Short lingual frenulum: From diagnosis to laser and speech-language therapy

D. Tripodi, G. Cacciagrano, S. D´Ercole, F. Piccari, A. Maiolo, M. Tieri

Università degli Studi "G. d'Annunzio" di Chieti-Pescara

E-mail: tripodi@unich.it

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Abstract

Aim To evaluate the effects of tongue frenulectomy performed with two therapeutic approaches: Laser frenulectomy and combined laser and speech-language therapy.

Materials and methods The study involved 180 patients (90 males and 90 females) aged between 6 and 12 years. After examination and data collection, the patients were stratified according to three degrees of severity: mild, moderate and severe. After treatment, the test group (laser frenulectomy and combined laser and speech-language therapy) was compared with the control group (laser frenulectomy) in the pre-surgical phase, at one week, 1 month, 3 months, 6 months and 12 months after surgery.

Results Statistical analysis showed statistically significant differences between the pre-surgical and post-surgical values at 3 months, 6 months and 12 months after surgery ($p<0,05$).

Conclusions It is essential to establish diagnosis criteria to which the clinician should refer in order to decide the treatment plan. This study shows that combined laser and speech-language therapy leads to better results than the resection treatment of the frenulum with laser technique alone.

KEYWORDS Lingual frenulum, ankyloglossia, laser frenulectomy, speech and language therapy.

Introduction

The lingual frenulum is a small fold of soft tissue extending from the floor of the mouth to the midline of the underside of the tongue [Eisler Pompea et al., 2017].

The data on the incidence of pathological frenulum in the literature are rather variable because of the lack of a consistent definition [Ferrés-Amat et al., 2017; Kupietzky and Botzer 2005]. Recent data on newborns show that 25.1% of newborns presents a first grade ankyloglossia with a 64.9% prevalence of in males [Ferreés-Amat et al., 2017; Ferrés-Amat et al., 2016; Friend et al., 1990]; other data concern ethnic groups other than Caucasian [Bai and Vaz 2014, Kumar et al., 2017].

It is important to know the normal morphology of the frenulum to distinguish physiological and pathological cases. It is useful to have a valid and clear classification to simplify the diagnosis and, finally, to choose a standardised therapeutic protocol. Some authors proposed quantitative classifications based on precise measurements of the frenulum [Azizi et al., 2014; Kotlow et al., 1999, Lalakea et al., 2002; Lee et al., 1989; Marchesan et al. 2005; Ruffoli et al. 2005]; others instead, considered the morphology and the lingual function for qualitative classifications [Ferrés-Amat et al., 2016; Hazelbaker, 1993].

Diagnostic criteria include: medical history (lingual function during breastfeeding, swallowing, phonation, oral breathing, etc.); extraoral examination (face, lips, oral muscles) and intraoral (insertions, consistency, thickness, elasticity of the frenulum); evaluation of lingual movements and lingual resting posture; linear measurement of the frenulum length. It is of considerable importance to perform a phonetic and swallowing examination with the collaboration of a speech-language therapist [Ferrés-Amat et al., 2016].

A frenulum is defined as pathological when it causes pathological conditions of orthodontic, functional, periodontal and postural type due to abnormalities of length, volume, consistency, and insertion.

The limit case occurs when the tongue fuses partially or totally to the floor of the mouth due to an excessive shortness of the frenulum with a reduced or absent lingual mobility, a condition known as ankyloglossia [Eisler Pompea et al., 2017]. On the contrary, there may be mild forms, where tongue mobility is partially reduced: In these caes, consideration should be given to the patient's age. In fact, with the growth the frenulum can stretch and resize; therefore, it is necessary to wait untile the age of 6–7 years for the possibility of spontaneous regression.

The aim of present study is to attempt to draw a pathological lingual frenulum diagnostic method and to evaluate two different therapeutic approaches: laser frenulectomy and combined laser and speech-language therapy.

Materials and methods

The sample examined consisted of 180 children (90 males and 90 females) between 6 and 12 years (mean age 9.1 years; SD 1.8); referred to the Paediatric unit of the Dental Clinic of the University of Chieti Pescara for evaluation and treatment of the short lingual frenulum over a period of 2 years.

Parental informed consent was obtained for all patients before examination (privacy law DL 196/2003). The selected subjects participated voluntarily in the study.

In this study, the approval from the Ethics Committee was not required since the research protocol was based on a clinical protocol previously approved by the Department for medical use.

The inclusion criteria were: Absence of systemic diseases; no history of orthodontic therapy.

The exclusion criteria were: Systemic diseases, such as: neurodegenerative diseases, autoimmune diseases, disability, serious infectious diseases.

During the first visit, personal data were collected for every patient; then, the parents were submitted to a questionnaire with questions on possible difficulties during breast-feeding, if alterations in the phonation had been noted, swallowing, reduced togue mobility, and oral breathing. Thereafter, an intraoral objective examination with assessment of the lingual function, phonemic examination and swallowing was carried out, with the collaboration of a speech-language therapist. The patients was asked to to raise their tongue, lower it, lateralize it and make circular movements: the ability to perform these movements was noted. Then, the frenulum length was measured by a digital caliper (Powerfix Profi 0-100mm±0.02 mm /0,001" mm precision); the reference measure for this assessment was the maximum opening of the mouth by keeping the tip of the tongue at the palatal retroincisal spot spot, measuring the distance between the incisal margin of the lower central incisors and that of the upper incisors.

According to the literature [Marchesan et al., 2005; Ruffoli et al., 2005], 3 levels of short lingual frenulum are possible: mild, moderate, and severe (Table 1). Therefore, the sample has been divided in 3 groups, according to this classification.

For laser frenulectomy a Galbiati G25 diode laser (AlGaAs) 4 W, fiber 320 µm) was used. Surgery was performed after local anaesthesia (Articaine with adrenaline 1: 200 000). The healing was achieved by second intention and without sutures because of laser induced hemostasis. Every patient received precise instructions about post-surgery: Three months of speech therapy protocol rehabilitation, and they were motivated and encouraged about the importance of this.

Then, the two groups were compared (test and control); each group consisted of 90 patients, 45 males and 45 females.

The test group followed a specific speech therapy rehabilitation after surgery, while the control group did not. Follow-ups were performed at 1 week, 1 month, 3 months, 6 months and 12 months; caliper measurements were repeated during every check.

The statistical analysis was performed with GraphPad Prism software version 6.0 (GraphPad Software, La Jolla, CA, USA).

Pearson correlation coefficient was used to verify the relationship between the continuous variables. SAS system was used to perform statistical calculations. Data were expressed as: mean ± standard deviation. We used the Student t test, and p value <0.05 was considered statistically significant.

		Patients
Normal	≥23mm	0
Mild	17–22mm	90
Moderate	4–16 mm	84
Severe	≤3mm	6

TABLE 1 Ruffoli's classification of the lingual frenulum length.

	Pre-surgery	1 week	1 month	3 months
Test	16.77±5.08	21.90±5.21	23.99±5.65	26.27±4.96
Control	16.54±4.17	20.56±4.33	21.41±5.84	21.92±5.87

TABLE 2 Pre- and post-surgery (after one week, 1 month, 3 months) mean values (in mm) of maximum opening of the mouth by keeping the tip of the tongue at the spot measuring the distance between the incisal margin of the lower central incisors and that of the upper incisors.

	6 months	12 months
Test	26.29±5.02	26.30±5.23
Control	21.96±5.78	21.94±5.88

TABLE 3 Post surgery (after 6 and 12 months) mm mean values of maximum opening of the mouth by keeping the tip of the tongue at the spot measuring the distance between the incisal margin of the lower central incisors and that of the upper incisors.

Results

Results (Table 2, 3; Fig. 1), show statistically significant differences in pre- and post-surgery (after one week, 1 month, 3 months, 6 months and 12 months) mean values of maximum opening of the mouth.

Discussion

A short frenulum determines a specific tongue malfunction, with prevailing sagittal component, in which the symmetry with respect to the front median line is maintained on the frontal plane, but resulting in altered vertical tongue position.

This situation can influence the occlusion and the neuromuscular response [Azizi, 2014; Eisler Pompéia et al., 2017; Laganà et al., 2018; Matsumoto et al., 2012; Meenakshi et al., 2014; Srinivasan et al., 2013]. In fact, dental occlusion can be affected by the muscular balance between the centripetal force exerted by the buccinator and perioral muscles, from the outside on the teeth, and the centrifugal tongue force exerted towards the outside. Lingual position is crucial for intermaxillary bone relationships. In the normal rest position, the tongue is contained inside the dental arches: The anterior portion of the dorsal aspect touches the anterior third of the palate and the tongue tip touches the palate papilla; there are nasal breathing and normal labial competence without dental contact [Ferro et al., 2017; Laganà et al., 2018; Matsumoto et al., 2012; Meenakshi et al., 2014, Piancino, 2019; Rosa, 2019; Srinivasan and Chittaranjan, 2013; Srinivasan et al., 2013,]. In addition, recent evidence has emphasised the role of a short lingual frenulum in the pathogenesis of sleep-disordered breathing (SDB) in childhood. The oral dysfunction induced by a short frenulum may promote oral-facial dimorphism, decreasing the size of the upper airway

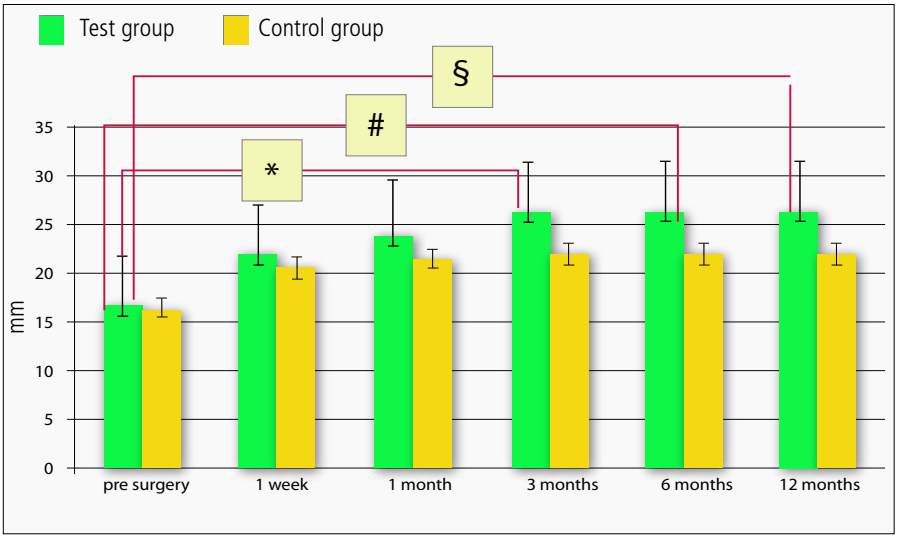

FIG. 1 Pre- and post surgery mean values of maximum mouth opening. On the horizontal axis: time; vertical axis: distance between the incisal margin of the lower central incisors and that of the upper incisors in mm.
* = statistically significant difference between pre-and post-surgery (3 months) for the test group: a clear improvement can be noted.
# = statistically significant difference between pre-and post-surgery (6 months) for the test group.
§= statistically significant difference between pre- and post-surgery (12 months) and speech therapy for the test group.

lumen and increasing the risk of upper airway collapsibility during sleep [Villa et al., 2019].

According to the literature, laser lingual frenulectomy provides great efficiency and comfortable treatment, both for the paediatric patient and for the operator [Garrocho-Rangel et al., 2016; Komori et al., 2017]. It is also a more conservative method and is less traumatic to the tissues than conventiional techniques; furthermore, laser has advantages such as a bloodless surgical field, no suture, less swelling and post-surgical pain [Barot et al., 2014, Nicoloso et al., 2014].

Examining the sample population and considering the baseline measurements, it was found that:
- 5% of patients (90 patients) have a mild short lingual frenulum;
- 46.6% of patients (84 patients) have a moderate short lingual frenulum;
- 3.4% of patients (6 patients) have a severe short lingual frenulum.

As regards the short lingual frenulum therapy two groups were compared: The test group (laser frenulectomy in combination with speech-language therapy rehabilitation) and a control group (laser frenulectomy).

We observed a significant difference between the pre-surgical and post-surgical measurements at 3 months in the test group.

The speech-language therapy is necessary; lingual frenulectomy and rehabilitation exercises can influence the orofacial and nasal functions [Saccomanno et al., 2019] and the orofacial muscle [Giuca et al., 2008]: An improvement of electromyographic potential has been demonstrated [Tecco et al., 2015]. At least 4 weeks of speech-language therapy after surgery is required to correct well-established compensatory movements and the tongue should mobilised be in order to prevent scarring [Ferrés-Amat et al., 2016].

The test group patients show a faster healing and a greater improvement of baseline measurements, especially when compared with the control group, which shows less and delayed improvement, in agreement with Lee et al. [1989].

One week after surgery it can be observed a good healing process and fibrin organisation; two weeks after surgery this process was nearly completed and, after a month, the healing was completed with *restitutio ad integrum*. The following check-ups (6 month and 12 month) confirmed the stability of the results obtained with both protocols.

Conclusion

The present study attempts to draw a diagnostic method for pathological lingual frenulum.

About the treatment, there is a clear improvement after laser surgery combined with speech-language therapy; therefore, laser surgery combined with speech-language rehabilitation is clearly more effective compared to laser surgery alone.

References

› Azizi A, Moosavi S, Jamilian A. The Relationship Between Frenulum Length and Malocclusion. Gen Dent 2014 Jul-Aug;62(4):66-7.
› Bai PM, Vaz AC. Ankyloglossia among children of regular and special schools in karnataka, india: A prevalence study. J Clin Diagn Res Jun 2014; 8 (6): ZC36-8.
› Barot VJ, Vishnoi SL, Chandran S, Bakutra GV. Laser: The torch of freedom for ankyloglossia. Indian J Plast Surg 2014 Sep-Dec;47(3):418-22.
› Ferrés-Amat E, Pastor-Vera T, Ferrés-Amat E, Mareque-Bueno J, Prats-Armengol J, Ferrés-Padró E. Multidisciplinary management of ankyloglossia in childhood. Treatment of 101 cases. A protocol. Med Oral Patol Oral Cir Bucal 2016 Jan 1;21(1):e39-47.
› Ferrés-Amat E, Pastor-Vera T, Rodríguez-Alessi P, Ferrés-Amat E, Mareque-Bueno J, Ferrés-Padró E. Management of ankyloglossia and breastfeeding difficulties in the newborn: breastfeeding sessions, myofunctional therapy, and frenotomy. Case Rep Pediatr 2016;2016:3010594.
› Ferrés-Amat E, Pastor-Vera T, Rodriguez-Alessi P, Ferrés-Amat E, Mareque-Bueno J, Ferrés-Padró E. The prevalence of ankyloglossia in 302 newborns with breastfeeding problems and sucking difficulties in Barcelona: a descriptive study. Eur J Paediatr Dent 2017 Dec;18(4):319-325.
› Ferro R, Pasini M, Fortini A, Arrighi A, Carli E, Giuca MR. Evaluation of maxillary and mandibular arch forms in an italian adolescents sample with normocclusion. Eur J Paediatr Dent 2017 Sep;18(3):193-198.
› Friend GW, Harris EF, Mincer HH, Fong TL, Carruth KR. Oral anomalies in the neonate, by race and gender, in an urban setting. Pediatr Dent 1990 May-Jun;12(3):157-61.
› Garrocho-Rangel A, Herrera-Badillo D, Pérez-Alfaro I, Fierro-Serna V, Pozos-Guillén A. Treatment of ankyloglossia with dental laser in paediatric patients: scoping review and a case report. Eur J Paediatr Dent 2019 Jun;20(2):155-163.
› Giuca MR, Pasini M, Caruso S, Tecco S, Necozione S, Gatto R. Index

of orthodontic treatment need in obese adolescents. Int J Dent 2015;2015:876931:1-7.
› Giuca MR, Pasini M, Pagano A, Mummolo S, Vanni A. Longitudinal study on a rehabilitative model for correction of atypical swallowing. Eur J Paediatr Dent 2008 Dec;9(4):170-4.
› Hazelbaker AK. The assessment tool for lingual frenulum function (ATLFF): Use in a lactation consultant private practice. Thesis. Pasadena, Calif: Pacific Oaks College; 1993.
› Kotlow LA. Ankyloglossia (tongue-tie): A diagnostic and treatment quandary. Quintessence Int 1999 Apr;30(4):259-62.
› Komori S, Matsumoto K, Matsuo K, Suzuki H, Komori T. Clinical study of laser treatment for frenectomy of pediatric patients. Int J Clin Pediatr Dent 2017 Jul-Sep; 10 (3), 272-277.
› Kumar RK, Nayana Prabha PC, Kumar P, Patterson R, Nagar N. Ankyloglossia in infancy: an indian experience. Indian Pediatr 2017 Feb 15;54(2):125-127.
› Kupietzky A, Botzer E. Ankyloglossia in the infant and young child: clinical suggestions for diagnosis and management. Pediatr Dent 2005 Jan-Feb; 27 (1), 40-6.
› Laganà G, Di Fazio V, Paoloni V, Franchi L, Cozza P, Lione R. Geometric morphometric analysis of the palatal morphology in growing subjects with skeletal open bite. Eur J Orthod 2018; 1–6.
› Lalakea ML, Messner AH. Frenotomy and frenuloplasty. S Op Tech Otolaryngol 2002; 13;94.
› Lee SK, Kim YS, Lim CY. [A pathological consideration of ankyloglossia and lingual myoplasty]. Taehan Chikkwa Uisa Hyophoe Chi 1989 Mar;27(3):287-308.
› Marchesan IQ. Lingual frenulum: quantitative evaluation proposal. Int J Orofacial Myology 2005 Nov;31:39-48.
› Matsumoto T, Romano F L, Ferreira J T L, Valério R A. Open bite: diagnosis, treatment and stability. Braz Dent J 2012; 23(6): 768-778.
› Meenakshi S, Jagannathan N. Assessment of lingual frenulum lengths in skeletal malocclusion. J Clin Diagn Res 2014 mar; 8 (3): 202-204.
› Piancino MG, Di Benedetto L, Matacena G, Deregibus A, Marzo G, Quinzi V. Paediatric Orthodontics Part 3: Masticatory Function during development. Eur J Paediatr Dent 2019 sep; 20 (3), 247-249.
› Pompéia LE, Simoni Ilinsky R, Feijó Ortolani CL, Faltin Júnior K. Ankyloglossia and its influence on growth and development of the stomatognathic system. Rev Paul Pediatr 2017 Apr-Jun; 35 (2), 216-221.
› Rosa M, Quinzi V, Marzo G. Paediatric Orthodontics Part 1: Anterior open bite in the mixed dentition. Eur J Paediatr Dent 2019 mar; 20 (1): 80-82.
› Ruffoli R, Giambelluca MA, Scavuzzo MC, Bonfigli D, Cristofani R, Gabriele M. Ankyloglossia: a morphofunctional investigation in children. Oral Dis 2005;11:170–4.
› Saccomanno S, Di Tullio A, D'Alatri L, Grippaudo C. Proposal for a Myofunctional Therapy Protocol in Case of Altered Lingual Frenulum. A Pilot Study. Eur J Paediatr Dent 2019 Mar; 20 (1): 67-72.
› Srinivasan B, Chitharanjanh AB. Skeletal and dental characteristics in subjects with ankyloglossia, Srinivasan and Chitharanjan. Progress in Orthodontics 2013; 14:44.
› Tecco S, Baldini A, Mummolo S, Marchetti E, Giuca MR, Marzo G, Gherlone EF. Frenulectomy of the tongue and the influence of rehabilitation exercises on the sEMG activity of masticatory muscles. Case Rep Pediatr 2016;2016:3010594.
› Villa MP, Evangelisti M, Barreto M, Cecili M, Kaditis A. Short lingual frenulum as a risk factor for sleep-disordered breathing in school-age children. Sleep Med 66 2019 Oct 23; 119-122 .