


ANKYLOGLOSSIA

N Parhizkar, M.D.
Pediatric Otolaryngology
Head & Neck Surgery

Ankyloglossia

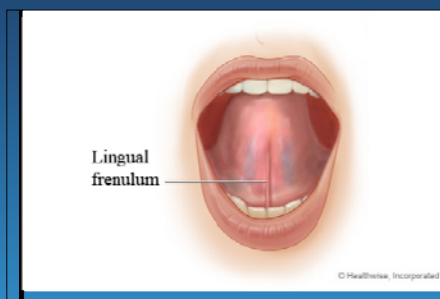
Short Frenulum



- Ankyloglossia (tongue tie) is a congenital oral anomaly characterized by an abnormally short lingual frenulum
- Partial fusion or in rare cases total fusion of the tongue to the floor of the mouth due to an abnormality of the lingual frenulum (Kummer, A. 2005, Dec 27)
- Believed to limit the range of motion of the tongue, impairing the ability to fulfill its function

Ankyloglossia

Short Frenulum



- By definition, a frenulum, is a narrow fold of mucous membrane connecting a moveable part to a fixed part.
- As such, it can help to stabilize the base of the tongue but does not interfere with tongue tip movement.
- With Ankyloglossia, however, the lingual frenulum has an anterior attachment near the tip of the tongue and may also be unusually short.
- This causes virtual adhesion of the tongue tip to the floor of the mouth and can result in restricted tongue tip movement

Clinical assessment of Frenulum

- Attachment of the frenum to the tongue should normally be approximately 1 cm posterior to the tip
- The frenulum's attachment to the inferior alveolar ridge should be proximal to or into the genioglossus muscle on the floor of the mouth



Why would Limited tongue mobility matter?

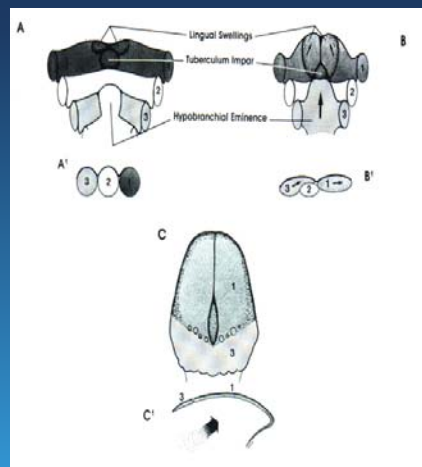


Tongue is an important oral structure that is essential in

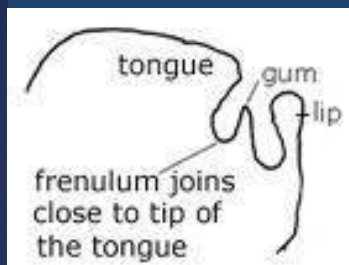
- Position of teeth
- Periodontal tissue health
- Swallowing and nursing
- Mastication and Deglutition
- Forming words during speaking
- Squeezing food into the pharynx
- Taste

Development of the Tongue

- Begins at GA 4 weeks
- Localized proliferation of the mesenchyme results in formation of several swellings in the floor of the oral cavity
- Oral part (anterior two-thirds) develops from the fusion of two distal tongue buds or **lateral lingual swellings** and a **median tongue bud** (tuberculum impar)
- Pharyngeal part or root of the tongue (posterior one-third) develops from the **copula** and the **hypobranchial eminence** (forms from the 2nd, 3rd and 4th branchial arches)
- Fusion of the two (adult = terminal sulcus)
- muscles of the tongue arise from **occipital somites** which migrate into the tongue area



ch
d arch



Embryology

- During tongue's development it is fused to the floor of the mouth
- The frenulum is left as the only remnant of the initial attachment
- Ankyloglossia is the result of a short fibrous lingual frenulum or a highly attached genioglossus muscle

Anatomy

- Tongue Highly mobile organ made up of longitudinal, horizontal, vertical and transverse intrinsic muscle bundles
- Intrinsic muscles fan-like genioglossus inserted into the medial part of the tongue
- Extrinsic Muscles Styloglossus & hyoglossus inserted into the lateral portions
- Sublingual and Submandibular ducts travel in the anterior floor of the mouth and terminal junction is at the base of the frenulum

Ankyloglossia

- Incidence Varies widely based on study
- Ranges between 0.02% to 5% (Kupitetzky, botzer, Pediatric dentistry, 27:1, 2005)
- 1.7%-4.8% (Deshmukh V. Pediatric On Call 2007)
- 4.8% Messner et al .Arch Otolaryngl Head Neck surgery/Vol 126, Jan 2000
- Male to female ratio is 3:1 with no racial predilection
- Associated with Opitz syndrome, orofacialdigital syndrome, beckwith-Wiedemann syndrome

Features of Newborns affected by Ankyloglossia

Features of 36 Newborns affected (Messner et al.)

Sex M/F 24/12 (50%)

First born 8 (42%)

Race: Hispanic 18/Caucasian 8/Pacific Islander 5/Asian 4

Ankyloglossia Mild 23 (64%) Moderate 13 (36%)

Frenulum Thin 32 (89%) Thick 4 (11%)

Notched Tongue 8 (22%)

Differential Diagnosis

- Bifid tongue
- Oral Ranula
- Congenital furrowing
- Macroglossia
- Lymphatic Malformations
- Lingual thyroid

An infant with Ankyloglossia will look different on exam than an older child with the same condition



Criteria to Diagnose Ankyloglossia

Table 3. Prevalence of ankyloglossia

STUDY	YEAR	N	COUNTRY	TYPE OF STUDY	DIAGNOSTIC METHOD	DAYS POSTPARTUM	PREVALENCE N (%) (95% CONFIDENCE INTERVAL)
Messner et al ⁷	2000	1041	United States	Prospective trial	None; subjective impression with clinical correlate	Not applicable	50 (4.8) (3.6-6.3)
Ballard et al ⁸	2002	3036	United States	Uncontrolled case series	Hazelbaker's assessment tool ¹⁷ for lingual frenulum function	2-3	127 (4.2) (3.5-5.0)
Griffiths ⁶	2004	521	United Kingdom	Prospective uncontrolled cohort study	None; subjective impression with clinical correlate	18	All patients in study had ankyloglossia
Hogan et al ⁵	2005	1866	United Kingdom	Randomized controlled trial	None; subjective impression with clinical correlate	3-70 (median 15)	201 (10.7) (6.6-14.74)
Ricke et al ⁹	2005	3490	United States	Case-control study	Hazelbaker's assessment tool ¹⁷ for lingual frenulum function	Both 1 and 30 days	148 (4.24) (1.1-7.42)

Evaluation of the Frenulum

Lalakea recommended measuring lingual mobility in children and tongue elevation to document and define the degree of restriction and AG

Mobility is evaluated by measuring in mm the tip of the tongue extended past the lower dentition

Elevation is measured by recording interincisal distance with the tongue tip maxillary elevated and in contact the upper teeth

- Typically children with AG have protrusion and elevation values of 15 mm or less; 20-25 mm is normal range



Classification of Ankyloglossia

Free tongue: length from the inside of the lingual frenulum at the base of the tongue to the tip of the tongue

Clinically acceptable normal range of the free tongue is minimum of **16 mm**



Kotlow Assessment (American specialist pediatric dentistry)

A group of 322 children ranging from 16 months to 14 years were examined for the length of free tongue and evaluated for clinical evidence of speech and oral problems; Assessment of these measurements resulted in the development of the above descriptions/categories of Ankyloglossia

Ankyloglossia Classification

Kotlow Assessment

Class I: Mild 12-16 mm

Class II: moderate 8-11 mm

Class III: severe 3-7 mm

Class IV: complete ≤ 3 mm



Structural Guidelines

The tongue should not place excessive forces on the mandibular anterior teeth

the lingual frenum should allow a normal swallowing pattern

The lingual frenum should not create a distemia between the mandibular central incisors

In infants the underside of the tongue should not exhibit abrasion

The frenulum should not inhibit latching on during feeding

Children should not exhibit speech difficulties associated with limitations of the movement of the tongue

Tongue Tie Assessment Protocol (TAP) Tongue-tie "From Confusion to Clarity"



Hazelbaker The Assessment tool for Lingual Frenulum Function

- Most commonly used by lactation consultants
- Difficult to implement in busy clinic
- Score based on:
 - Functional Items: lateralization/Lift of Tongue/Extension of Tongue
 - Appearance Items: Appearance when lifted/Elasticity/Length of lingual frenulum when lifted

Diagnostic Characteristics

Inability to protrude the tongue past the edge of the lower gingiva or mandibular incisors.

With protrusion attempts, the tongue tip becomes notched in midline, resulting in a heart-shaped edge.

In addition, the patient is unable to touch the roof of the mouth with the tongue tip when the mouth is open



Evaluation of Patient with Ankyloglossia

Maternal Factors

Pain/nipple injury, blocked ducts/mastitis during breastfeeding

Infant Factors

Poor weight gain, vomiting, gagging, gas, burping

Child Factors

Lack of lingual mobility which affects speed and accuracy of tongue movements

Eating difficulty caused by poor coordination of oral musculature

Dental problems which are severe and wide ranging

Preschool/School age Patient

- AG does not prevent or delay the onset of speech, but may interfere with Articulation
- Simple speech articulation test: If the tip of the tongue is restricted, The articulation of l or tongue sounds such as t "d" "th and s" may not be accurate
- If a child can correctly articulate the above sounds but has other speech challenges, a speech pathology evaluation vs. frenulectomy is suggested

To Clip or Not to Clip: That is the Question?



Controversy

Messner and Lalakea (2000) found that 60% of ENTs, 50% of SLPs, and 23% of pediatricians believed that Ankyloglossia is likely to cause speech problems.

No consensus among practitioners regarding the significance of a short frenulum and its management

Possible issues from a Short Frenulum

- **Feeding problems:** 25% of newborns with a short frenulum
- **Dentition:** pulling effect on the gingiva away from the teeth and even a cause for mandibular distemia; Usually occurs after age 8-10
- As the child gets older they may have difficulty moving a bolus in the oral cavity and clearing food from the sulci and molars. This can lead to chronic halitosis and dental decay
- **Cosmetic:** looks abnormal and tongue has a forked or serpent look
- **Speech:** usually /L/ sounds and interdental sounds like /th/ are affected because of the restricted movement of the lip

Functional Effects of Ankyloglossia

The functional effects

- **Feeding problems.** The literature on Ankyloglossia primarily deals with potential difficulty with breast feeding (Nicholson, 1991; Jain, 1995; Fitz-Desorgher, 2003; Ricke et al., 2003). Range 15-25% of newborns with Ankyloglossia will have trouble with nursing



Ankyloglossia and Lactation

- Prospective study: Majority are able to breastfeed, 25% will experience
 - Feeding difficulties
 - Latching issues
 - Prolonged maternal pain
 - Do not have problems with the bottle—Ankyloglossia should not deter parents from breastfeeding
- Tongue movement evaluations using U/S has demonstrated that in breastfeeding vs. bottle feeding infant tongue is projected further forward

Lactation and Ankyloglossia

- Messner et al. Arch of Otolaryngology-Head and Neck Surgery:
 - 50 Newborns with Ankyloglossia
 - 83% successful lactation with no intervention vs. 92% of parents with infants with no Ankyloglossia
 - Breastfeeding difficulties in 9 (25%) of the Ankyloglossia parents vs. 1 (3%) of the control Mothers during a minimal 2 month follow up
 - Thus early weaning not substantiated by these results; subgroup (25%) with difficulties had no correlation b/n grade of Ankyloglossia and incidence of BF difficulties

Functional Effects of Ankyloglossia

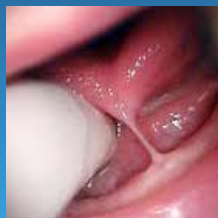
Dentition. If the lingual frenulum is attached high on the gingival ridge behind the lower mandibular incisors, it can pull the gingiva away from the teeth and even cause a mandibular diastema. However, this is usually not a problem until age 8-10.



Functional Issues with Ankyloglossia



- Cosmetics and personal interactions. There is no doubt that Ankyloglossia may look abnormal and has even been described as a forked or "serpent" tongue.
- There can also be difficulty in social interactions.



Ankyloglossia and Speech

- Through the centuries assumed that if the tongue tip cannot move well due to Ankyloglossia it must effect speech

In fact, this is even mentioned in the Bible. In Mark 7:35, it says "... and the bond that tied his tongue was loosed, and he talked plainly." Despite the common belief of this effect, there is no empirical evidence in the literature that Ankyloglossia typically causes speech defects.

On the contrary, several authors, even from decades ago, have disputed the belief that there is a strong causal relationship (Wallace, 1963; Block, 1968; Catlin & De Haan, 1971; Wright, 1995; Agarwal & Raina, 2003).

In addition, there are very few other articles in the literature that even address the effects of tongue-tie on speech.

Speech & Ankyloglossia

Certainly, children with Ankyloglossia are often found to have no speech problems. So how is this possible?

Lingual-alveolar sounds (t, d, n) are produced with the top of the tongue tip and therefore, they can be produced with very little tongue elevation or mobility. The /s/ and /z/ sounds require the tongue tip to be elevated only slightly, but can be produced with little distortion if the tip is down.

The most the tongue tip needs to elevate is to the alveolar ridge for production of an /l/, /th/

Speech and Ankyloglossia

- In their study, 9 out of 15 patients showed "improvement" in speech after frenulectomy. However, many months went by between the pre- and post-operative assessments.
- No information on the types of disarticulations noted preoperatively.
- Finally, the authors admitted that they used a relatively small and disparate study group.
- In addition, they noted that they did not use a standard speech sample, and that multiple SLPs performed the assessments, which were not blinded. Therefore, the results of this study should be considered with caution.

Speech & Ankyloglossia

- In evaluating the effect of Ankyloglossia on speech, therefore, it is important to focus on lingual-alveolar sounds (particularly /l/) and interdental sounds (voiced and voiceless /th/).
- Tongue-tie could be considered a contributing factor if the child cannot produce these sounds, even with the alternate placement noted above, and all other speech sounds are produced normally.
- Tongue tie may also be a bigger problem if there is oral-motor dysfunction as well.

Articulation

- Retrospective Review (Haber et al. Can tongue tie cause dysarticulation? Nov 2008)
 - 11 children with articulation problems who underwent frenuloplasty, 9 improved significantly

What is not clear is whether these articulation problems can be overcome without intervention?

No clinical scale available sensitive enough to relate length of the frenulum and articulation difficulties

No tool in predicting which kids will develop speech/mechanical problems

Most Children with articulation problems speech therapy is indicated and often all that is required.

When is Ankyloglossia a problem that needs treatment?

Feeding - A new baby with a too tight frenulum can have trouble sucking and may have poor weight gain. Such feeding problems should be discussed with your child's pediatrician who may refer you to an otolaryngologist—head and neck surgeon (ear, nose, and throat specialist) for additional treatment.

NOTE: Nursing mothers who experience significant pain while nursing or whose baby has trouble latching on should have their child evaluated for tongue tie. Although it is often overlooked, tongue tie can be an underlying cause of feeding problems that not only affect a child's weight gain, but lead many mothers to abandon breast feeding altogether.

Around the age of three, speech problems, especially articulation of the sounds / l / r / d / n / th / sh / and / z / may be noticeable. Evaluation may be needed if more than half of a three-year-old child's speech is not understood outside of the family circle. Although, there is no obvious way to tell in infancy which children with Ankyloglossia will have speech difficulties later, the following associated characteristics are common:

V-shaped notch at the tip of the tongue

Inability to stick out the tongue past the upper gums

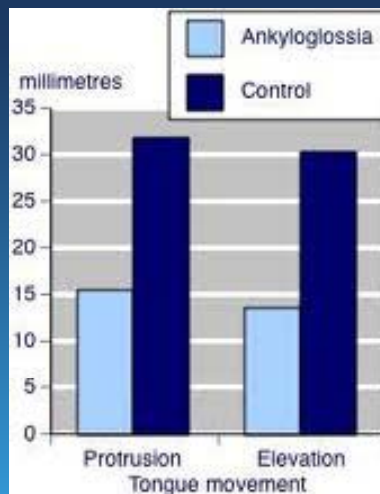
Inability to touch the roof of the mouth

Difficulty moving the tongue from side to side

As a simple test, caregivers or parents might ask themselves if the child can lick an ice cream cone or lollipop without much difficulty. For older children with tongue-tie, appearance can be affected by persistent dental problems such as a gap between the bottom two front teeth

Treatment of Ankyloglossia

If the child demonstrates any of the problems noted above, a frenulectomy (surgical release of the tongue) can be done. In past times, midwives used a sharpened fingernail to slit the frenulum immediately after birth

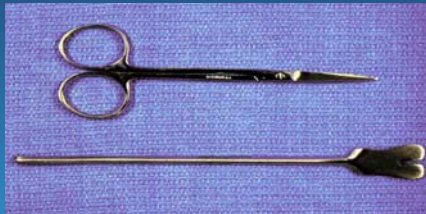


Infant Frenulectomy

- Frenulectomy can be done in the office with no anesthetics. In older children, the operation requires general anesthesia to ensure adequate cooperation from the patient to gain access to the floor of the mouth to perform the procedure.
- The frenulum is divided with scissors or with electrocautery. The band is thin, and generally requires no sutures.
- The procedure takes only a few minutes to perform. Tongue mobility is generally adequate to prevent adhesions from forming that may again limit tongue mobility

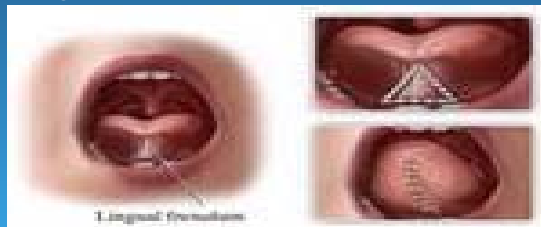
Treatment

- Frenotomy technique: Defined as cutting/division of the frenulum may be accomplished with topical anesthetic and minimal discomfort to the infant.



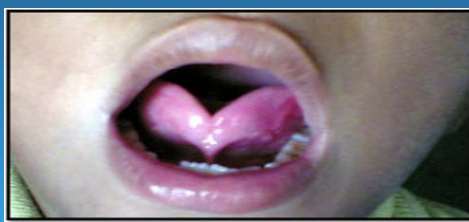
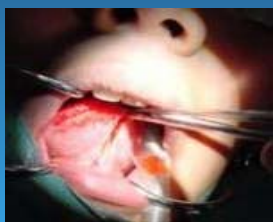
Frenulectomy with closure

- Older Children
- Thick/vascular Frenulum may require sutures/z-plasty
- This "Z-plasty" minimizes the risk of scar formation. Risks of frenulectomy are very low, but may include pain, minor bleeding, or infection.



Frenectomy

- Defined as the excision or removal of the frenum; Preferred procedure for patients with a thick and vascular frenulum where bleeding may be a possibility and or concern for scar tissue; wound is sutured closed; Done With GMA



Effectiveness of frenotomy for Infants

Table 5. Effectiveness of frenotomy for infants with ankyloglossia

STUDY	YEAR	N	TYPE OF STUDY	OUTCOME
Hogan et al ⁶	2005	1866: 201 with ankyloglossia; 56 had frenotomy	Randomized controlled trial	54/56 had improved breastfeeding mechanics and reduced nipple pain with frenotomy; 79% improved immediately, and an additional 16% improved within 48 h
Griffiths ⁶	2004	519 had frenotomy (215 were <3 mo)	Prospective uncontrolled cohort study	124/215 (57%) had improved feeding immediately; 174/215 (80%) had improved feeding at 24 h; 139/215 (65%) were still breastfed at 3 mo; 204/215 could extend tongue out of mouth at 3 mo
Ballard et al ⁶	2002	3036: 123 with ankyloglossia; 35 had frenotomy	Uncontrolled case series	Decreased mean maternal pain score from 6.9 (± 2.31) to 1.2 (± 1.52); increased comfort for 31/35 breastfeeding mothers
Masaitis and Kaempf ⁶	1996	2450: 36 had frenotomy	Case report	32/36 (89%) were breastfeeding 1 wk after procedure; 33/36 (92%) had normal tongue motion; 34/36 (94%) had appropriate growth at 3 mo; 36/36 (100%) reported normal criteria; 19/36 (53%) continued breastfeeding; 2/36 (0.5%) were weaned early due to breastfeeding problems
Marmet et al ⁶	1990	13: 7 had frenotomy	Case report	5/7 had improved latch and decreased nipple pain and had resolved slow weight gain and milk-supply difficulties; 1/7 had improved suck dynamics; and 1/7 showed no improvement
Feiss et al ⁶	1990	3: 2 had frenotomy	Case report	1 showed improved sucking, and weight gain normalized; 1 developed a lisp
Notestine ¹²	1990	2: 2 had frenotomy	Case report	1 mother had increased nipple comfort and less nipple trauma; 1 had increased comfort, and nipple distortion was resolved

Frenotomy Results Reviewed

- 7 Studies: poor methodological quality; Only one: randomized controlled trial
 - All Showed significant improvement in recorded outcomes after frenotomy
 - None described serious complications
 - In prospective nonrandomized cohort study, 80% had improved feeding 1 day after frenotomy

Conclusion:

- Ankyloglossia is an uncommon oral anomaly that can cause difficulty with breast-feeding, speech articulation, and mechanical tasks. For many years the subject of Ankyloglossia has been controversial, with practitioners of many specialties having widely different views regarding its significance.
- In many children, Ankyloglossia is asymptomatic; the condition may resolve spontaneously, or affected children may learn to compensate adequately for their decreased lingual mobility. Some children, however, benefit from surgical intervention (frenotomy or frenuloplasty) for their tongue-tie.
- Parents should be educated about the possible long-term effects of tongue-tie while their child is young (< 1 year of age), so that they may make an informed choice regarding possible therapy
- Early Intervention is ideal since it avoids habit formation and negative effects of failure: whether it is due to messy/slow eating/funny looking teeth/self-esteem/speech problems