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Tongue-tie assessment: clinical aspects and a new diode laser technique for its management

ABSTRACT

Background Often breastfeeding problems experienced by mothers and their babies may be attributed to the abnormal attachment of the infant's tongue (ankyloglossia) and/or maxillary lip-tie. Proper breastfeeding depends upon an infant's ability to correctly latch onto its mother's breast. If born with oral soft tissue abnormalities such as tongue-tie or lip-tie, it may be almost impossible for the infant to breastfeed. During the oral evaluation of an infant presenting with breastfeeding problems, one factor that is often overlooked and undiagnosed – and thus untreated – is the attachment of the upper lip to the maxillary gingival tissue.

Case report The case is reported of tongue-tie and breastfeeding difficulties, treated with a novel technique: the diode laser (980 nm).

Keywords Ankyloglossia; Breastfeeding; Diode laser; Lingual frenulum.

Introduction

Ankyloglossia, also known as tongue-tie, is a congenital oral condition characterised by a short, thickened, or abnormally tight lingual frenulum [Messner and Lalakea, 2002]. This anomaly can cause varying degrees of

reduced tongue mobility, and has been associated with functional limitations including atypical swallowing, speech articulation problems, mechanical problems such as the inability to clean the oral cavity, and psychosocial stress [Edmunds et al., 2011]. In many cases, ankyloglossia can be resolved through surgical procedures [Campan et al., 1996]; however, it should also be noted that, despite the reduced length of the lingual frenulum, in many cases the elasticity of the mouth floor may allow normal tongue mobility, avoiding frenectomy. Tongue-tie also affects breastfeeding in infants, making a natural act a difficult and sometimes impossible task, and much has been published on this topic [Messner, 2000; Dollberg et al., 2006; Wallance and Clarke, 2006; Kotlow, 2013]. However, renewed interest in breastfeeding has brought to light many problems and challenges concerning infant feeding [Edmunds et al., 2011], and statistics indicated mothers' renewed preference for breastfeeding [Wright and Schanler, 2001]; thus considerable fresh data is now accumulating. Mothers and infants may experience a variety of difficulties in mastering breastfeeding: a breastfeeding mother may experience sore nipples, blocked ducts, nipple and breast infection, and signs of low milk supply. Infants may be unable to transfer milk adequately, in part due to their inability to maintain an effective latch and seal onto the breast [Kotlow, 2011]. These infants sleep badly and gain inadequate weight, sometimes being diagnosed as "failure to thrive". Anatomical factors, such as tongue-ties and frenulum/lip-ties, should be carefully considered as primary factors in creating breastfeeding difficulties [Defabianis, 2000]. Difficulty or inability to breastfeed can be caused by lingual hypomobility, and the resulting inability of the nursing infant to squeeze the nipple against the upper arch and the hard palate during suction; furthermore, the lateral margins of the tongue should raise to form a U-shaped channel that wraps around the nipple, to avoid milk leaking into the vestibule of the mouth. During suction, the lips are also involved, as they maintain the nipple in place, while providing a seal to prevent loss of milk [Kloars, 2007].

Early diagnosis and intervention are fundamental for the subsequent morpho-functional development of the child and adolescent: the permanence of atypical swallowing may be responsible for functional alterations with speech impediments, as well as morphological dentoskeletal alterations leading to orthodontic problems [Defabianis, 2000; Queiroz Marchesan, 2004]. The persistence of these morpho-functional alterations can cause suprahyoid and subhyoid muscular-facial alterations, and/or alterations of the neck muscles and spinal column, leading initially to a tendency toward altered posture and later to postural alterations [Queiroz Marchesan, 2004]. In paediatric dentistry, the laser is one of the alternatives that in some cases complements and in others completely replaces traditional techniques: the American Academy of Pediatric Dentistry (AAPD) recognises laser as a useful tool to provide dental restoration, and to perform surgical operations on soft tissue in infants, children, and adolescents, including

those with special healthcare needs. The laser meets the modern concept of minimally invasive dentistry: it is widely reported that children are the first patients benefitting from dental laser treatment, for both minimally invasive surgical therapies and diagnostic purposes [Edmunds et al., 2011; Kotlow, 2011; Olivi et al., 2012]. A case is reported of ankyloglossia treated with a 980 nm diode laser.

Case report

A 2 year-old female patient with severe ankyloglossia, was brought to the Department of Maternal and Paediatric Dentistry, Italian Stomatological Institute (ISI, Milan, Italy) (Fig. 1). Her mother reported that she suffered from speech difficulties and breastfeeding. This difficult breastfeeding probably caused pain at the mother's breast, resulting in early weaning and weight loss; she also had noticed the tongue-tie, whereupon the girl had been examined by a specialist. The objective examination determined Class 3 tongue-tie; surgical repair should be associated with speech therapy. Due to the complexity of the surgery and the poor patient cooperation, it was decided to perform the operation in the surgery room under intravenous sedation.

Surgical procedure

Treatment was performed with a diode laser wavelength 980 nm (Raffaello, DMT Lissone, MB, Italy). Irradiation was delivered by means of a flexible quartz fiber that was kept in contact with the lingual frenum, from 1.8 to 2.0 W average power in continuous wave mode, for 5–10s with a mean fluence of 11–22 J/cm² optical fiber of 320 µm. Before and during laser therapy, the surface was cooled with saline solution to protect the superficial tissues from thermal damage. Treatment was performed with topical anaesthesia (lidocaine spray 15%). Frequent contact cooling was employed to avoid ulceration. After surgery, haemostasis was obtained quickly without the need for suturing (Fig. 2). Lingual mobility immediately increased (Fig. 3).

Postsurgical procedure

The surgical wounds healed by second intention, regardless of depth; no antibiotics or anti-inflammatory analgesics were prescribed. Chlorhexidine gel (0.2%, Curadent Healthcare, Saronno, Italy) was applied to the surgical area twice a day to maintain good postoperative oral hygiene. The follow-up after 14 days showed perfect wound healing; lingual mobility had improved, partly thanks to dedicated exercises and speech therapy.

Discussion

Ankyloglossia comprises the abnormal junction of the tongue to the mouth floor, limiting its movement. Tables and classifications have been proposed, including surgical



FIG. 1 Class 3 tongue-tie.



FIG. 2 Frenectomy performed with 980 nm diode laser without suture.



FIG. 3 After surgery lingual mobility immediately increased.

indications for the different categories of ankyloglossia. Table 1 reports that proposed by Kotlow [1999]. More recently, Kotlow developed a set of clinical criteria to classify the position of the labial frenulum [Kotlow, 2010] (Table 2). In infants, Class 3 or 4 frenulum may seriously compromise breastfeeding. This condition also has the potential to create dental caries if the upper lip is abnormally restricted and forms a pocket, trapping retained milk on completion of nursing. The risk of caries increases in cases where a thick fibrous attachment limits the normal function and mobility of the upper lip [Kotlow, 2013]. Ankyloglossia is more common in boys and the incidence is estimated around 4-5% [Queiroz Marchesan, 2004].

There are several therapeutic strategies to treat the condition: if the frenulum is very thin, frenotomy can be done by the paediatrician directly in the clinic. It consists of simply cutting the frenulum with a scalpel, and suturing is not required [19]. Conversely, frenectomy should rather be performed by an oral surgeon, since it is essential to protect important anatomical structures near to the surgical site, like the Wharton duct, sublingual blood vessels, the terminal branches of the lingual nerve. To prevent a profuse bleeding from the sublingual blood vessels, frenectomy should be done in hospital or in a protected environment where adequate systems of haemostasis are available.

The first step in frenectomy is the infiltration of local anaesthetic; a suture stitch is then generally applied at

Morphological classification of ankyloglossia according to Kotlow	Lingual frenulum (mm)
Class 1	Mild ankyloglossia: 12–16 mm
Class 2	Moderate ankyloglossia: 8–11 mm
Class 3	Severe ankyloglossia: 3–7 mm
Class 4	Complete ankyloglossia: less than 3mm

TABLE 1 Classes of morphological classification of ankyloglossia according to Kotlow.

the tip of the tongue, enabling it to be extruded to give the surgeon better visibility. The frenulum is then isolated by placing two Halstead Mosquitos (one at the tongue insertion of the frenulum, one at its insertion on the mouth floor), taking care not to damage the sublingual caruncles. The procedure continues with sectioning the soft tissues, preferably with a “V” incision of the frenulum using a scalpel, electroscalpel or a surgical laser. The benefits of laser surgery compared to conventional surgery in paediatric dentistry are numerous: precise and selective interaction with the treated tissue [Kotlow, 2004b], in most cases rapid haemostasis and no suture requirement [Martens, 2011; Boj et al., 2011], fast wound healing with less postoperative discomfort and reduced use of analgesics [Kotlow, 2004], reduced need for local anaesthesia [Boj et al., 2011], treatment without hospitalisation or general anaesthesia, and reduced operating time [Genovese and Olivi, 2008]. Further benefits are the decontamination of tissues and antibacterial properties, reducing the need for postoperative antibiotics. Preventive measures should be taken: the fiber tip should not be held in the same place for too long and the treated tissue should be cooled to avoid thermal damage. The excellent clinical results so obtained increase patient compliance.

Conclusion

In treating ankyloglossia, the choice of therapy must only be made after a careful and extensive analysis of the condition. The paediatrician should coordinate collaboration among the various specialists involved (paedodontist, oral surgeon and speech therapist) in the treatment of each individual case, so as to achieve a comprehensive resolution of the problem. The case reported here shows that diode laser surgery is a safe and well-tolerated treatment for ankyloglossia. The results show that this new therapy is highly effective, and may provide a valid alternative to conventional surgical procedures.

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Maxillary frenulum	
Class 1	Little or no tissue attachment of the lip to the gingival tissue
Class 2	Frenulum attaches above or at the border between free and attached gingival tissue
Class 3	Frenulum attaches at or into the interproximal area between the upper central incisor
Class 4	Frenulum attaches into the palatal tissue

TABLE 2 Classes of morphological classification of the maxillary frenulum.

whatsoever with any organisation or individual.

The patient's parents signed their informed written consent to publication of the manuscript and figures.

References

- Boj JR, Poirer C, Hernandez M, Espasa E, Espanya A. Review: Laser soft tissue treatments for pediatric dental patients. *Eur Arch Paediatr Dent* 2011 ;12(2):100-5.
- Campan P, Baron P, Duran D, Casteigt J. Lingual frenectomy: a therapeutic protocol. A technic for frenectomy with 2 incision lines combined with active postoperative kinesitherapy during and after healing. *Schweiz Monatsschr Zahnmed* 1996;106(1):45-54.
- Campan P, Baron P, Duran D. Lingual frenectomy: a therapeutic protocol. A technique for frenectomy with 2 incision line combined with active postoperative kinesitherapy during and after healing. *Schweiz Monatsschr Zahnmed* 1996;106(1):45-54.
- Defabianis P. Ankyloglossia and its influence on maxillary and mandibular development (A seven year follow up case report). *Funct Orthod* 2000;17(4):25-33.
- Dollberg S, Botzer E, Gunis F, Mimouni FB. Immediate nipple pain relief after frenotomy in breast-fed infants with ankyloglossia: a randomized, prospective study. *J Pediatr Surg* 2006; 41(9): 1598-600.
- Edmunds J, Miles SC, Fulbrook P. Tongue-tie and breastfeeding: a review of the literature. *Breastfeed Rev* 2011;19(1):19-26.
- Edmunds J, Miles SC, Fulbrook P. Tongue-tie and breastfeeding: a review of the literature. *Breastfeed Rev* 2011 Mar;19(1):19-26.
- Genovese MD, Olivi G. Laser in paediatric dentistry: patient acceptance of hard and soft tissue therapy. *Eur J Paediatr Dent* 2008b Mar; 9 (1):13-7.
- Kloars T. Familiar ankyloglossia (tongue tie). *Int J Paediatr Otorhinolaryng* 2007;71:1321-24.
- Kotlow L. The influence of the maxillary frenum on the devolpment and pattern of dental caries on the anterior teeth in breastfeeding infants: prevention, diagnosis and treatment. *J Hum Lact* 2010 ; 26(3),304-308.
- Kotlow LA. Ankyloglossia (tongue tie): a diagnosticand treatment quandary. *Quintessence Int* 1999;30(4):259-62.
- Kotlow LA. Diagnosing and understanding the maxillary lip-tie (superior labial, the maxillary labial frenum) as it relates to breastfeeding. *J Hum Lact Nov* 2013, 29(4): 458-64.
- Kotlow LA. Diagnosis and treatment of ankyloglossia and tied maxillary fraenum in infants using Er:YAG and 1064 diode lasers. *Eur Arch Paediatr Dent* 2011 Apr; 12(2):106-12.
- Kotlow LA. Laser in pediatric dentistry. *Dent Clin North Am* 2004;48(4):889-92.
- Kupietzky A, Botzer E. Ankyloglossia in the infant and young child: clinical suggestions and management. *Pediatr Dent* 2005; 27(1): 40-6.
- Martens LC. Laser physics and review of laser applications in dentistry for children. *Eur Arch Paediatr Dent* 2011; 12(2):61-7.
- Messner AH, Lalakea ML. Ankyloglossia: controversies in management. *Int J Pediatr Otorhinolaryngol* 2000 Aug 31;54(2-3):123-31.
- Messner AH, Lalakea ML. The effect of ankyloglossia on speech in children. *Otolaryngol Head Neck Surg*.2002 Dec;127(6):539-45.
- Olivi G, Signore A, Olivi M, Genovese MD. Lingual Frenectomy: functional evaluation and new therapeutical approach. *Eur J Paediatr Dent* 2012 ;13 (2): 101-106.
- Queiroz Marchesan I. Lingual Frenulum: classification and speech interference. *Int J Orofacial Myology* 2004;30:31-8.
- Wallance H, Clarke S. Tongue tie division in infants with breastfeeding difficulties. *Int J Pediatr Otorhinolaryngol* 2006 70 (7):1257-61.
- Wright A, Schanler R. The resurgence of breastfeeding at the end of the Second Millennium. *J Amer Soc Nutrit Sci* 2001;131;421-425.