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Sleep Surgeon
Otolaryngology (ENT) – Maxillofacial Surgery

**Restrictive lingual frenulum as a phenotype for
upper airway resistance syndrome and
obstructive sleep apnea.**



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Health



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MEDICINE

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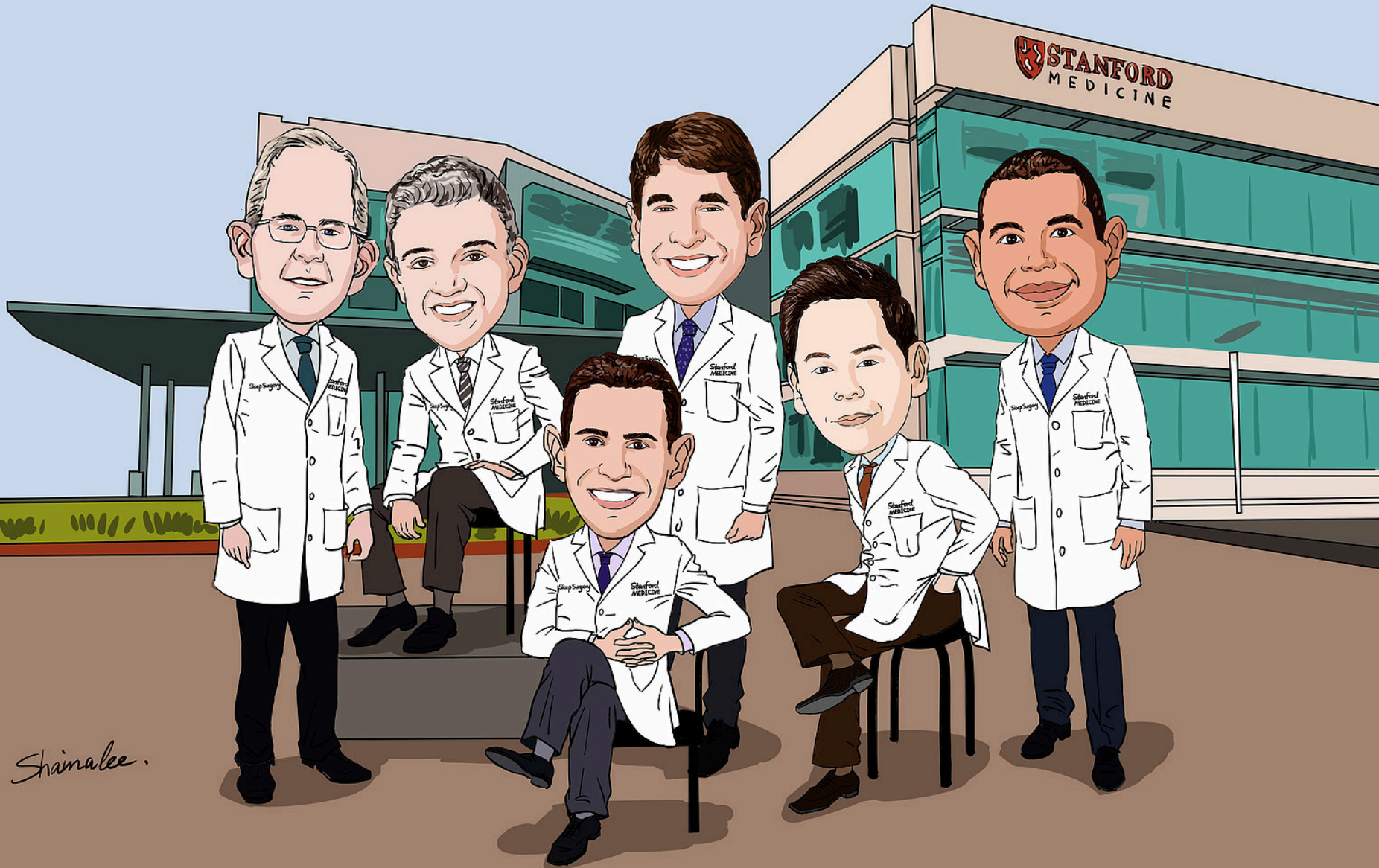
Learning Objectives

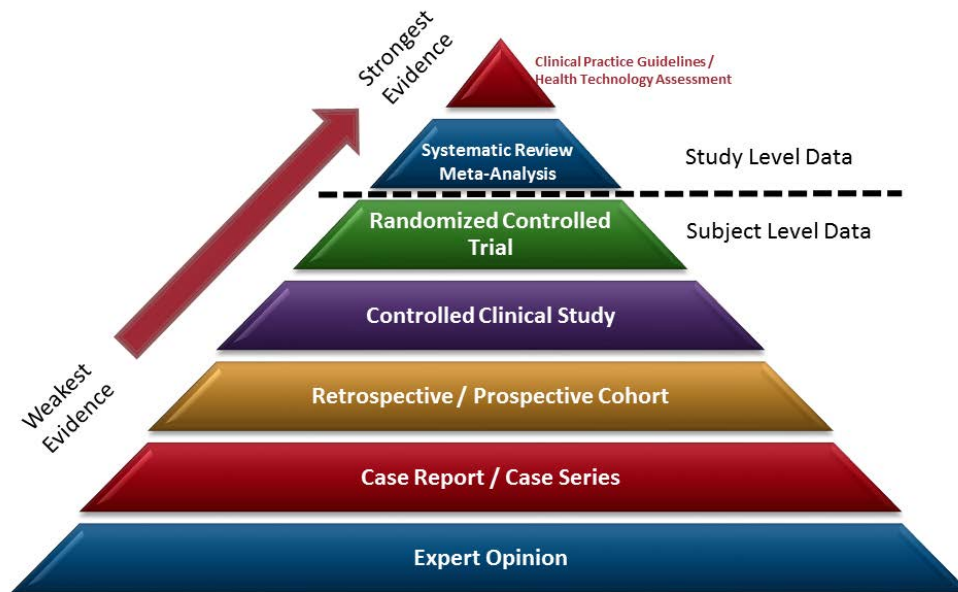
Learning Objectives:

- Understand the recent research that supports restricted lingual frenulum as phenotype of OSA.
- To appreciate tongue range of motion ratio as a communication tool for tongue-tie severity.
- To recognize the value of primary intention closure in wound healing.
- Explain the importance of myofunctional therapy as an essential component in optimizing the results of surgical treatment.

I have no financial disclosures to report.

Stanford Sleep Surgery Fellowship Alumni Network
Clinical Research: Study Design and Statistical Analysis





Strength	Level	Design	Randomization	Control
High	Level 1	Randomized control trial (RCT)	Yes	Yes
		Meta-analysis of RCT with homogeneous results	No	
	Level 2	Prospective comparative study (therapeutic)	No	Yes
		Meta-analysis of Level 2 studies or Level 1 studies with inconsistent results	No	
	Level 3	Retrospective Cohort Study	No	Yes
		Case-control Study	No	Yes
		Meta-analysis of Level 3 studies	No	
Low	Level 4	Case Series	No	No
	Level 5	Case Report	No	No
		Expert Opinion	No	No
		Personal Observation	No	No

A frequent phenotype for paediatric sleep apnoea: short lingual frenulum

Christian Guilleminault, Shehlanoor Huseni and Lauren Lo

Affiliation: Stanford University Sleep Medicine Division, Redwood City, CA, USA.

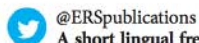
Correspondence: Christian Guilleminault, Stanford University Sleep Medicine Division, 450 Broadway, (Pavillion C 2nd floor), Redwood City, CA 94063, USA. E-mail: cguil@stanford.edu

ABSTRACT A short lingual frenulum has been associated with difficulties in sucking, swallowing and speech. The oral dysfunction induced by a short lingual frenulum can lead to oral-facial dysmorphism, which decreases the size of upper airway support. Such progressive change increases the risk of upper airway collapsibility during sleep.

Clinical investigation of the oral cavity was conducted as a part of a clinical evaluation of children suspected of having sleep disordered breathing (SDB) based on complaints, symptoms and signs. Systematic polysomnographic evaluation followed the clinical examination. A retrospective analysis of 150 successively seen children suspected of having SDB was performed, in addition to a comparison of the findings between children with and without short lingual frenula.

Among the children, two groups of obstructive sleep apnoea syndrome (OSAS) were found: 1) absence of adenotonsils enlargement and short frenula ($n=63$); and 2) normal frenula and enlarged adenotonsils ($n=87$). Children in the first group had significantly more abnormal oral anatomy findings, and a positive family of short frenulum and SDB was documented in at least one direct family member in 60 cases.

A short lingual frenulum left untreated at birth is associated with OSAS at later age, and a systematic screening for the syndrome should be conducted when this anatomical abnormality is recognised.



A short lingual frenulum left untreated at birth is associated with obstructive sleep apnoea syndrome at a later age <http://ow.ly/6kMQ30163nG>



Acknowledgements

We thank Soroush Zaghi (Stanford University Sleep Medicine Division, Redwood City, CA, USA) for his help with the statistical analyses.

Study Design

- 150 pediatric patients with OSA
 - Short frenulum (n=70)
 - Normal frenulum (n=80)

CEFAC
Saúde e Educação



LINGUAL FRENULUM PROTOCOL (Marchesan, 2014)

CLINICAL EXAMINATION

Name: _____	Gender: F () M ()
Examination date: ___/___/___	Age: ___ years and ___ months
Responsible: _____	Birth: ___/___/___
Relative: _____	

I – GENERAL TESTS

Measurements using a caliper. Larger or equal 50,1% (0) – Less or equal 50% (1) FINAL RESULT =

Take measurements from superior right or left incisive to the inferior right or left incisive. Consider the same tooth for all the measurements.	Value in millimeters
A. Open mouth wide	
B. Open mouth wide with the tongue tip touching the incise papilla	
Difference between the two measurements, in percentage	%



Alterations during tongue elevation (best result = 0 e worst result = 3) FINAL RESULT =

Open mouth wide; raise the tongue without touching the palate	NO	YES
A. Tip of the tongue's shape: oblong or square	(0)	(1)
B. Tip of the tongue- V-shape	(0)	(2)
C. Tip of the tongue's shape: like a heart	(0)	(3)

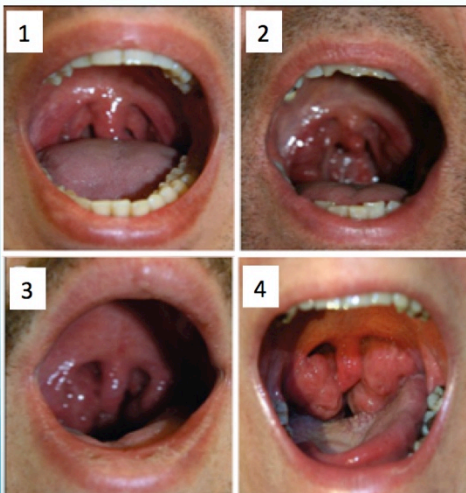
If the tongue is heart-shaped, consider this aspect only.



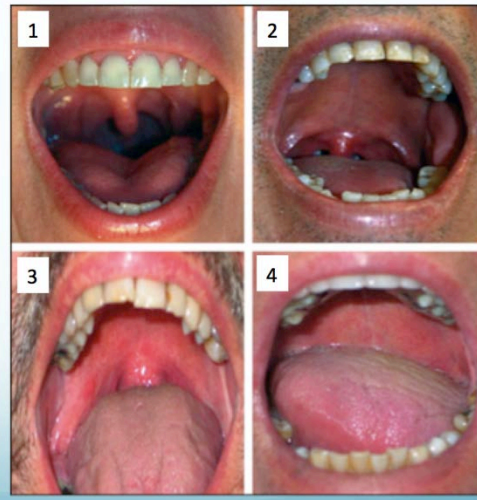
Study Design

- Other Physical Exam Findings
 - Tonsil Size: Grade 1-4
 - Mallampati Tongue Position: Grade 1-4
 - High Arched Palate: Yes/No

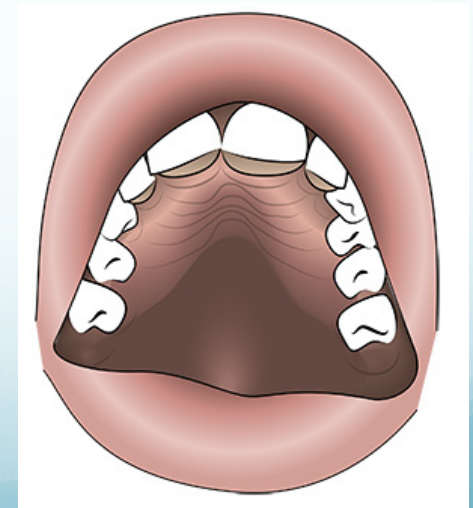
Tonsil Size



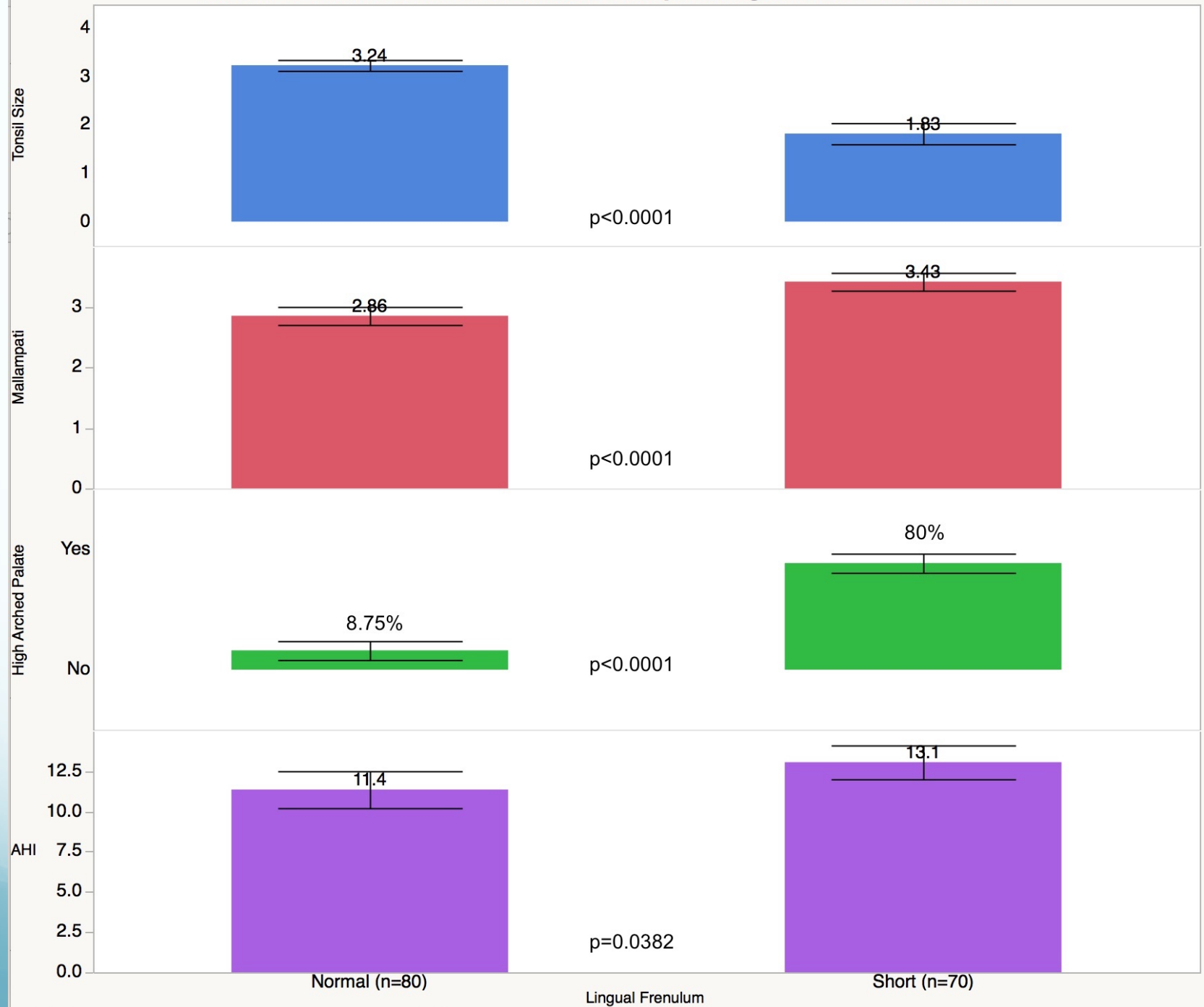
Mallampati Tongue Position



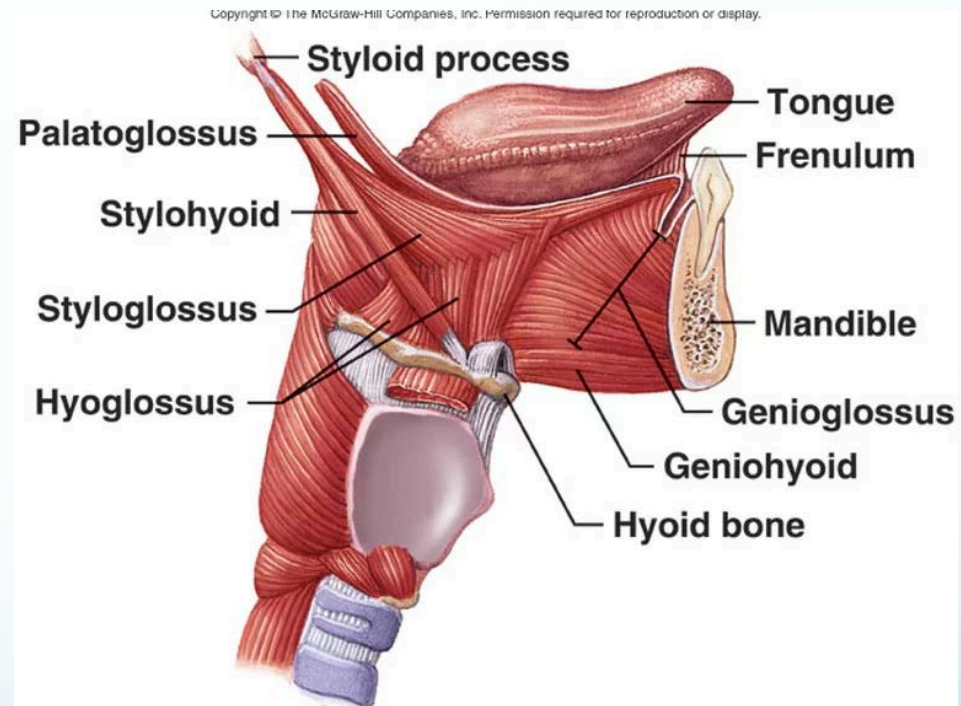
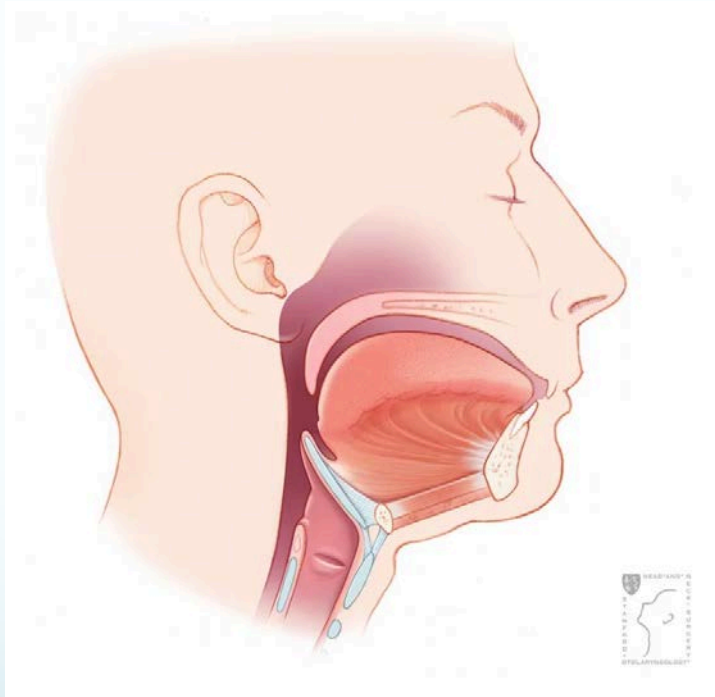
High Arched Palate

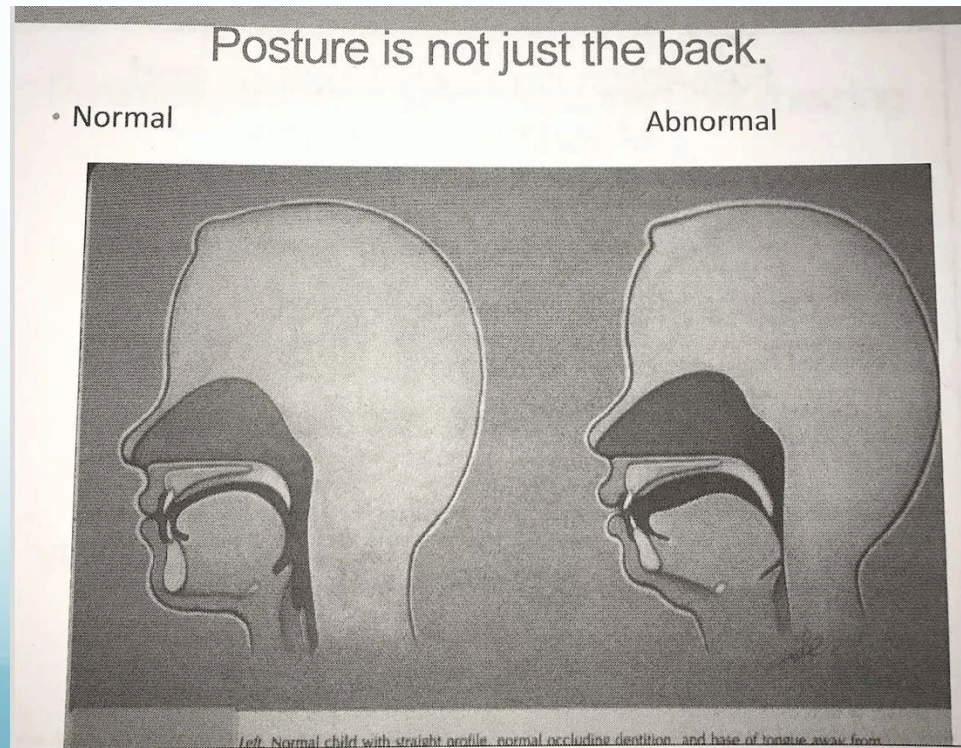


Short Frenulum vs. Tonsil Size, Mallampati, High Arched Palate, AHI



Tongue Mobility & Maxillofacial Development





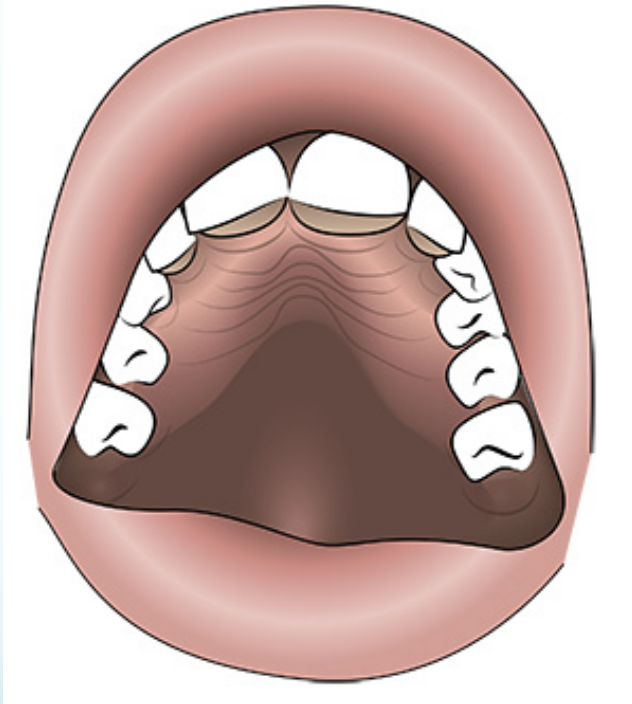
Maxillary deficiency



Narrow vs Wide
Maxilla



Nasal Obstruction and High Arched Palate

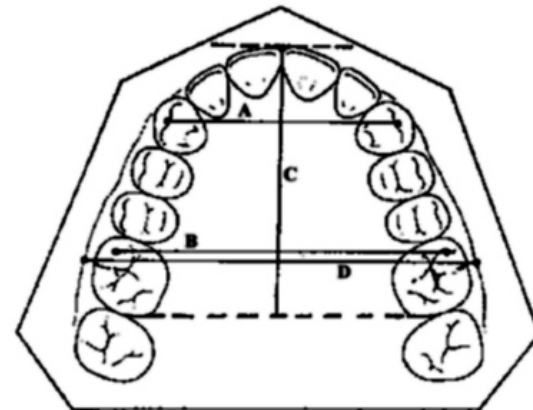


Ankyloglossia as a risk factor for maxillary hypoplasia: a functional – anatomical study.

Audrey Yoon DDS, MS¹; Soroush Zaghi MD^{2,3}; Sandy Ha BA⁴; Clarice S. Law DMD, MS¹; Christian Guillemineault DM, MD, DBiol⁵; Stanley Y.C. Liu MD, DDS².



MAXILLARY DENTAL CAST DIMENSIONS



Tongue – Tie: Yes or No?



Tongue – Tie



“Yes” or “No”?

➔ Does not really work to describe this “functional” ankyloglossia.

SCOVILLE CHILE HEAT CHART

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SCOVILLE HEAT UNITS

15,000,000
2,000,000-5,300,000
1,000,000
577,000
200,000-350,000
100,000-250,000
30,000-50,000
15,000-30,000
12,000-30,000
8,000-23,000
5,000-8,000
3,500-8,000
2,500-4,000
1,500-2,500
1,000-2,500
1,000-2,000
500-2,000
500-1,500

TYPES OF PEPPERS

Pure Capsaicin
U.S. Grade Pepper Spray
Bhut Jolokia
Red Savina
Habanero
Chiltepin
Cayenne
Arbol
Manzano
Serrano
Yellow Hot
Jalepeño Pepper
Guajillo
Chilaca
Pasilla
Pablano
Anaheim
Chile Verde

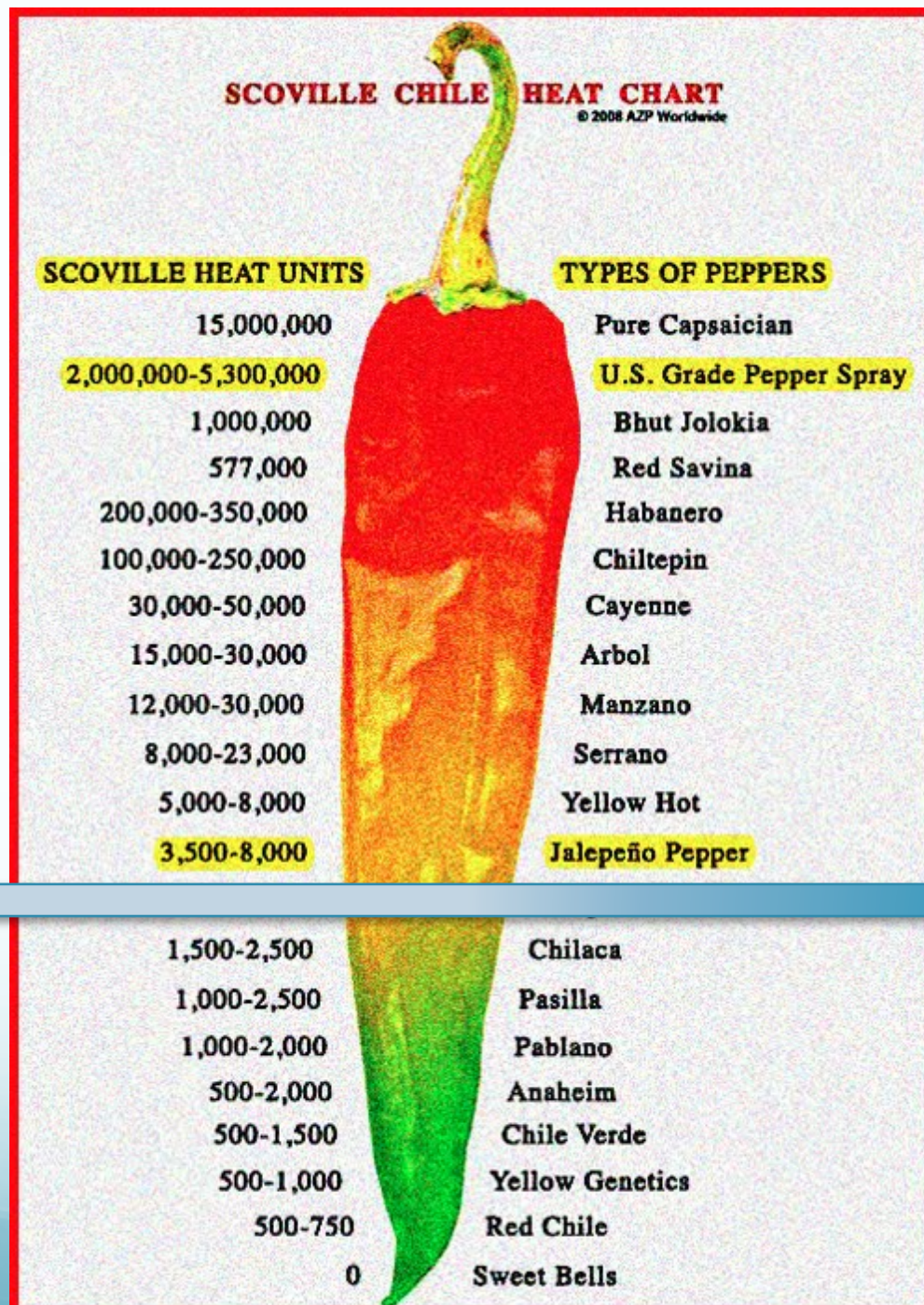
500-750

0

Red Chile

Sweet Bells





Toward a functional definition of ankyloglossia: validating current grading scales for lingual frenulum length and tongue mobility in 1052 subjects

Audrey Yoon¹ • Soroush Zaghi^{2,3} • Rachel Weitzman⁴ • Sandy Ha⁵ • Clarice S. Law¹ • Christian Guilleminault⁶ • Stanley Y.C. Liu²

Received: 18 October 2016 / Revised: 25 November 2016 / Accepted: 28 December 2016
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Abstract

Purpose Alterations of the lingual frenulum may contribute to oromyofacial dysfunction, speech and swallowing impediments, underdevelopment of the maxillofacial skeleton, and even predispose to sleep breathing disorder. This study aims to assess the utility of existing instruments for evaluation of restricted tongue mobility, describe normal and abnormal ranges of tongue mobility, and provide evidence in support of a reliable and efficient measure of tongue mobility.
Methods A prospective cohort study of 1052 consecutive patients was evaluated during a 3-month period. Age, gender, ethnicity, height, weight, BMI, maximal interincisal mouth opening (MIO), mouth opening with tongue tip to maxillary incisive papillae at roof of mouth (MOTTIP), Kotlow's free-tongue measurement, and presence of severe tongue-tie were recorded. Secondary outcome measures include tongue range of motion deficit (TRMD, difference between MIO and MOTTIP) and tongue range of motion ratio (TRMR, ratio of MOTTIP to MIO).

Results Results indicate that MIO is dependent on age and height; MOTTIP and TRMD are dependent on MIO; Kotlow's free-tongue measurement is an independent measure of free-tongue length and tongue mobility. TRMR is the only independent measurement of tongue mobility that is directly associated with restrictions in tongue function.

Conclusions We propose the use of tongue range of motion ratio as an initial screening tool to assess for restrictions in tongue mobility. "Functional" ankyloglossia can thus be defined and treatment effects followed objectively by using the proposed grading scale: grade 1: tongue range of motion ratio is >80%, grade 2 50–80%, grade 3 < 50%, grade 4 < 25%.

Keywords Ankyloglossia • Frenulum • Tongue tie • Oromyofacial dysfunction • Classification of ankyloglossia • Tongue tie grading scale

Introduction



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Kotlow, L. A. (1999). "Ankyloglossia (tongue-tie): a diagnostic and treatment quandary." Quintessence International **30**(4).



Kotlow's Free-Tongue Measurement:

Ages 18 months to 14 years

Clinically acceptable, normal range of free tongue: greater than 16 mm.

Class I: Mild ankyloglossia: 12 to 16.

Class II: Moderate ankyloglossia: 8 to 11 mm

Class III: Severe ankyloglossia: 3 to 7 mm

Class IV: Complete ankyloglossia: < 3 mm

15 mm = Mild Ankyloglossia

Kotlow, L. A. (1999). "Ankyloglossia (tongue-tie): a diagnostic and treatment quandary." Quintessence International **30**(4).



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Class III: Severe ankyloglossia: 3 to 7 mm

Class IV: Complete ankyloglossia: < 3 mm

31 mm → Normal

Functional Classification of Ankyloglossia Based on Tongue Range of Motion Ratio (TRMR)



Grade 1 Functioning: TRMR > 80%



Grade 2 Functioning: TRMR 50-80%



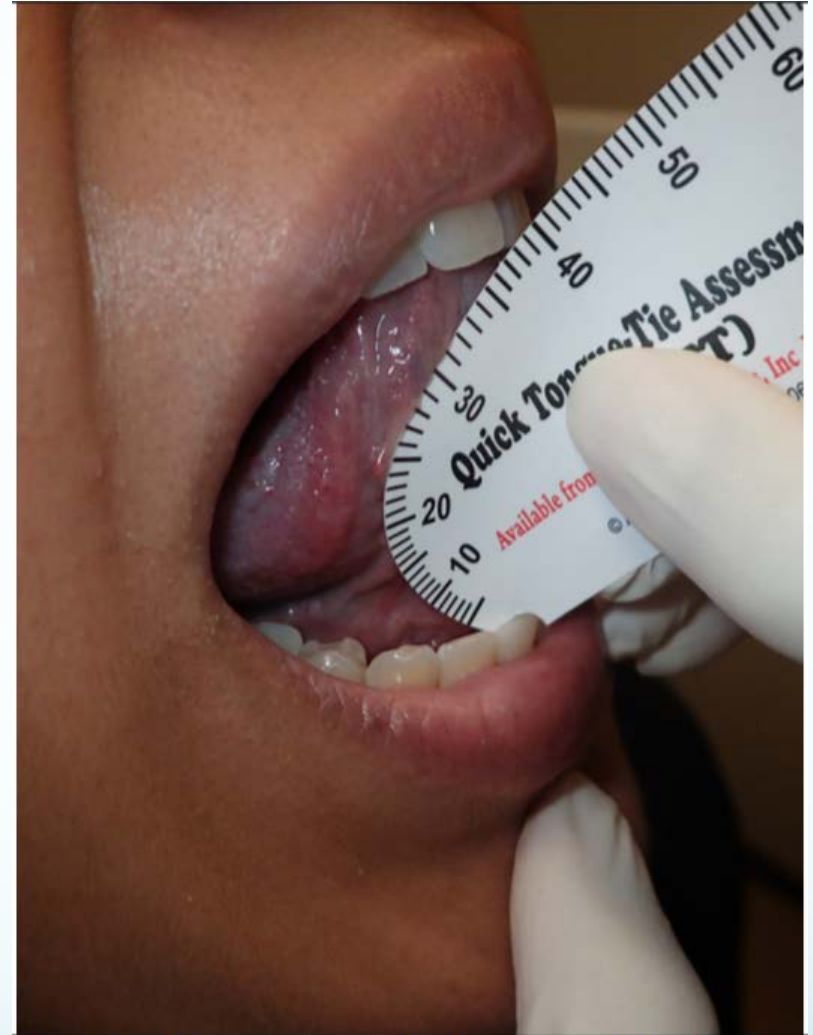
Grade 3 Functioning: TRMR < 50%



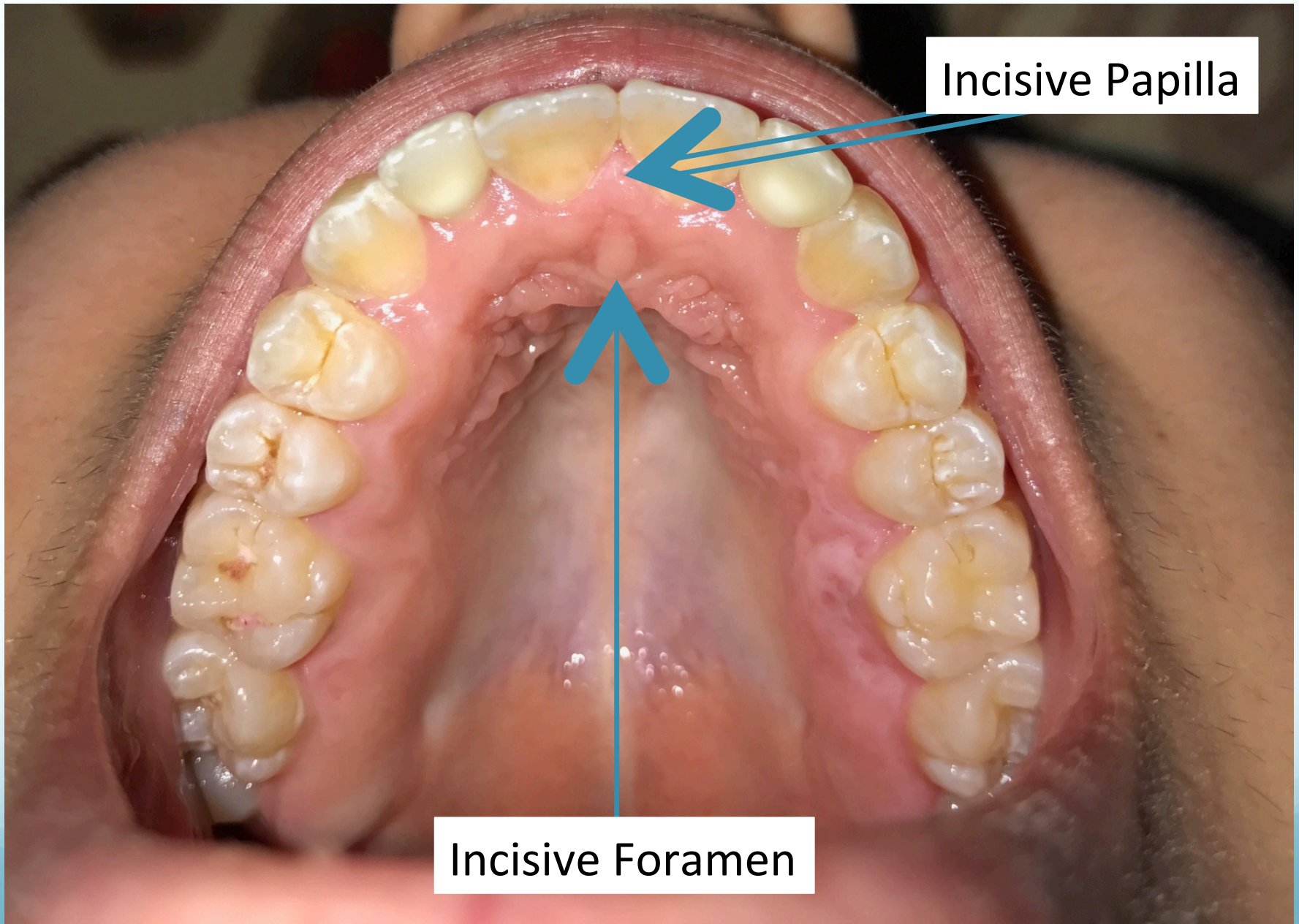
Grade 4 Functioning: TRMR < 25%



Maximal Interincisal Mouth Opening
(MIO, Example: 50 mm)



Mouth Opening with Tongue Tip to
Incisive Papilla
(MOTTIP, Example: 38 mm)



Incisive Papilla

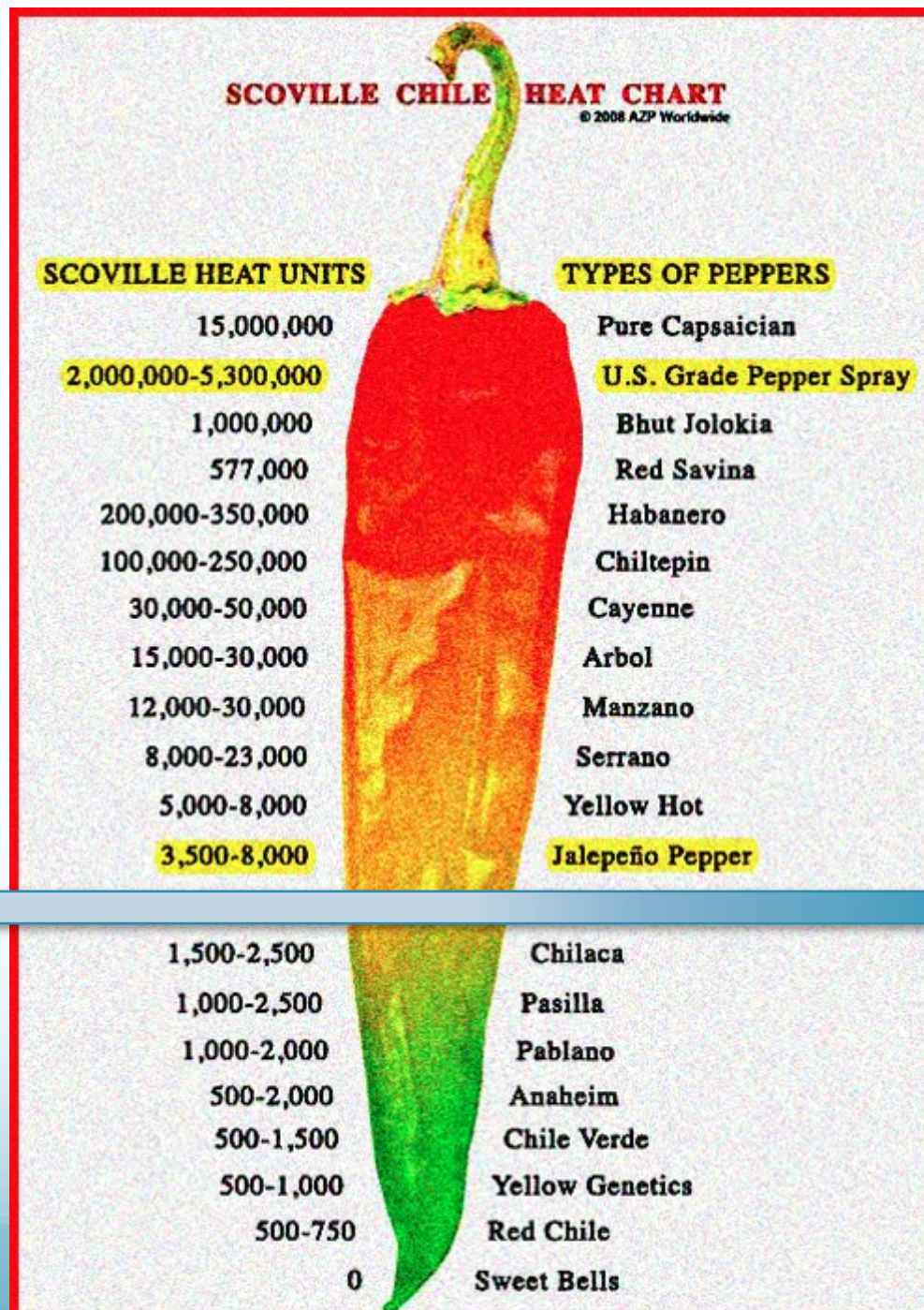
Incisive Foramen

Grade 4 TRMR
(<25% mobility)

Grade 3 TRMR
(<50% mobility)

Grade 2 TRMR
(50-80% mobility)

Grade 1 TRMR
(>80% mobility)



CONCLUSION—

Toward a functional definition of ankyloglossia: validating current grading scales for lingual frenulum length and tongue mobility in 1052 subjects

We propose the use of TRMR as an initial screening tool to assess for restrictions in tongue mobility, where a normal value for TRMR is between 51- 77% (this represents the $M \pm 1$ SD to include 68% of the population).

Values below 46% can be considered significantly below average (bottom 10%), and values greater than 80% represent significantly above average functioning (top 10%).

With the high reliability and precision of TRMR in assessing tongue mobility, not only can “functional” ankyloglossia be defined, treatment effects of myofunctional therapy and/or extension lingual frenuloplasty can then be followed objectively.

This allows clinicians of various disciplines **to effectively communicate tongue mobility** and associated nasal and oral functions as they pertain to facial development. More advanced lingual frenulum protocols could be used to further characterize the specific alterations to the frenulum that render a functional impairment.

Tongue Range of Motion Ratio Objective Tool to Assess *Tongue Mobility*

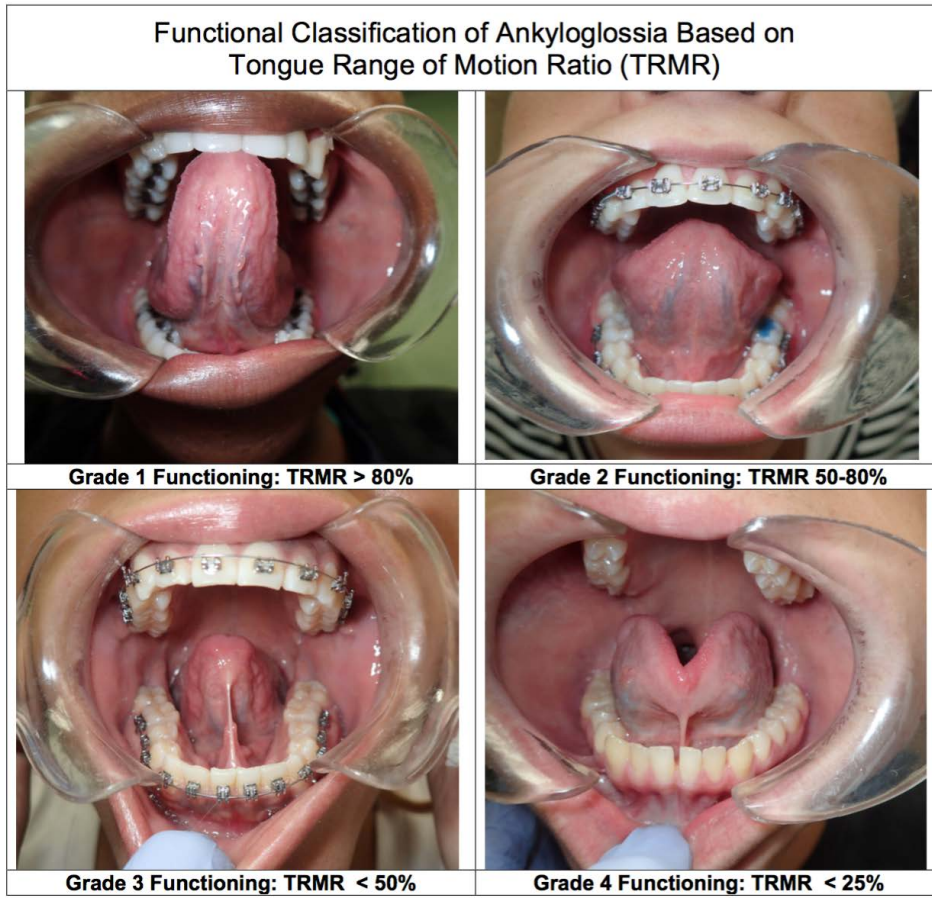


Fig.6 A grading scale for the functional classification of ankyloglossia is proposed based on the TRMR (ratio of MOTTIP to MIO).

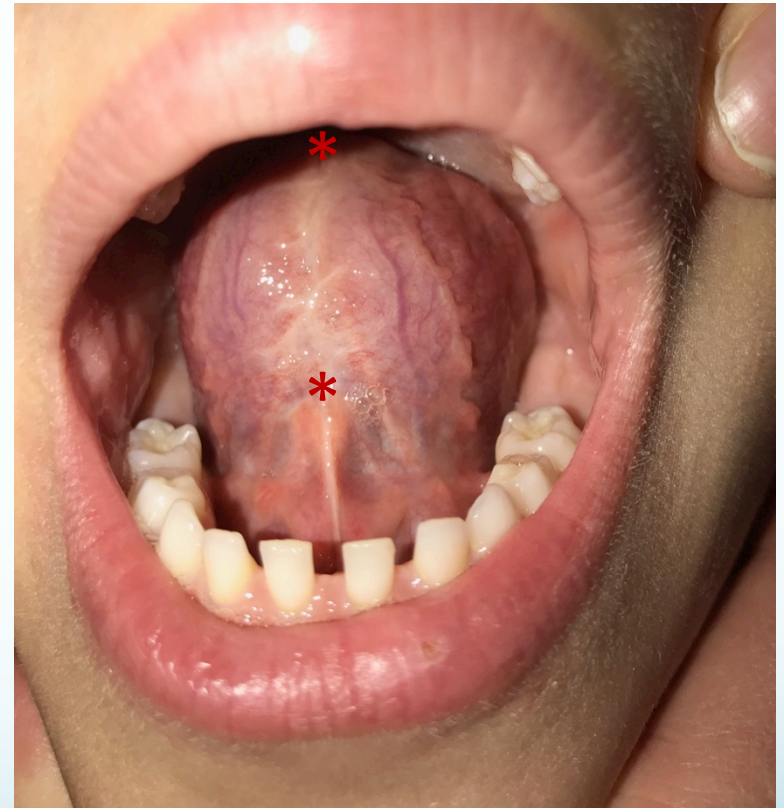
Grade 1: tongue range of motion ratio is >80%, grade 2 50–80%, grade 3 <50%, grade 4 <25%.

Higher grades reflect decreased tongue mobility and increased severity of tongue tie. The photos here demonstrate the deficit in the mobility of the tongue tip relative to MIO.

With increasing ankyloglossia, the tongue tip is unable to touch the incisive papilla unless the mouth opening is closed to some extent.

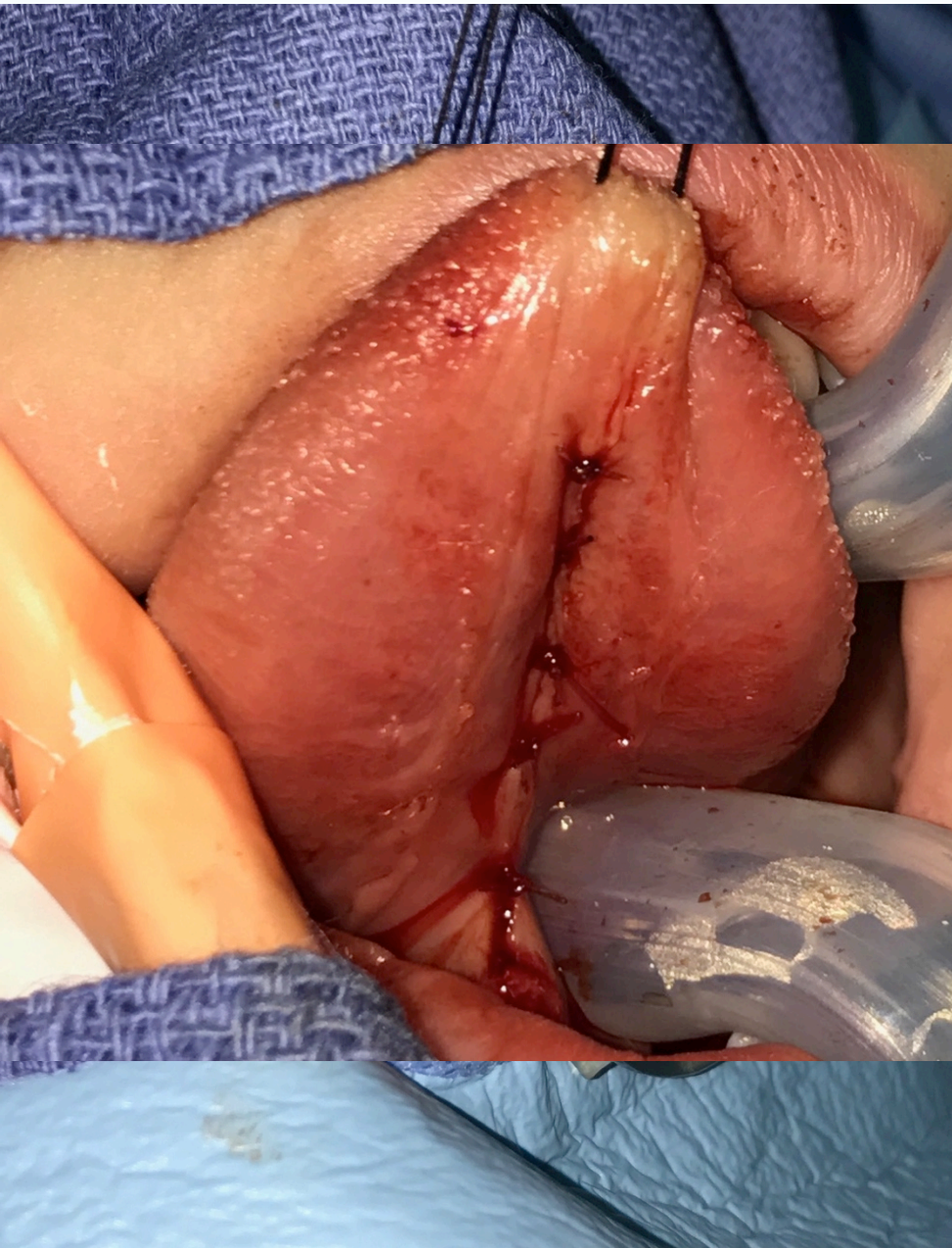
Considering grade 3, mouth opening is limited to 50% of maximal opening in order for the tongue tip to reach the incisive papilla. For grade 4, mouth opening is limited to 25% of MIO for the tongue tip to reach the incisive papilla.

8 Weeks Post-Frenuloplasty

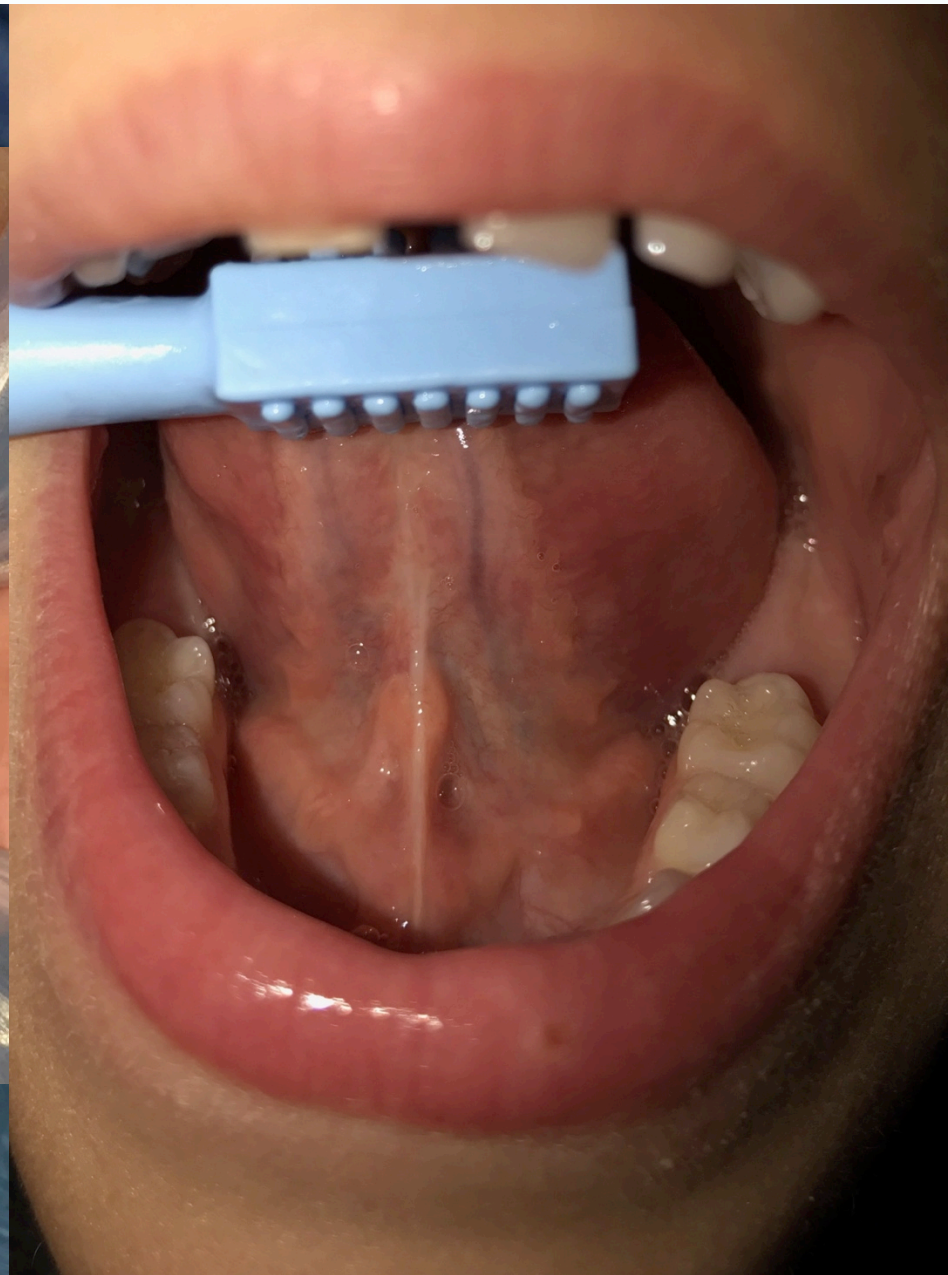


"He really has a large range of motion that he is learning how to use with the exercises. Doing great now with his new tongue thanks to you. "

Day of Surgery



8 Weeks Later

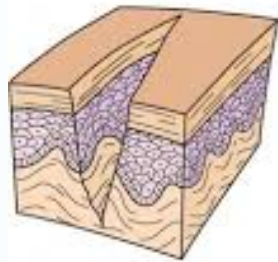


1 Week Post-Op

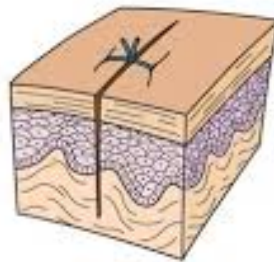


Wound Healing

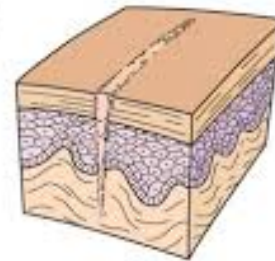
Primary intention



Clean incision

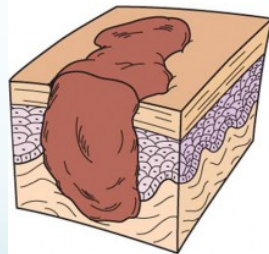


Early suture

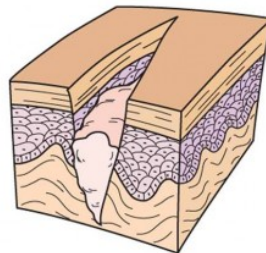


"Hairline" scar

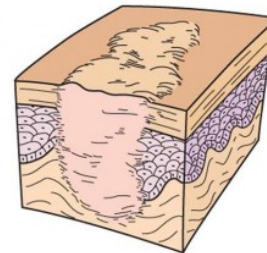
Secondary intention



Gaping wound
with blood clot



Granulation tissue
fills in wound



Large scar

Frenuloplasty Standards

Goal #1: Optimize outcomes after frenulum release.

- Primary intention healing
- Minimize scarring due to cautery / laser
- MYOFUNCTIONAL THERAPY

Goal #2: Completely release the frenulum.

“Myofunctional Frenuloplasty”

- Mucosal frenulum
- Sub-mucosal attachments (deep or posterior tongue-tie)

Frenuloplasty: WHY I do it In Adults

59 year-old female with a long history of headaches, chronic sinus infections, forward head posture, jaw tension, and cervical neck discomfort.

- Prior “incomplete” frenectomy at age 7.
- Maxillary expansion that was completed 3-4 years ago → resolved her sinus infections.
- Now presenting with worsening sleep quality over the last few years and especially the past 4-5 months.



**Baseline
Pre-Operative**



Grade 2 Mobility

**1 Month
Post-Operative**



Grade 1 Mobility

**Immediate
Post-Operative**



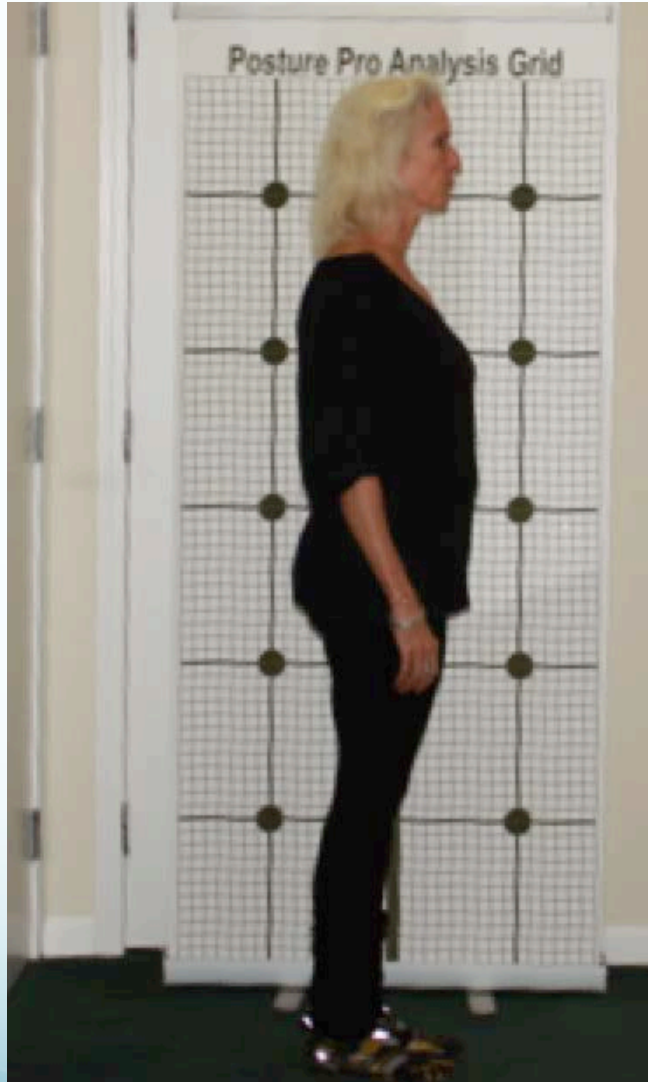
Grade 2 Mobility

**1 Month
Post-Operative**

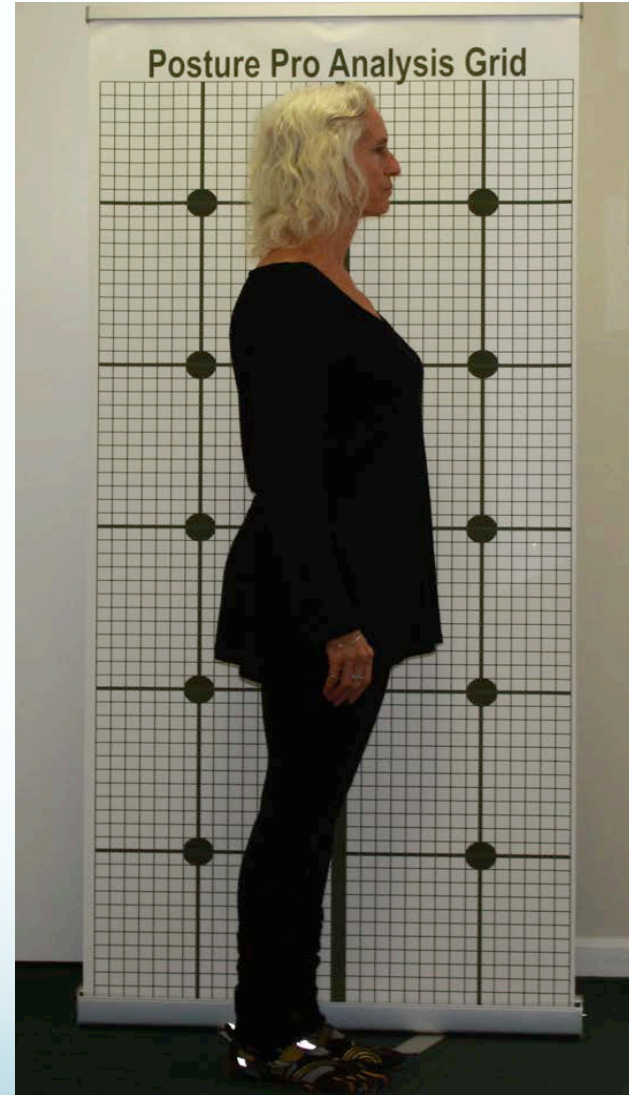


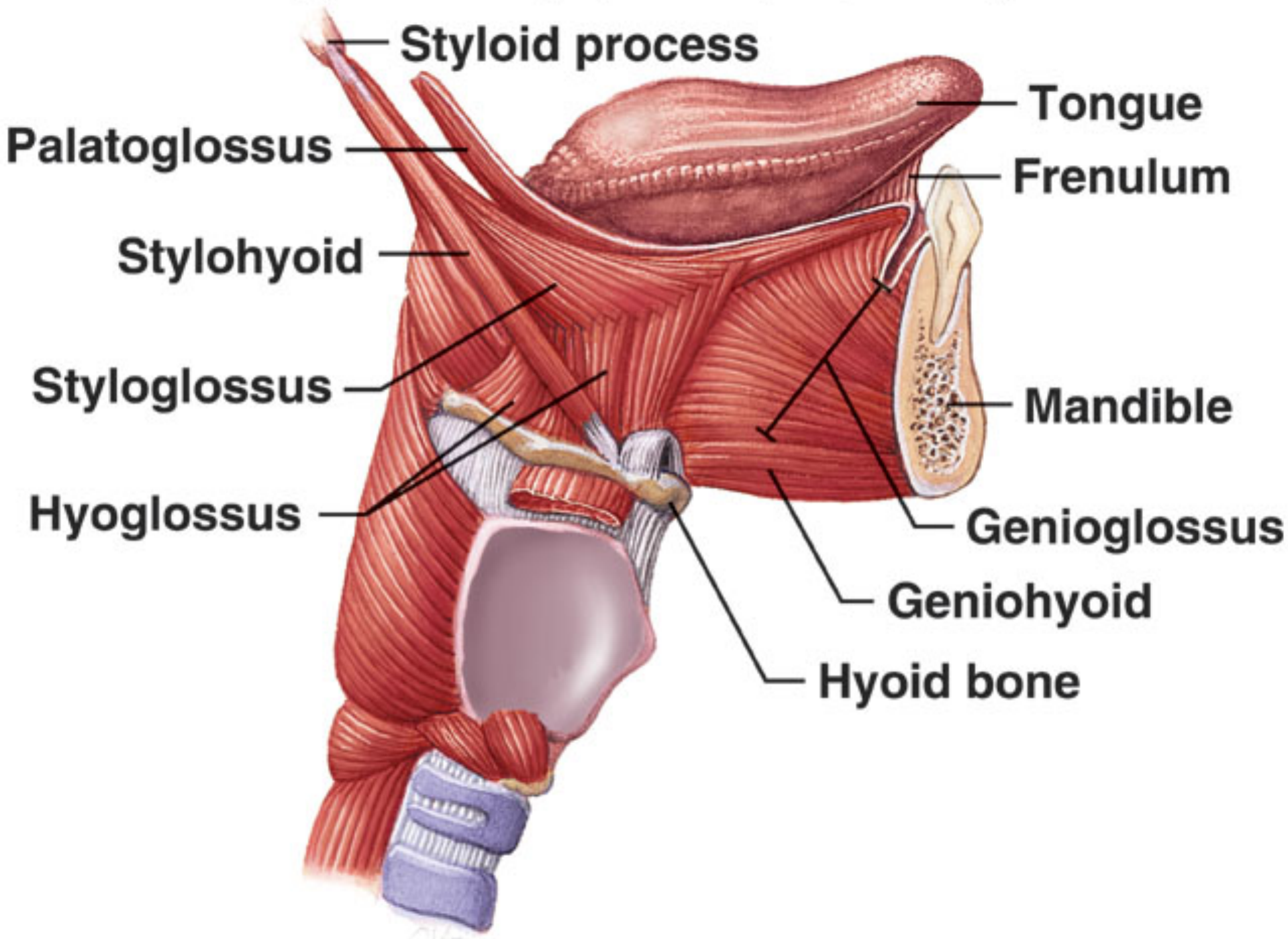
Grade 1 Mobility

Baseline Pre-Operative



Immediate Post-Operative





Frenuloplasty: HOW I do it In Adults



































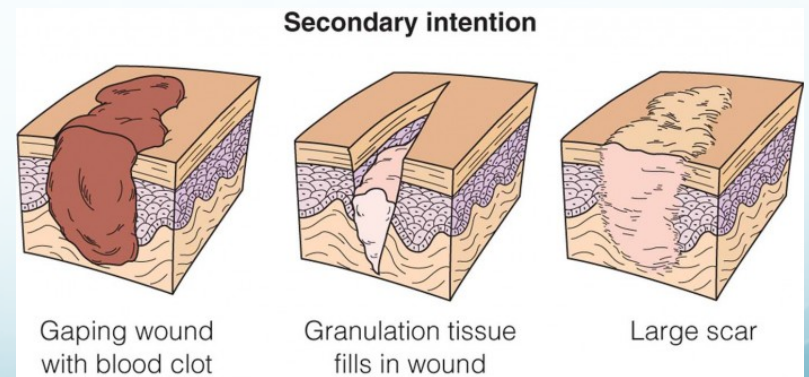
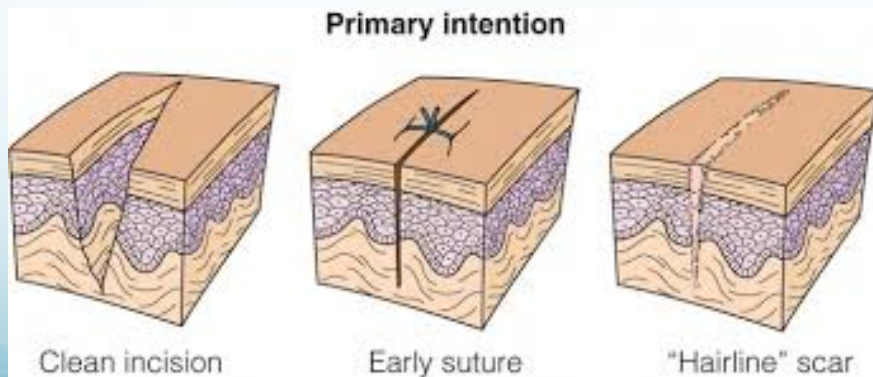
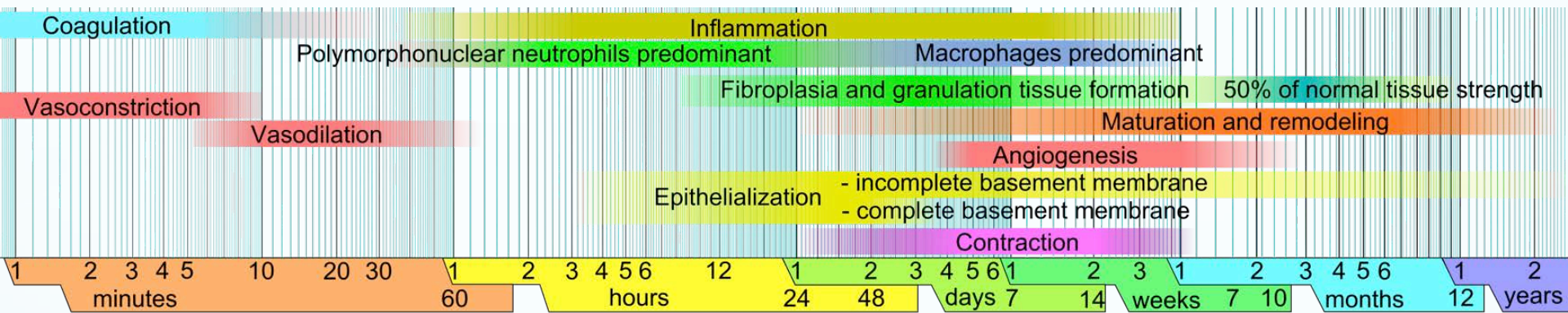
5 Days Post-Op



3 weeks later



Wound Healing



3 weeks



4 weeks



Myofunctional Therapy



Highly Effective Physical Therapy Exercises to Improve Breathing, Bite, and Orofacial Posture

Name: _____

Next Visit:

Date/Time:

Week: Frenectomy Follow Up...Day 1to 7

Sheet

#

Exercises

Monday

Tuesday

Wednesday

Thursday

Friday

Saturday

Sunday

[illegible]

Joy L. Moeller, RDH, BS
(310) 454-4044 joyleamoeller@aol.com

Next Visit:

Date/Time:

Week: Follow up Day 7 to 14 Post Surgery Frenectomy

Sheet #

Exercises

Monday

Tuesday

Wednesday

Thursday

Friday

Saturda

Sunday

Jaw Breaker 25x 3x per day
Push tongue into cheek

Caves count to 10 10x 3x per day
Make a vacuum seal up to the hard palate

**Pencil Pull count to 5 over and under pencil
and resist May use a chop stick**

Peanut butter rub 25x 3x a day (Rub palate to remove imaginary peanut butter with tongue)

**Tongue depressor push-up Count to 10 10x
3x a day (Push tongue depressor into tip of
tongue and push in and up with resistance)**

Tongue Point and Trace 10x 3x a day
Stick out tongue into a point and count to 10
and then place tip up to palate and trace
back to soft palate)

Keep Tongue Moving!

[illegible]

Post Surgical Exercises

Timeline	Exercise	Frequency
Day of surgery	Tongue tip elevation to spot/partial jaw opening/hold 10 seconds	2x/day
	Salt water rinse/always swish for 20 seconds	2x/day
Day 2	Tongue tip to spot and hold 10 seconds/partial jaw opening/repeat 2x	3x/day
	Left right tongue movement inside mouth 5x	3x/day
	Tongue tip to spot (hold); make K sound 10x	3x/day
	Salt water rinse	3x/day
Day 3	Tongue tip to spot and hold 10 seconds/full jaw opening/Repeat 5x	3x/day
	Left right tongue movement inside mouth 10x	3x/day
	Tongue suction/partial jaw opening/hold 10 seconds/Repeat 5x	3x/day
	Tongue trace/repeat 3x (discontinue if painful)	3x/day
	Salt water rinse	3x/day
Day 4-6	Tongue tip to spot and hold 10 seconds/full jaw opening/Repeat 5x	3x/day
	Left right tongue movement inside mouth 10x	3x/day
	Tongue suction/partial jaw opening/hold 10 seconds/Repeat 5x	3x/day
	Tongue trace/mouth open partial/repeat 5x (discontinue if painful)	3x/day
	Salt water rinse	3x/day
Day 7-14	Tongue suction/pull jaw downward stretch and hold 10sec/5x	3x/day
	Tongue push into each cheek/hold 5 seconds/repeat 5x	3x/day
	Tongue trace/mouth open wide/repeat 5x	3x/day
	Tongue protrusion/narrow/ hold 10 seconds/repeat 5x	3x/day
	Tongue sweep of teeth/upper and lower/repeat 5x	3x/day
	Salt water rinse	2x/day
Day 15-22	Continue stretching tongue (choose one exercise from above)	1x/day

 Zaghi MD

Thank you!

