

What is a tongue tie? Defining the anatomy of the lingual frenulum

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No conflict of interest to declare

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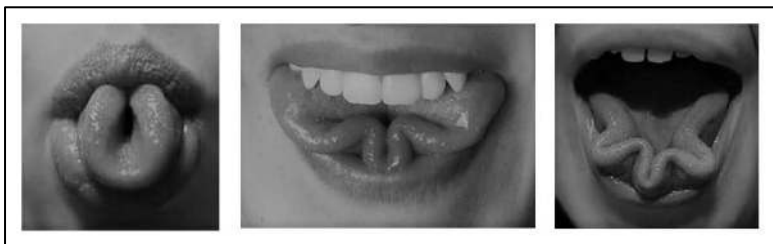
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Objectives of talk: To understand & appreciate:

- the tongue is a muscular hydrostat
- the lingual frenulum is:
 - a dynamic structure
 - formed by a layer of fascia & overlying mucosa
 - not a string/band/cord
 - has normal variability in appearance
- that “lingual frenulum” is not synonymous with “tie”
- the floor of mouth fascia has:
 - a primary role in suspension of the tongue
 - potentially conflicting roles of tongue stability versus mobility
- there is still a lot we don't know

What is a muscular hydrostat? ... The human tongue!

- An anatomical structure that consists of muscles essentially without skeletal support
- Muscles are orientated in different dimensions within structure (intrinsic tongue muscles)
- Shape and contour altering by which muscles contract/relax
- Volume of structure remains constant (incompressible)



What is the lingual frenulum?

- A dynamic structure that changes in shape & appearance with tongue movement
- A structure formed by a layer of fascia that spans across the floor of mouth, with the overlying mucosa
- It is not a midline cord, band, mast or string
- A structure with normal variability between individuals

“Lingual frenulum” is not synonymous with “tie”

Having a lingual frenulum is normal!!!

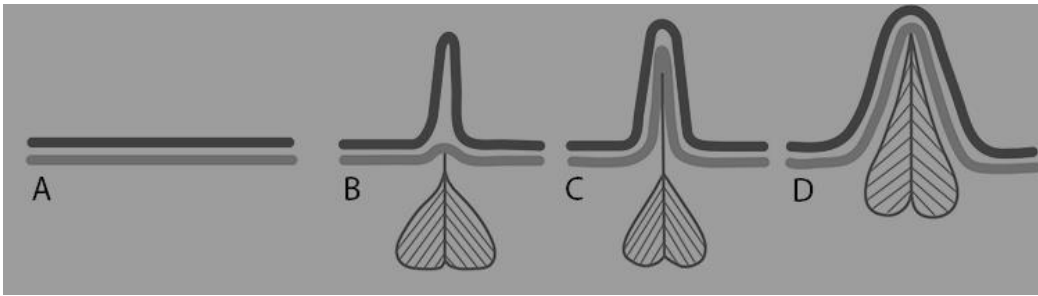
A lingual frenulum can be described by its morphology (appearance), which may include:

- Thin & transparent vs Thicker & Opaque vs Thick and less well defined (see diagram below)
- Height of attachment along ventral tongue (description only ≠ diagnosing or grading as tongue tie)
- Height of attachment to mandible (if elevated gives “Eiffel Tower” appearance when under tension)
- Length of frenulum between mandibular and ventral tongue attachments

Other important anatomical structures to include in examination:

- Anterior free length of tongue
- Mandible size and position
- Hard palate: height & contour, soft palate structure

ANATOMICALLY-BASED UNDERSTANDING OF LINGUAL FRENULUM STRUCTURE (COLOR VERSION IN PAPER)



DARK LINE: ORAL MUCOSA **GRAY LINE:** FLOOR OF MOUTH FASCIA, WITH **GENIOGLOSSUS** SUSPENDED FROM FASCIA

A: Tongue relaxed, floor of mouth fascia immediately beneath mucosa

B, C & D: Variations in frenulum morphology with tongue elevated to raise frenulum

B: "Transparent" frenulum - mucosal fold elevates above fascia to form fold, with fascia remaining low/at base of fold

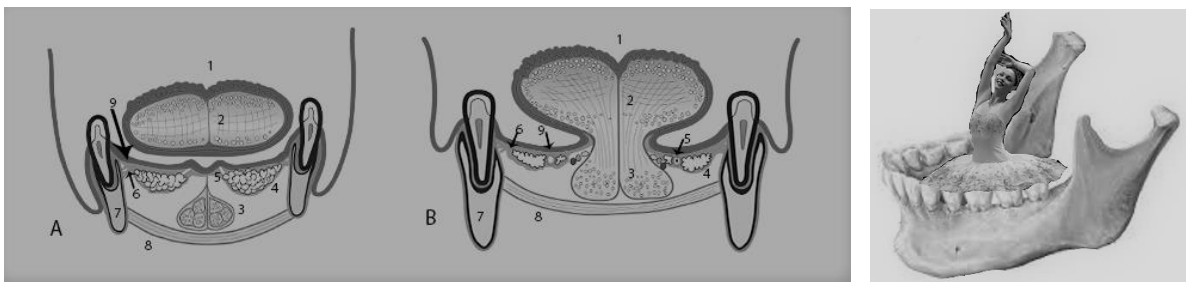
C: "Opaque" frenulum - mucosal and fascia elevate together to form fold

D: "Thick" frenulum" - mucosa and fascia elevate together, with genioglossus also drawn into fold

What is floor of mouth fascia?

- A fascial layer that:
 - Inserts around the inner surface of the mandible (immediately beneath the mucosa)
 - Spans across the floor of mouth
 - Merges centrally with the superficial dense connective tissue on the ventral tongue surface
 - Moves, as tongue movements create tension in the layer
 - Suspends the tongue, allowing extrinsic muscles to alter tongue position in the oral cavity
 - Has the (potentially conflicting) roles of providing tongue stability and maximising mobility
 - Has variability between individuals in:
 - Thickness and composition
 - Height of attachment in the midline (both to the mandible and to the ventral tongue)

DIAGRAM OF FLOOR OF MOUTH FASCIA: CORONAL SECTION (COLOR VERSION IN PAPER)



A: ANTERIOR FLOOR OF MOUTH (UNDER BLADE OF TONGUE)

B: SHOWING PARALINGUAL SPACE (UNDER LATERAL SIDES OF TONGUE)

1. Tongue - dorsal surface
2. Tongue - intrinsic muscles
3. Anterior fibers of genioglossus (in Diagram A: suspended from floor of mouth fascia, in Diagram B: merging into body of tongue)
4. Sublingual glands (enveloped by and suspended from floor of mouth fascia)
5. Submandibular duct (in Diagram A: entering ampulla at mucosal surface, in Diagram B: embedded in fascia with sublingual glands)
6. Floor of mouth fascia - spans floor of mouth (insertion into mandible immediately beneath oral mucosa)
7. Mandible
8. Mylohyoid
9. Oral mucosa ("roof" of floor of mouth)

What Is a Tongue Tie? Defining the Anatomy of the In-Situ Lingual Frenulum

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Surgical release of the lingual frenulum (frenotomy) has become an increasingly common procedure, performed from birth through to adulthood. Surprisingly, detailed anatomy of the in-situ lingual frenulum has never been described, and no anatomical basis has been proposed for the individual variability in frenulum morphology. The lingual frenulum is frequently referred to as a "cord" or "sub-mucosal band" of connective tissue, yet there is no evidence to support this anatomical construct. This paper aims to describe the anatomy of the in-situ lingual frenulum and its relationship to floor of mouth structures. Fresh tissue microdissection of the lingual frenulum and floor of mouth was performed on nine adult cadavers with photo-documentation and description of findings. The lingual frenulum is a dynamic structure, formed by a midline fold in a layer of fascia that inserts around the inner arc of the mandible, forming a diaphragm-like structure across the floor of mouth. This fascia is located immediately beneath the oral mucosa, fusing centrally with the connective tissue on the tongue's ventral surface. The sublingual glands and submandibular ducts are enveloped by the fascial layer and anterior genioglossus fibers are suspended beneath it. Lingual nerve branches are located superficially on the ventral surface of the tongue, immediately deep to the fascia. The lingual frenulum is not a discrete midline structure. It is formed by dynamic elevation of a midline fold in the floor of mouth fascia. With this study, the clinical concept of ankyloglossia and its surgical management warrant revision. *Clin. Anat.* 00:000-000, 2019.

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Defining the Anatomy of the Neonatal Lingual Frenulum

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The lingual frenulum is recognized as having the potential to limit tongue mobility, which may lead to difficulties with breastfeeding in some infants. There is extensive variation between individuals in the appearance of the lingual frenulum but an ambiguous relationship between frenulum appearance and functional limitation. An increasing number of infants are being diagnosed with ankyloglossia, with growing uncertainty regarding what can be considered "normal" lingual frenulum anatomy. In this study, microdissection of four fresh tissue premature infant cadavers shows that the lingual frenulum is a dynamic, layered structure formed by oral mucosa and the underlying floor of mouth fascia, which is mobilized into a midline fold with tongue elevation and/or retraction. Genioglossus is suspended from the floor of mouth fascia, and in some individuals can be drawn up into the fold of the frenulum. Branches of the lingual nerve are located superficially on the ventral surface of the tongue, immediately beneath the fascia, making them vulnerable to injury during frenotomy procedures. This research challenges the longstanding belief that the lingual frenulum is a midline structure formed by a submucosal "band" or "string" and confirms that the neonatal lingual frenulum structure replicates that recently described in the adult. This article provides an anatomical construct for understanding and describing variability in lingual frenulum morphology and lays the foundation for future research to assess the impact of specific anatomic variants of lingual frenulum morphology on tongue mobility. *Clin. Anat.* 00:000-000, 2019.

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