Lingual Frenectomy: A Quantitative Surgical Perspective for Assessing Tongue Elevation

ABSTRACT: The purpose of this report is to provide a novel perspective of how using mathematics can provide a "quantitative" perspective for potential gains from surgery or losses from re-adhesion

The lingual frenum is a mucosa connecting the floor of the mouth with the ventral surface of the tongue or in rare cases, the alveolar ridge. The movement and function of the tongue can be affected by the frenum. The thickness of the frenum can vary from diaphanous (thin and veil-like) to a thick, bulky chord-like or even appear web-like. The shape of the frenum can be notched, cupped, heart-shaped, square, rounded, or blunted.

Ankyloglossia (tongue-tie) is a congenital anomaly where the child is born with an abnormally short or thick lingual frenulum that limits the movement of the tongue. This anomaly is associated with difficulty breastfeeding due to trouble latching on, associated nipple pain, infection, and inadequate milk supply.[1] Ankyloglossia can also be related to other health issues such as feeding problems, oral hygiene concerns, speech problems, and developmental and social consequences. Studies have indicated that this congenital anomaly occurs in 4-10 % of 3.86 million births that occur each year (2017 data) which translates to 154,400-386,000 instances of tongue-tie annually.[2]

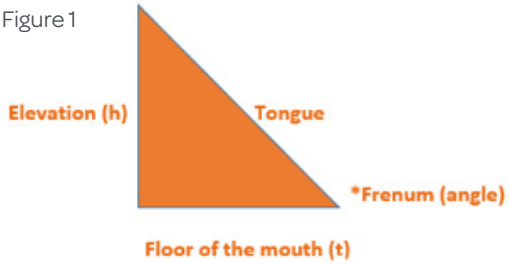
Determining tongue-tie should be made first on function and second on morphology. Most evaluation formats can assess tongue tie on function and morphology, but there is no quantitative measure in which to evaluate gain from surgery or loss from re-adhesion postoperatively.

Dr. Ligh has developed a new quantitative assessment, Ligh's Rule of Tongue, that provides a novel quantitative perspective for potential gains from surgery of losses from re-adhesion.
Utilizing this quantitative method of measurement contributes to positive outcomes when used in conjunction with electrocautery during a lingual frenectomy procedure.

The human tongue divides into anterior and posterior parts by the terminal sulcus, which is a V-shaped groove. The anterior oral part is the visible part situated at the front and makes up roughly 2/3's of the tongue's length. The posterior pharyngeal is the part closest to the throat, approximately 1/3 of the total length. According to G.B. Hopkins, the average length increases from 39.9 mm (neonatal) to 79.8 mm (adult).

Patients with tongue-tie often have a tethering or limitation of the tongue's ability to elevate or lift towards the palate or backside of the incisors after the teeth have erupted. These patients can experience many detrimental issues and contributory effects. "Ligh's Rule of Tongue," enables the application of mathematical formulas derived from trigonometry to predict the elevation gain of a frenectomy or tongue-tie release. This application increases the angle of the tongue with the floor of the mouth.

Figure 1



The diagram above depicts sin θ =h/t, and according to trigonometric function, (sine) is opposite over hypotenuse. Solving for h gives an expression of the tip of the tongue given the angle, h = t sin θ.

Viewing the tongue in a sagittal perspective in relationship to the floor of the mouth, we can picture a right triangle. If the tongue has an incomplete fixation to the floor of the mouth, the angle is 0 degrees or is a confluent straight line with the floor of the mouth. If the tongue can elevate to an angle perpendicular to the floor of the mouth, this is 90 degrees.

SURGICAL PERSPECTIVE OF POTENTIAL GAIN FROM SURGERY OR LOSSES FROM RE-ADHESION

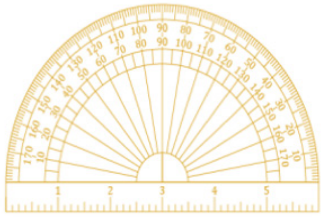


Figure 2

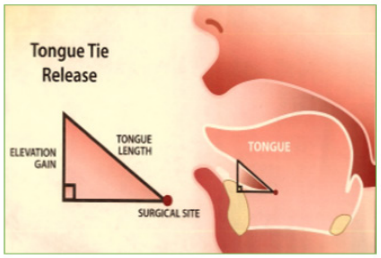


Figure 3

A tongue hinges at the back of the mouth. If a right triangle is drawn using the entire length of the tongue as the hypotenuse, we can apply trigonometric ratios to calculate the gain in elevation of the tip of the tongue with a change in the angle at the frenum location caused by a frenectomy or frenum release. (Figure 2) This calculation also underscores the importance of preventing re-adhesion after surgery because even a small change in the angle represents a more significant loss in the elevation. (Figure 3)

We can now measure and document the quantitative pre- and post-procedural angles in terms of Theta angle in degrees (θ) and h (elevation of the tongue at the tip in mm). This measurement allows us to assess the benefits (elevation gain) of frenectomy procedures quantitatively. This method can also give us data post-procedure if there are symptoms of re-adhesion.

It is important for the reader to appreciate that with even a slight 10 degree change this could result in a 6 mm elevation change which is SIGNIFICANT.

Dr. Ligh uses instruments that provide proper visualization, tissue deflection, and the medications and devices necessary to facilitate the procedure. To learn more, please see Dr. Ligh's white paper, Lingual Frenectomy with Electrocautery, is available online at http://www.boviemedical.com/wp-content/uploads/2018/08/lingual-frenectomy-with-electrocautery-white-paper_mm0165-00.pdf .

Dr. Ligh utilizes Bovie® fine tip electrocautery, a safe, effective, and efficient technique, for a lingual frenectomy. He has found that the advantages of using the Bovie® electrocautery line in frenectomy procedures include:

- Minimal need for post-op analgesics,
- Minimal bleeding,
- Ideal visibility/bloodless operating field,
- No Sutures,
- Less swelling and discomfort,
- Reduced risk of infection,
- Minimal procedure time,
- No need for eye protection,
- No generator or laser to crowd the operative arena, and
- Minimal safety hazard to the patient and healthcare team.

Achieving quantitative results with a mathematic viewpoint underscores the quantitative perspective and the effect of small changes both at surgery (release) and during healing (re-adhesion). Bovie® hand-held electrocautery provides a formula for a successful and safe frenectomy procedure.

Randy Ligh, DDS, MA, FAAC, FACD, CLEC, received his Bachelor of Arts degree from the University of California at Berkley. He went on to receive his DDS from Temple University in Philadelphia. Dr. Ligh completed his Pediatric Dental Residency at Martin Luther King, Jr. General Hospital/UCLA . He is a Diplomate of the American Board of Pediatric dentistry, a Fellow of the American Academy of Pediatric Dentistry, and a Certified Lactation Education Counselor. Dr. Ligh was an Associate Professor of Pediatric Dentistry at the University of the Pacific School of Dentistry. He is a popular lecturer and has authored numerous publications.