

## Use of laser in Pediatric Dentistry frenectomy surgery: A scoping review

Uso do laser em cirurgia de frenectomia em Odontopediatria: Uma revisão de escopo

Uso del láser en la cirugía de frenectomía en Odontopediatria: Una revisión del alcance

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### **Abstract**

The frenulum is a fold of the buccal mucosa made up of fibrous or fibromuscular tissue covered by a mucous membrane and may present an anomaly and may limit movements of the tongue or lips. Ankyloglossia is an anomaly in the lingual frenulum characterized by limited movement, altering speech and swallowing. The treatment of this anomaly is called frenectomy, which is a small surgery, where the frenulum is excised, so that that region can move without limitations. Since the use of laser in dentistry has been growing nowadays, it has been a great ally in frenectomy surgeries because it presents better trans and postoperative conditions. The objective of this study is to report, the current scenario of laser frenectomy in Pediatric Dentistry. Methodology: This study was carried out through a systematic scoping review, using the keywords Lip frenulum, Lingual frenum, Laser therapy and Pediatric dentistry, pointing out the applications of lasers in frenectomy surgery in pediatric patients. Results: The search found 18 studies and noting that laser frenectomy is a safe procedure to be used in Pediatric Dentistry. Conclusion: It is concluded that the use of laser in frenectomy in pediatric dentistry patients is very well accepted by patients and dentists in relation to conventional surgery because it is less invasive, without interurrences and less bleeding, positively interfering with the patient's quality of life.

**Keywords:** Lip frenulum; Lingual frenum; Laser therapy; Pediatric dentistry.

### **Resumo**

O frênulo é uma prega da mucosa bucal constituída por tecido fibroso ou fibromuscular recoberto por uma membrana mucosa, podendo apresentar anomalia e limitar os movimentos da língua ou dos lábios. A anquiglossia é uma anomalia do frênulo lingual caracterizada por limitação de movimentos, alterando a fala e a deglutição. O tratamento dessa anomalia é chamado de frenectomia, que é uma pequena cirurgia, onde é excisado o frênulo, para que aquela região possa se movimentar sem limitações. Como o uso do laser na odontologia vem crescendo atualmente, ele tem sido um grande aliado nas cirurgias de frenectomia por apresentar melhores condições trans e pós-operatórias. O objetivo deste estudo é relatar o cenário atual da frenectomia a laser na Odontopediatria. Metodologia: Este estudo foi realizado por meio de uma revisão sistemática de escopo, utilizando as palavras-chave Frênulo labial, Frênulo lingual, Terapia a laser e Odontopediatria, apontando as aplicações do laser na cirurgia de frenectomia em pacientes pediátricos. Resultados: A pesquisa encontrou 18 estudos e constatando que a frenectomia a laser é um procedimento seguro para ser utilizado em Odontopediatria. Conclusão: Conclui-se que o uso do laser na frenectomia em pacientes

de odontopediatria é muito bem aceito pelos pacientes e dentistas em relação à convencional cirurgia por ser menos invasiva, sem intercorrências e com menor sangramento, interferindo positivamente na qualidade de vida do paciente.

**Palavras-chave:** Freio labial; Freio lingual; Terapia a laser; Odontopediatria.

### Resumen

El frenillo es un pliegue de la mucosa bucal formado por tejido fibroso o fibromuscular recubierto por una membrana mucosa y puede presentar una anomalía y limitar los movimientos de la lengua o los labios. La anquiglosia es una anomalía en el frenillo lingual caracterizada por limitación del movimiento, alteración del habla y de la deglución. El tratamiento de esta anomalía se llama frenectomía, que es una pequeña cirugía, donde se extirpa el frenillo, para que esa región pueda moverse sin limitaciones. Dado que el uso del láser en odontología ha ido creciendo en la actualidad, ha sido un gran aliado en las cirugías de frenectomía porque presenta mejores condiciones trans y postoperatorias. El objetivo de este estudio es informar el escenario actual de la frenectomía láser en Odontología Pediátrica. Metodología: Este estudio se realizó mediante una revisión sistemática del alcance, utilizando las palabras clave Frenillo labial, Frenillo lingual, Terapia por láser y Odontología Pediátrica, señalando las aplicaciones de los láseres en la cirugía de frenectomía en pacientes pediátricos. Resultados: La búsqueda encontró 18 estudios y se observa que la frenectomía láser es un procedimiento seguro para ser utilizado en Odontología Pediátrica. Conclusión: Se concluye que el uso del láser en frenectomía en pacientes de odontopediatria tiene muy buena aceptación por parte de pacientes y odontólogos en relación con el convencional. cirugía porque es menos invasiva, sin intercorrências y con menos sangrado, interfiriendo positivamente en la calidad de vida del paciente.

**Palavras clave:** Frenillo labial; Frenillo lingual; Terapia por láser; Odontología pediátrica.

## 1. Introduction

The frenulum is an oral mucosa fold comprising fibrous or fibromuscular tissue, covered by a mucous membrane, and may present abnormality where its form may limit movements of the tongue or lips (Brito et al. 2008).

Ankyloglossia is a tongue or lip frenulum abnormality, characterized by limiting their movement, and can be noted when the patient is still a newborn, being important for the dental surgeon to evaluate and diagnose to inform the need for treatment (Olivi et al., 2018; Nunes et al., 2021).

Most of the times, the treatment of ankyloglossia consists in a minor surgery involving the excision of the frenulum.

For pediatric patients, it is extremely important that the procedures are fast, practical, simple, and less stressful. In conventional surgery, frenectomy is conducted with the help of a scalpel, where an incision is made for cutting and sectioning the frenulum, to remove it or even reduce it, eliminating its excess and then, proceeding with the suture.

Laser frenectomy is a procedure which contemplates the patient comfort requirements, due to the great advantages inherent to its use, since the need for less quantity of anesthetic, bleeding reduction, more easily visualization of the surgical site and sterilization of the surgical wound (Estrela, 2018).

Laser frenectomy was cited and indicated by several authors due to several benefits. By the fact that it does not require suture, just minimal anesthesia, and no bleeding, these make it a more advantageous procedure for pediatric patients. The conventional surgery may present trans- and post-operative complications, thus, making the use of laser more indicated in such cases (Júnior et al, 2015).

The objective of this study is to report, the current scenario of laser frenectomy in Pediatric Dentistry.

## 2. Methodology

A systematic scoping review was conducted following the steps proposed by Arksey and O'Malley (2005); such approach was conducted in five steps:

The survey question was identified in the first step. A broad survey question was elaborated: What is the current scenario, described in the available scientific literature, related to laser frenectomy surgery in Pediatric Dentistry?

The relevant studies were identified in step 2. A search was conducted in two scientific databases in November 2022. In the Biblioteca Virtual de Saúde (Virtual Health Library) (BVS) – LILACS with the following terms: *(tw:(frenectomia))*

AND (tw:(laser)) AND (tw:(odontopediatria)). In Pubmed, the search was: (("lasers"[MeSH Terms] OR "lasers"[All Fields] OR "laser"[All Fields]) AND frenectomy[All Fields] AND ("child"[MeSH Terms] OR "child"[All Fields] OR "children"[All Fields])) AND ("2010/05/17"[PDat]: "2020/05/13"[PDat]), and in LILACS: (tw:(frenectomia)) AND (tw:(laser)) AND (tw:(odontopediatria)).

The selection of the studies was conducted in step 3. The titles and summaries of the studies included in the search were read by two independent evaluators, and the ones relevant to the study objective were selected, in cases of disagreement, a third evaluator was responsible for the tie-break. The selected works were fully read to map the study-relevant data. There was no language restriction. The inclusion criteria were empiric studies, case and theoretical studies concerning laser frenectomy in children. The exclusion criteria were studies which did not include laser frenectomy, or those which did not report surgeries in children.

Step 4: Mapping the findings. The relevant information from the selected studies were extracted and plotted in a table.

Step 5: Grouping, summarizing, and analyzing the results. The included studies were categorized and analyzed.

### 3. Results and Discussion

The search in BVS - Lilacs conducted on 11/18/2022, found two studies employing the methodology described in the steps. In PubMed, by using the same filter and search date, 16 additional studies were found, totalizing 18. All the studies were included, and no one was excluded (Table 1).

**Table 1 - Studies found.**

Authors/Year	Database	Country/Place	Method	Objective	Main findings
Mezzapesa et al. (2020)	PubMed	Bari, Italy	Case report	To show the safety and efficacy of frenectomy with no bleeding, with diode laser.	The use of diode laser in frenectomy surgeries is safe and efficient in patients of all ages, once it is not invasive, it provides a short time procedure, and good trans- and post-operative conditions.
Ngoc et al. (2019)	PubMed	Hanoi, Vietnam	Case report. Study conducted in 30 children who were submitted to diode laser frenectomy.	To evaluate the effect of laser diode in the need for local anesthesia, in bleeding control and in the post-operative conditions of the children.	70% required only topical anesthetic for frenectomy to be conducted. In 80% of the procedures, there was no bleeding, and in 20% grade 1 bleeding (WHO scale) was noted, and in 100% no post-operative bleeding was present.
Khosraviani et al. (2019)	PubMed	Iran	Systematic review	To investigate the effectiveness of laser in soft tissue problems in children.	High and low power lasers are a safe and efficient tool in soft tissues in children.
Donoso-Martinez et al. (2018)	Medline	Chile	Literature review	To review literature.	Laser speeds up the cell repair process, and is silent, without scaring the children.
Olivi et al. (2018)	PubMed	Rome, Italy	Case report. Frenectomy with Er:YAG laser in children from 8 to 10 years of age.	To propose a frenectomy surgery technique which is minimally invasive, safe, easy and reproducible.	The patients stated there were no post-operative complications, such as pain and bleeding. In the surgery site, after three weeks, the presence of a thin scar line was noted (as expected).
Komori et al. (2017)	PubMed	Japan	Case report. 35 patients aged 15 years or less, by following up the treatment and prognosis for the complaint of frenulum abnormality.	To present the moment to take action with laser treatment in cases of frenulum abnormality.	21 out of 35 children were submitted to frenectomy by using carbon dioxide laser. 7 were submitted to general anesthesia and 14 to local anesthesia. There were no trans- and post-operative complications; The procedure was fast and safe.

Kamble et al. (2017)	PubMed	Maharashtra, India	Case report of a 13 year-old child with abnormality in the lip frenulum – diastema	To present the fast and esthetic closure of diastema with laser frenectomy	Laser showed to be a safe and non-invasive treatment being, thus, recommended for pediatric patients.
CADTH (2016)	PubMed	Ottawa, Canada	Literature review between 2011 and 2016.	To indicate the efficacy of frenectomy as a treatment for ankyloglossia.	The procedure showed to be safe and tolerable, with many studies reporting no type of complications.
Junior et al. (2015)	PubMed	Pernambuco, Brazil	Case report, a group was submitted to conventional surgery, and another one to Nd:YAG laser frenectomy.	To analyze and compare the pre-, trans- and post-operative conditions in conventional and in Nd:YAG laser frenectomy surgery.	No statistical difference was noted with respect to pain and oral function. The procedures with Nd:YAG laser lasted shorter time, there was no bleeding, and no suture was needed, compared to conventional surgery.
Paschoal et al. (2014)	PubMed	São Paulo, Brazil	Case report	To analyze to clinical cases where the application of laser therapy decreased the post-operative symptoms following pediatric surgical procedures.	The application of laser therapy showed a positive effect in preventing post-invasive surgery discomfort, and was well accepted by the children and parents.
Junqueira et al. (2014)	PubMed	Minas Gerais, Brazil	Case report	To describe a series of clinical cases of ankyloglossia approached by several techniques.	All the techniques were successful for the treatment of ankyloglossia. The use of laser was considered as safe and simple, appropriate for use in pediatric patients.
Suter et al. (2014)	PubMed	Germany	Case report, where all the patients were submitted CO2 laser frenectomy in the period from 2002 to 2011.	To analyze the closure, persistence or reopening of the upper midline diastema following frenectomy, with and without orthodontic treatment.	Frenectomy associated to orthodontic treatment was more predictable. This study has also pointed out the importance of interdisciplinarity in these cases.
Onisor et al. (2013)	PubMed	Geneva, Switzerland	Case report using Er:YAG laser and CO2 laser.	To find the most appropriate techniques and parameters enabling the laser to be Er:YAG laser, to be successfully used in small intraoral interventions in soft tissues.	The Er:YAG laser presented good cutting and coagulation effects during the procedures in soft tissues, and concerning the parameter, it must be adjusted for each laser unit according to each procedure's needs.
Delli et al. (2013)	PubMed	Switzerland	Bibliographic review	To review the current literature on maxillary midline frenulum, conditions and complications associated to its treatment.	Laser techniques are reports as the method of choice for frenulum removal surgery.
Pié-Sanchez et al. (2012)	PubMed	Barcelona, Spain	Case report, 50 children were submitted to CO2 laser, Er laser and Cr:YSGG laser frenectomy procedure.	To compare the reinsertion of the upper lip frenulum, bleeding, surgery time and healing of the surgery wounds in laser frenectomies.	CO2 laser provides a field with no blood and shorter surgery times compared to Er, Cr:YSGG laser. On the other hand, Er, Cr:YSGG laser presented faster healing.
Olivi et al. (2012)	PubMed	Genova, Italy	Bibliographic review	To present the importance of surgical intervention (frenectomy) when ankyloglossia generates mechanical limitations.	Following laser frenectomy, the post-operative symptoms and relapses were absent. It is important to have an interdisciplinary approach in the case.
Puthussery et al. (2011)	PubMed	United Kingdom	Prospective study	Follow up of 21 cases of frenectomy with carbon dioxide laser.	Decreased post-operative pain and bleeding, reduced damage to the muscle.
Santos et al. (2007)	Medline	São Bernardo do Campo, Brazil	Case report of lip and tongue Nd:YAP laser frenectomies.	Clinical case presentation.	Some trans- and post-operative complications can be minimized by using the surgical laser, in addition to the use of low power therapeutic laser.

Source: Elaborated by the author(s).

There are two types of lip frenula, the upper and lower ones. They are characterized by sagittal folds of the alveolar mucosa, with triangle shape, these being inserted into the median portion of the alveolar process' vestibular component and ending approximately four millimeters above the interproximal papilla of the central incisors. Under normal conditions, it is inserted into the gingival mucus limit, thus being, in the "V" shape depression which separates the adhered gum of the alveolar mucosa (Júnior et al, 2015; Awooda, 2023). The tongue frenulum, in its turn, extends from half of the lower face of the tongue to the mouth floor. It is a large median fold of mucous tunic which exceeds the gum, recovering the lingual face from the anterior alveolar crest to the postern inferior face of the tongue, being constituted of fiber-dense connective tissue and, occasionally, of upper fibers of the genioglossus muscle. Such mucous fold extends from a more fixed part to a part with greater freedom of movement (Brito et al, 2008). Several oral functions can be affected, restriction of the tongue movements related to ankyloglossia, such as suction, deglutition, speech, chewing and joint movements. Therefore, the early detection of a thick, or very tense, frenulum, with or without tongue movement limitation is essential, especially at birth or in childhood (Mezzapesa et al., 2020; Alves, 2023; Nascimento et al., 2024).

Some of the lasers used in dentistry are in the visible light range (argon and some "therapeutic lasers") and others, in the infrared range, therefore, invisible to the naked eye. The therapeutic properties of the lasers have been studied since their discovery, their analgesic action being particularly observed on the chronic pain forms of several etiopathogeneses, since the peripheral receptors to the stimulus in the central nervous system. Therefore, when the laser light interacts with the cells and tissue in the appropriate dose, certain cell functions can be stimulated (Khosraviani et al., 2019; Fioravanti et al, 2021).

Frenectomy is a surgical procedure intended to remove the frenulum, allowing both the orthodontic movement to close the diastemas, and the appropriate movement of the tongue required for the functional activities. The procedure must be prematurely conducted, as soon as the diagnosis is obtained, preventing, or minimizing the implications related to the poor dental positioning and to the muscle development, which can be impaired (CADTH, 2016; Alves, 2023; Nascimento et al. 2024).

This surgical procedure can be conducted through two methods: conventional and laser (dos Santos, 2007).

In the conventional method, anesthesia is induced, followed by an incision made with the scalpel in the frenulum, with total or partial removal of it. Following incision, the soft tissues need to be sutured. The recovery can be a little uncomfortable in the first days, due to the suture yarns and more bleeding may occur.

In the laser method, the conventional scalpel is replaced by high power laser, and there is no need for suture once laser already promotes the lesion coagulation and sterilization.

The use of laser in frenectomy is indicated, particularly in pediatric patients, due to the short period of time to conduct the work, once the children tend not to be comfortable for a long time on the dental chair, and since laser provides a less invasive procedure, the post-operative period is more favorable to the patient (Bianchi et al., 2021; Onur, 2021; de Melo et al., 2022; Silva et al., 2022; Xie et al., 2022; Ginini et al., 2023).

Pié Sánchez et al (2012) compared the upper lip frenectomy by using CO2 laser ( $\lambda = 10600$  nm) with Er, Cr:YSGG laser ( $\lambda = 2780$  nm). Frenectomy by using CO2 laser obtained better results in hemorrhage control during the surgical procedure and less surgery time, however, by applying Er, Cr:YSGG laser, the healing period was shorter. Olivi et al. (2012; 2028), in their turn, conducted the frenectomies by using an Er:YAG 2940 nm laser, LightWalker AT Fotona, and all the patients reported that the procedure was well tolerated, with no pain, bleeding, edema or post-operative discomfort.

Many authors defend the preference for using laser in frenectomy surgeries due to several advantages it provides, such as reduced work time, better post-operative comfort, significantly reduced trans- and post-operative bleeding (Komori et al., 2012; Kamble et al., 2012; Paschoal et al., 2014; Junqueira et al., 2014; Mezzapesa et al., 2020; Ginini et al., 2023). However, there is no consensus concerning the type of laser to be used.

## 4. Conclusion

Currently, laser has been employed in pediatric dentistry in several procedures presenting several advantages.

The use of laser in frenectomy is very well accepted by the patients and dental surgeons compared to conventional surgery, for being less invasive, for providing less bleeding and for not presenting post-operative complications.

There is no consensus concerning the type of laser to be used; future studies should establish safe protocols in frenectomy surgery in children.

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