no pain, and healing was uncomplicated. At 1 month, complete mucosal re-epithelialization, improved tongue elevation and protrusion, and restored palatal contact were observed, without clinically apparent reattachment. Speech articulation also appeared improved on clinical reassessment; however, standardized speech and swallowing assessments were not performed.

Conclusion: Diode laser-assisted lingual frenectomy was feasible and associated with favorable short-term anatomical and clinically observed functional outcomes in this child. These findings represent an individual clinical observation and do not establish treatment superiority or a causal relationship between surgery and functional improvement. Further studies using standardized outcome measures and longer follow-up are needed.

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INTRODUCTION

Ankyloglossia, commonly referred to as tongue-tie, is characterized by an altered lingual frenulum that may restrict tongue movement. Its clinical significance varies considerably, and current evidence emphasizes that anatomical appearance alone should not constitute an indication for surgery. Treatment decisions should instead consider the relationship between the lingual frenulum and clinically relevant functional limitations [1,2].

Assessment of ankyloglossia remains challenging because multiple anatomical and functional classification systems are used, with limited validation and substantial heterogeneity between diagnostic approaches. A recent systematic review concluded that no single quantitative diagnostic tool can currently be recommended because of heterogeneity and low certainty of evidence [3]. Consequently, clinical assessment should integrate tongue mobility, functional limitations, and the patient's specific complaints rather than rely exclusively on an anatomical classification.

Speech articulation is one of the most frequently discussed functional concerns in older children with ankyloglossia. However, the relationship between tongue-tie and speech disorders remains controversial. A systematic review found no clear association between ankyloglossia and speech disorders and emphasized the generally low quality and small sample sizes of the available studies [4]. More recent evidence suggests that frenectomy may improve articulation in selected children, although the available studies remain limited by subjective outcome assessment and heterogeneous protocols [5].

Several surgical approaches have been described, including conventional frenotomy or frenectomy, frenuloplasty, electrosurgery, and laser-assisted procedures. Comparative evidence does not currently demonstrate clear superiority of one surgical technique over another [6]. Laser-assisted surgery has nevertheless attracted interest because of potential perioperative advantages, including improved operative-field visibility, hemostasis, reduced need for suturing, and potentially reduced postoperative discomfort. A systematic review specifically addressing laser treatment of ankyloglossia reported favorable perioperative characteristics but also emphasized the need for appropriate laser training, protective measures, and standardized protocols [7].

Functional rehabilitation is another important component of contemporary management. Evidence suggests that postoperative myofunctional therapy may enhance tongue mobility and functional adaptation, although the quality of evidence remains limited [8]. In a randomized clinical trial involving children aged 6–12 years, postoperative tongue exercises were associated with greater improvements in tongue mobility and related functional measurements than frenectomy alone [9].

The present case describes the management of a 7-year-old child with a restrictive lingual frenulum and reported swallowing and speech articulation difficulties. It provides a detailed account of the surgical technique, laser settings, postoperative rehabilitation, and short-term clinical outcomes, while acknowledging the limitations of subjective functional assessment and short follow-up.

CASE PRESENTATION

This case report was prepared in accordance with the CARE (CAseREport) guidelines [10]. Written informed consent for the surgical procedure and publication of anonymized clinical photographs was obtained from the patient's parent or legal guardian.

Patient Information

A 7-year-old male child was referred to the Department of Pediatric Dentistry for the evaluation and management of a restrictive lingual frenulum. The patient's medical and surgical histories were non-contributory, with no history of systemic disease, bleeding disorders, or prior oral surgical procedures. The main functional complaints reported by the parents were swallowing dysfunction during the oral phase and speech articulation difficulties, accompanied by visible restriction of tongue movement.

Clinical Findings

Intraoral examination revealed a short, thick, and restrictive lingual frenulum that markedly limited tongue elevation and protrusion. The anatomical appearance was clinically described as Kotlow class III (Figure 1A). At maximum mouth opening, the patient was unable to contact the incisive papilla with the tongue tip, and elevation of the tongue toward the palate was markedly restricted.

Speech assessment performed clinically before treatment revealed articulation difficulties involving the lingua-alveolar

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consonants /r/, /l/, /t/, and /d/. No standardized speech-language pathology instrument or acoustic analysis was used. The treatment decision was based on the combination of anatomical restriction and clinically relevant functional complaints rather than on the anatomical classification alone.

Therapeutic Intervention

Topical 20% benzocaine gel was applied to the lingual frenulum for approximately 2 minutes. Local anesthesia was then achieved using 0.3 mL of 2% mepivacaine with 1:100,000 epinephrine infiltrated into the anterior frenular region. The procedure was performed using a 980-nm diode laser (Doctor Smile Simpler®, Lambda S.p.A., Vicenza, Italy) equipped with a 300-µm quartz fiber. The fiber tip was initiated using dark articulating paper.

The tongue was gently elevated and stabilized with sterile gauze to expose the restrictive frenular tissue. The fiber was maintained approximately parallel to the floor of the mouth and used in light-contact mode with controlled brush-like movements. The restrictive fibers were progressively released from the anterior insertion toward the ventral surface of the tongue (Figure 1B).

The laser was operated in gated pulsed mode. The peak power was 1.5 W and the average power was 0.75 W. The 300-µm fiber was used in contact delivery, with an approximate manual movement speed of 1 mm/s. Active irradiation time was approximately 120 seconds, delivered in short intermittent passes, with a calculated total energy delivery of approximately 90 J.

These parameters were specific to this case and should not be interpreted as a standardized or universally recommended protocol. Published pediatric laser protocols remain heterogeneous, and optimal parameters depend on wavelength, fiber characteristics, tissue thickness, operative technique, and operator experience [7].

The procedure lasted less than 4 minutes. Complete release of the restrictive frenular tissue was achieved, with satisfactory intraoperative hemostasis and no need for suturing (Figure 1C). No intraoperative complication was observed.

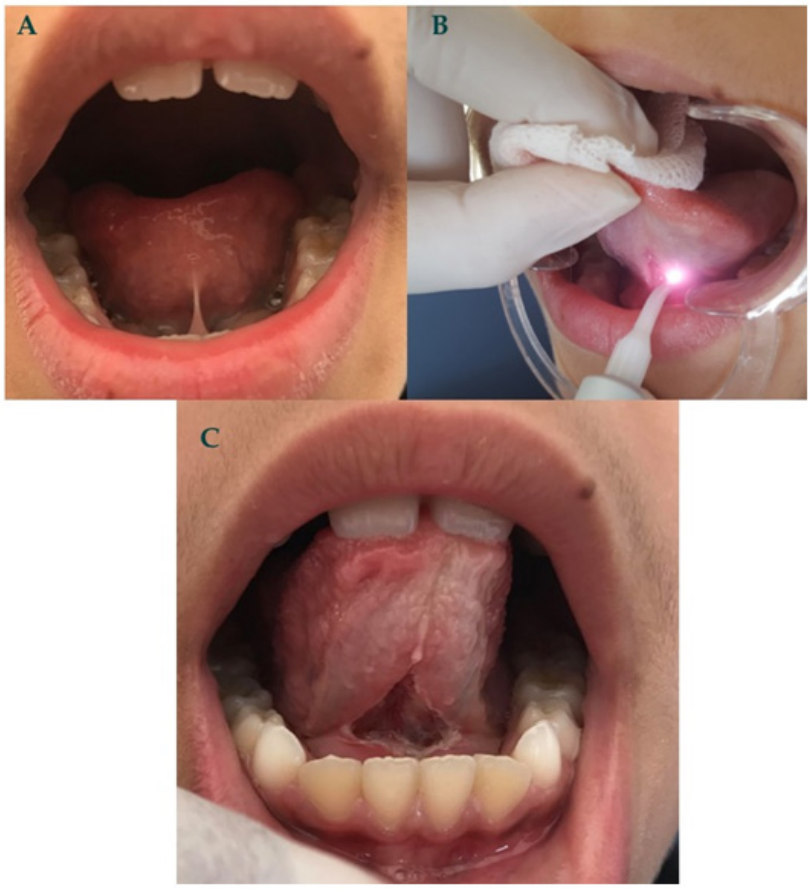

Figure 1: Clinical sequence of diode laser lingual frenectomy

A: Preoperative intraoral view showing a short and restrictive lingual frenulum. **B:** Intraoperative view during progressive release of the lingual frenulum using a 980-nm diode laser. **C:** Immediate postoperative appearance showing satisfactory release and hemostasis.

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Postoperative instructions included oral hygiene and dietary recommendations. Acetaminophen at a weight-adjusted dose of 15 mg/kg (375 mg per dose for this 25-kg child) was prescribed on an as-needed basis. No systemic antibiotics were prescribed because there were no clinical signs of infection or other indication for antimicrobial therapy.

Beginning 48 hours after surgery, the patient performed a structured program of tongue myofunctional exercises four times daily for 4 weeks. The exercises consisted of:

1. active vertical elevation of the tongue toward the hard palate;
2. lateral tongue movements along the maxillary dental arch; and
3. repeated tongue protrusion and retraction.

The rehabilitation program was intended to facilitate functional tongue mobility and adaptation following surgical release.

Follow-Up and Outcomes

At the 2-week postoperative examination, the patient reported no pain, corresponding to a visual analog scale score of 0, and had not required analgesic medication. The surgical site showed satisfactory healing, with a whitish fibrinous layer covering the wound, consistent with healing by secondary intention (Figure 2A). There were no clinical signs of infection, prolonged bleeding, or significant edema. Tongue mobility appeared improved compared with the preoperative examination.

At the 1-month follow-up, complete mucosal re-epithelialization was observed, with healthy tissue color, texture, and vascularity (Figure 2B). The fibrinous layer had resolved. There was no clinically apparent hypertrophic scarring, wound contraction, or reattachment. Tongue protrusion extended beyond the vermilion border without central notching, and palatal contact could be achieved without assistance.

Clinical reassessment also suggested improvement in the production of the previously affected lingua-alveolar consonants. However, this observation was not supported by standardized speech-language testing or acoustic analysis. Swallowing function was not reassessed using a standardized clinical or instrumental evaluation. Accordingly, no objective conclusion regarding improvement in swallowing could be drawn.

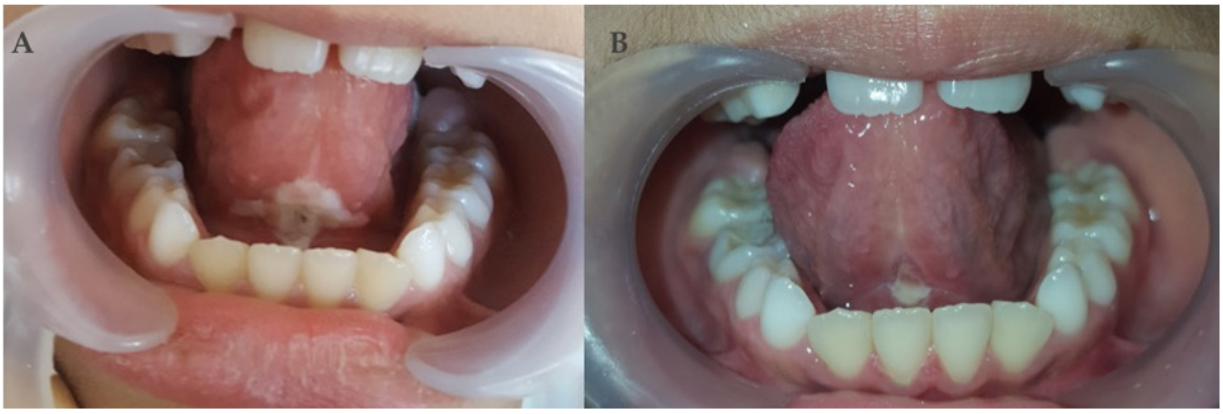

Figure 2: Postoperative healing following diode laser lingual frenectomy.

A: Clinical appearance at 2 weeks after surgery showing satisfactory healing without signs of infection. **B:** Clinical appearance at 1 month demonstrating progressive healing with a whitish appearance of the surgical site and no clinically apparent reattachment.

DISCUSSION

The present case illustrates the management of a school-aged child in whom a restrictive lingual frenulum was accompanied by clinically relevant functional complaints. Contemporary recommendations emphasize that the decision to perform lingual frenectomy should not be based solely on anatomical appearance. Importantly, the 2026 evidence-based recommendations from the Brazilian Academy of Paediatric Otorhinolaryngology Task Force found insufficient evidence to establish causal relationships between altered lingual frenulum and several functional conditions, while acknowledging that selected children with phonetic difficulties may be considered for surgical treatment [2]. This distinction is particularly important because the present case represents an individual clinical observation rather than evidence of causality.

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The speech findings in this child should therefore be interpreted cautiously. Previous systematic reviews have highlighted substantial methodological limitations in the literature, including small sample sizes, heterogeneous diagnostic criteria, and inconsistent outcome measures [4]. Nevertheless, the 2024 systematic review and meta-analysis by Carnino et al. found an overall association between frenectomy and improved speech articulation in selected pediatric patients, although many outcomes were subjectively assessed [5]. The clinically observed improvement in articulation in the present case is compatible with these findings but cannot establish a treatment effect in the absence of standardized preoperative and postoperative speech assessment.

The choice of diode laser was based on its established use for soft-tissue surgery and its potential perioperative advantages. Comparative pediatric evidence has not demonstrated a consistent superiority of laser over conventional techniques [6]. Similarly, a recent systematic review of surgical techniques in pediatric ankyloglossia confirms substantial heterogeneity in operative approaches and does not support a universal preference for one technique [11]. Thus, the favorable operative characteristics observed in this case—rapid tissue release, effective hemostasis, and avoidance of suturing—should be regarded as case-specific outcomes rather than evidence that diode laser is inherently superior to scalpel surgery.

Laser-tissue interaction is highly dependent on wavelength, power, exposure time, fiber diameter, movement speed, and tissue characteristics. The systematic review by Murias et al. emphasized that laser-assisted treatment of ankyloglossia may offer advantages such as reduced bleeding and reduced need for sutures, while also stressing the importance of operator training and appropriate laser safety measures [7]. In the present case, a 980-nm diode laser with a 300-µm fiber was used in gated pulsed mode at a peak power of 1.5 W and an average power of 0.75 W, with approximately 90 J of total energy delivered.

These parameters should not be generalized. In particular, the absence of clinically evident thermal injury does not demonstrate the absence of microscopic thermal effects, because histological evaluation was not performed. Recent pediatric comparative evidence has also suggested that total laser energy may influence early wound healing, reinforcing the need for careful control of energy delivery and further investigation of standardized laser protocols [12]. Therefore, the present case should be viewed as a report of a specific clinical protocol rather than a proposed optimal laser setting.

The absence of postoperative pain in this patient is noteworthy but should also be interpreted cautiously. Laser-assisted frenectomy has been associated with favorable perioperative outcomes in several pediatric reports, but comparative evidence remains heterogeneous. A recent randomized controlled trial comparing diode laser with scalpel frenotomy in infants found improvements with both techniques and no consistent superiority of the laser approach across outcomes; importantly, the authors identified a relationship between total laser energy and healing quality at day 14 [12]. Although the population and procedure differ substantially from the present school-aged case, these findings reinforce the importance of individualized energy management.

Postoperative rehabilitation was deliberately incorporated into the treatment protocol. Myofunctional therapy is increasingly regarded as a potential adjunct to surgical release, although there is currently no universally accepted postoperative regimen. A systematic review found that combined surgical and myofunctional management may provide better functional outcomes than either intervention alone, while also emphasizing the low quality and limited number of available studies [8]. In a randomized clinical trial involving children aged 6–12 years, postoperative tongue exercises improved tongue mobility and maximum mouth opening compared with frenectomy without exercises [9]. These findings provide a rationale for the structured exercise program used in the present case.

However, postoperative care remains poorly standardized. A 2025 scoping review identified considerable variability in the type, frequency, duration, and timing of exercises prescribed after pediatric ankyloglossia surgery, with only a small number of studies directly examining their relationship with recovery outcomes [13]. Consequently, the four-week exercise protocol used here should be considered a case-specific rehabilitation strategy rather than an evidence-based universal regimen.

The 1-month outcome was favorable, with complete mucosal re-epithelialization, improved tongue mobility, palatal contact, and no clinically apparent reattachment. Nevertheless, the literature indicates that reattachment can occur after laser frenectomy. A recent case series involving five children aged 3–9 years reported satisfactory tongue mobilization in four patients but reattachment in one patient at 6 months [14]. This observation is clinically relevant because the present follow-up of only 1 month is insufficient to exclude delayed reattachment or scar-related restriction.

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The principal limitations of this report are therefore its single-case design, short follow-up, lack of standardized quantitative tongue-mobility measurements, absence of objective speech analysis, and absence of standardized swallowing assessment. In addition, the patient's reported swallowing difficulty cannot be interpreted as proof that ankyloglossia caused dysphagia, particularly given the lack of evidence establishing such a causal relationship [2]. Longer follow-up, ideally extending to at least 6–12 months, together with validated speech, tongue-mobility, and swallowing outcomes, would provide a more robust assessment of functional benefit.

Overall, this case supports the feasibility of diode laser-assisted lingual frenectomy as one possible treatment option in a carefully selected school-aged child with demonstrable anatomical restriction and functional complaints. It does not establish superiority of diode laser over conventional surgery, nor does it demonstrate that laser surgery alone improves speech or swallowing. The favorable outcome observed here most appropriately supports an individualized, function-oriented approach combining careful surgical technique with postoperative rehabilitation and appropriate multidisciplinary assessment.

CONCLUSION

Diode laser-assisted lingual frenectomy provided satisfactory short-term anatomical release, hemostasis, healing, and clinically observed functional improvement in this 7-year-old child with symptomatic ankyloglossia. The favorable outcome should be interpreted as a case-specific observation rather than evidence of treatment superiority or causality.

In school-aged children, surgical management should be individualized according to documented functional impairment rather than anatomical appearance alone. Postoperative functional rehabilitation may be a useful adjunct, but protocols remain heterogeneous. Longer prospective studies using standardized speech, tongue-mobility, swallowing, pain, healing, and recurrence outcomes are required to define the indications and optimal surgical parameters for laser-assisted lingual frenectomy.

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