FLASHA
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Lingual Frenulum Protocol

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Definition

• Tongue-tie (ankyloglossia) is a birth defect in which the tissue that attaches the tongue to the bottom of the mouth (lingual frenulum) is restrictive.

• Movements of the tongue may be restricted, depending on the grade of attachment to the mouth.

• Tongue-tie is an inherited birth defect. Usually the mother or father or a close relative also had the condition.

http://www.cigna.com/healthinfo/hw183100.html
Familial ankyloglossia

<table>
<thead>
<tr>
<th></th>
<th>Grandmother</th>
<th>Daughter</th>
<th>1º grandson</th>
<th>2º grandson</th>
<th>3º grandson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tongue protrusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tongue elevation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tongue on the right side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tongue on the left side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tongue elevation inside the mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

By Roberta Martinelli, 2010
• Ankyloglossia, commonly known as tongue tie, is a **congenital oral anomaly** which may decrease mobility of the tongue tip, and it is caused by an unusual **short, thick lingual frenulum**, a membrane connecting the underside of the tongue to the floor of the mouth.

• Ankyloglossia **varies in grade of severity from mild cases** characterized by mucous membrane bands **to complete ankyloglossia** whereby the tongue is **tethered** to the floor of the mouth.

http://en.wikipedia.org/wiki/Ankyloglossia
Frenula normal and altered
“Tongue tie or ankyloglossia has been the subject of much controversy. Tongue tie occurs when a common minor embryologic tissue remnant -- persistence of midline sublingual tissue that usually undergoes apoptosis during embryonic development -- causes restriction of normal tongue movement” (Knox, 2010).
Terminology

According to Knox, 2010

**Frenulum (or frenum):** a membranous fold of skin or mucous membrane that supports or restricts the movement of a part of organ.

**Persistent lingual frenulum:** presence of a frenulum between the underside of the tongue and the floor of the mouth; this does not necessarily cause clinical dysfunction.

**Tongue tie:** restriction of tongue movement or function by a persistent lingual frenulum. Note that some authors use “tongue tie” to refer to the presence of *any* sublingual tissue. In this article, a clear distinction is made between frenulum tissue, which may be present and in no way interfere with tongue function, and tongue tie, in which the frenulum is restrictive.

**Ankyloglossia:** synonym for tongue tie.

**Frenotomy (or frenulotomy):** surgical procedure in which the frenulum is incised.

**Frenectomy (or frenulectomy):** surgical procedure in which frenulum tissue is excised.

• Opinion varies, however, regarding how frequently ankyloglossia truly causes problems. Some professionals believe it is rarely symptomatic, whereas others believe it is associated with a variety of problems. The disagreement among professionals was documented in a study by Messner and Lalakea (2000).

• The authors sent a survey to a total of 1598 otolaryngologists, pediatricians, speech-language pathologists and lactation consultants with questions to ascertain their beliefs on ankyloglossia.

• 797 of the surveys were fully completed and used in the study. 69% answered that ankyloglossia is frequently associated with feeding difficulties. The majority of this percentage was lactation consultants and the minority was pediatricians; while 60% of otolaryngologists and 50% of speech pathologists answered that ankyloglossia is sometimes associated with speech difficulties, only 23% of pediatricians had the same answer; 67% of otolaryngologists and 21% of pediatricians answered that ankyloglossia is sometimes associated with social and mechanical difficulties.
• The frenulum consequences are not clear for some professionals.
• We believe that patients who have difficulty to chew and swallow, and mainly a speech disorder, may have frenulum alteration.
• An appropriate protocol will help speech-language pathologists to assess the tongue frenulum.
The reality

• Tongue tie may cause problems in feeding, breastfeeding, oral hygiene, dental health, dental occlusion, tongue mobility, chewing, swallowing, voice, speech and even in self-esteem.

• **Most of the health professionals do not know how they can diagnose the frenulum alteration.**

• Some of these professionals think this problem is not so important because the consequences are not so severe.
Most frequent SLPs doubts about tongue frenulum

1. How can we identify alterations in the tongue frenulum?
2. How can we evaluate these alterations?
3. How can we measure the tongue frenulum?
4. How can we classify the tongue frenulum alterations?
5. How can we be sure that the frenulum has any alteration?
6. What is the damage caused by the frenulum alteration?
Most frequent doubts

7. Can tongue frenulum alterations cause speech problems?
8. Can SLPs solve tongue frenulum alterations? How?
9. Can SLPs elongate the tongue frenulum?
10. What comes first, therapy or surgery?
11. What is the best age to do the surgery?
12. After surgery, is therapy necessary?
What literature says about these questions

• It depends on who answers the questions: physicians, dentists, SLPs or other professionals.

• The literature is controversial about this subject.

• For example, many physicians in Brazil indicate surgery only when the tongue has a heart shape during protrusion.

• This is a mistake, as you can see in the next case.
This is a very short frenulum. The tongue movements are altered, but in any of these photographs you will see a heart shape.

Irene Marchesan
Why I started studying frenulum

• I have been working with speech since 1978. In 1981, I saw a 6.6-year-old boy. The complaint was an alteration in the phone [s] – frontal lisp.

• When I did the clinical exam and diagnosed him, I realized he had a problem in the tongue frenulum and, probably, this was interfering in his speech.

• Of course, at that time, I was not totally able to classify the frenulum, but I could realize there was a relation between speech and tongue frenulum.
After that case, I started evaluating lingual frenulum, but I did not have a formal protocol

- At first, I searched if there was some lingual frenulum protocol published, and I found one for babies designed by a SLPs during her master degree (Halzelbaker, 1993).
- I also found two other protocols designed by dentists. Both creating methods to measure lingual frenulum (Lee et al, 1989; Kotlow, 1999).
- I designed the first protocol for children and adults in 2004 evaluating oral functions and establishing a quantitative method to classify lingual frenulum as normal or altered (Marchesan, 2005).
- From that protocol I continued researching and designed a new one with scores (Marchesan, 2010).

The aim of my speech is to present the lingual frenulum protocol with scores, which is divided into two parts

- The first part evaluates the general aspects of the tongue, and the second one evaluates the functional aspects of the tongue.
- The protocol provides scores that will help professionals to identify the frenulum alteration level, and relate the frenulum alteration to the oral function alterations, mainly the speech alterations.
The most important

• All assessments of the tongue frenulum must consider more than one characteristic.
• For example, we can't evaluate the frenulum only by what we see, or only by tongue movements.
• That means a frenulum protocol is very important.
Tongue Frenulum Protocol

History

Clinical Examination

History

Name: ____________________________ Gender: F ( ) M ( )
Examination date: __ / __ / __  Age: ___ years and ___ months  Birth: __ / __ / __
Responsible: _____________________________ Relative: ________________________

Studying: □ yes  □ no  Grade: __________
Working: □ yes  □ no  Profession: ________________________
Worked before □ no  □ yes  Professional Area: ________________________
Practicing sports: □ no  □ yes  Type: ________________________

Address: ________________________________
City: __________________ State: ______________ ZIP: ______________
Phone: Home: (____) ____________  Office: (____) ____________  Cell: (____) ____________
e-mail: ________________________________
Father’s name: __________________________ Mother’s name: __________________________
Siblings: □ no  □ yes  How many: ______________

Who referred patient for evaluation (Name, specialist, phone):
_____________________________________
Why?
_____________________________________
Main complaint: ________________________
Other complaints affecting:

(0) no  (1) sometimes  (2) yes

- lip
- tongue
- sucking
- chewing
- deglutition
- breathing
- speech
- tongue frenulum
- voice
- hearing
- learning
- facial aesthetic
- posture
- occlusion
- headache
- TMJ clicking
- TMJ pain
- neck pain
- shoulders pain
- mouth opening difficulty
- mandible range of motion
- Other

Family history – any other relative has frenulum alteration

☐ no  ☐ yes  Who?  Surgery was necessary: ☐ yes  ☐ no

Health problems

☐ no  ☐ yes  What kind:

Breathing problems

☐ no  ☐ yes  What kind:

Suckling

Breast-feeding:  ☐ yes  Age: _________  ☐ no  The baby had difficult suckling? ☐ no  ☐ yes

Bottle:  ☐ yes  Age: _________  ☐ no  What difficulty: ___________________________
Feeding – chewing difficulties
☐ no  ☐ yes  What:

Feeding – deglutition difficulties
☐ no  ☐ yes  What:

Oral habits:
☐ no  ☐ yes  What:

Speech alterations:
☐ no  ☐ yes  What:

Any social or professional issues due to speech alteration?
☐ no  ☐ yes  Social  ☐ no  ☐ yes  Response: ________________________________
☐ no  ☐ yes  Professional  ☐ no  ☐ yes  Response: ________________________________

Voice alteration:
☐ no  ☐ yes  What:

Frenulum of the tongue surgery:
☐ no  ☐ yes  What professional performed surgery: ________________________________
☐ no  ☐ yes  Results:  ☐ good  ☐ satisfactory  ☐ unsatisfactory

Add other important information________________________________________
CLINICAL EXAMINATION

I – GENERAL TESTS

II – FUNCTIONAL TESTS
I – GENERAL TESTS

Measurements using a caliper. Larger or equal 50.1% (0) – Less or equal 50% (1) FINAL RESULT =

<table>
<thead>
<tr>
<th>Consider the same tooth for all the measurements.</th>
<th>Value in millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open mouth wide</td>
<td></td>
</tr>
<tr>
<td>Open mouth wide with the tongue tip touching the incise papilla</td>
<td></td>
</tr>
<tr>
<td>Difference between the two measurements, in percentage</td>
<td>%</td>
</tr>
</tbody>
</table>

Alterations during tongue elevation (best result = 0 e worst result = 2) FINAL RESULT =

<table>
<thead>
<tr>
<th>Open mouth wide; raise the tongue without touching the palate</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tip of the tongue’s shape: oblong or square</td>
<td>(0)</td>
<td>(1)</td>
</tr>
<tr>
<td>2. Tip of the tongue’s shape: like a heart</td>
<td>(0)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

Frenulum fixation. Add A and B (best result = 0 e worst result = 3) Final result =

A – Mouth floor:

<table>
<thead>
<tr>
<th>Visible only from the sublingual caruncles</th>
<th>(0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible from inferior alveolar crest</td>
<td>(1)</td>
</tr>
</tbody>
</table>

Fixation in another point: ____________________________

B – Sublingual:

<table>
<thead>
<tr>
<th>In the middle of the tongue</th>
<th>(0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between the middle and the apex of the tongue</td>
<td>(1)</td>
</tr>
<tr>
<td>At the apex</td>
<td>(2)</td>
</tr>
</tbody>
</table>

Clinical frenulum classification (best result = 0 e worst result = 2) Final result =

<table>
<thead>
<tr>
<th>Normal</th>
<th>Borderline</th>
<th>Altered</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>
I – GENERAL TESTS

If the frenulum was considered altered it would be because:

| The frenulum seems normal but it is attached between the middle and the apex of the tongue | The frenulum is short | The frenulum is short and it is fixed between the middle and the apex of the tongue |
| Ankyloglossia (frenulum attached to apex of the tongue) | Another reason | Unsure |

General test evaluation total score: best result = 0 worst result = 8

When the score of the general test evaluation is equal or greater than 3, the frenulum may be considered altered.
# I – GENERAL TESTS

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

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value in millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open mouth wide</td>
<td>46,00</td>
</tr>
<tr>
<td>Open mouth wide with the tongue tip touching the incise papilla</td>
<td>37,55</td>
</tr>
<tr>
<td>Difference between the two measurements, in percentage</td>
<td>81,63%</td>
</tr>
</tbody>
</table>

Irene Marchesan

Calculating the proportion

- Mouth open wide: 46,00 mm
- Mouth open with the tongue touching papilla: 37,55 mm

\[
\frac{46,00}{37,55} \times 100\% = 123.21\% \\
X = 81.63\%
\]

Possible results

- Over 60% = normal frenulum
- Under 50% = abnormal frenulum
- Between 51% and 59% = doubt

Post-surgery data

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Open Mouth Wide</th>
<th>Tongue touching papilla</th>
<th>Relation between the measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation</td>
<td>30,55</td>
<td>No measurement</td>
<td>No measurement</td>
</tr>
<tr>
<td>After 18 therapies</td>
<td>41,80</td>
<td>21,80</td>
<td>52,15</td>
</tr>
<tr>
<td>One week after surgery</td>
<td>41,18</td>
<td>19,28</td>
<td>46,82</td>
</tr>
<tr>
<td>After one month</td>
<td>42,22</td>
<td>31,17</td>
<td>73,83</td>
</tr>
</tbody>
</table>
C.K.R.S.
16.10-year-old boy
Main complaint: speech
Short and anterior frenulum

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>Open mouth wide</th>
<th>Tongue tip touching the incise papilla</th>
<th>Difference between the two measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before frenectomy</td>
<td>Impossible to measure</td>
<td>Impossible to measure</td>
<td>Impossible to measure</td>
</tr>
<tr>
<td>One month after frenectomy</td>
<td><strong>58,53</strong></td>
<td><strong>29,35</strong></td>
<td><strong>50,14</strong></td>
</tr>
<tr>
<td>6 months after frenectomy</td>
<td><strong>56,82</strong></td>
<td><strong>40,13</strong></td>
<td><strong>70,62</strong></td>
</tr>
</tbody>
</table>
Before frenectomy October 31, 2008

6 months after frenectomy May 13, 2009
Alterations during tongue elevation (best result = 0 e worst result = 2) FINAL RESULT =

<table>
<thead>
<tr>
<th>Description</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open mouth wide; raise the tongue without touching the palate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Tip of the tongue’s shape: oblong or square</td>
<td>(0)</td>
<td>(1)</td>
</tr>
<tr>
<td>2. Tip of the tongue’s shape: like a heart</td>
<td>(0)</td>
<td>(1)</td>
</tr>
</tbody>
</table>
To see the heart shape it is better to raise the tongue than to protrude
Frenulum fixation. Add A and B (best result = 0 e worst result = 3) Final result =

<table>
<thead>
<tr>
<th>A – Mouth floor:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible only from the sublingual caruncles</td>
<td>(0)</td>
</tr>
<tr>
<td>Visible from inferior alveolar crest</td>
<td>(1)</td>
</tr>
</tbody>
</table>

Fixation in another point:
### B – Sublingual:

<table>
<thead>
<tr>
<th>Location</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the middle of the tongue</td>
<td>(0)</td>
</tr>
<tr>
<td>Between the middle and the apex of the tongue</td>
<td>(1)</td>
</tr>
<tr>
<td>At the apex</td>
<td>(2)</td>
</tr>
</tbody>
</table>
Clinical frenulum classification (best result = 0 e worst result = 2) Final result =

<table>
<thead>
<tr>
<th>Normal (0)</th>
<th>Borderline (1)</th>
<th>Altered (2)</th>
</tr>
</thead>
</table>

![Images of different frenulum classifications](image1.png)
Examples of different frenulum types

(A) **Normal**: it is attached from underneath the tongue to the floor of the mouth. In general, the frenulum is visible from the tongue down to the saliva caruncles.

(B) **Anterior**: when the frenulum is attached, underneath the tongue, at any point between the tongue midpoint and the apex.

(C) **Short**: it is attached underneath the tongue, as in the normal frenulum, but it is shorter than normal. In general, the frenulum is still visible underneath the tongue touching the alveolar crest.

(D) **Short and anterior**: a combination of (B) and (C).

(E) **Ankyloglossia**: when there is lack of, or minimal lingual frenulum, or the frenulum is attached to the apex of the tongue so that the tongue movements are very much limited.
**Normal:** it is attached from underneath the tongue to the floor of the mouth. In general, the frenulum is visible from the tongue down to the saliva caruncles.

As we can see, there are different patterns of normality.
Anterior: when the frenulum is attached, underneath the tongue, at any point between the tongue midpoint and the apex.
Short: it is attached underneath the tongue, as in the normal frenulum, but it is shorter than normal. In general, the frenulum is still visible underneath the tongue touching the alveolar crest.
Short and anterior: a combination of both
Ankyloglossia: when there is lack of, or minimal lingual frenulum, or the frenulum is attached to the apex of the tongue so that the tongue movements are very much limited.
## II - FUNCTIONAL TESTS

### Tongue mobility (best result = 0 e worst result = 14). Final result =

<table>
<thead>
<tr>
<th>Task</th>
<th>Successful</th>
<th>Partially successful</th>
<th>Unsuccessful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protrude and retract</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Touch the upper lip with the apex</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Touch the right commissura labiorum</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Touch the left commissura labiorum</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Touch U&amp;L molars</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Apex vibration</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Sucking against the palate</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

### Tongue position during rest (best result = 0 e worst result = 4). Final result =

<table>
<thead>
<tr>
<th>Position</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not visible</td>
<td>(0)</td>
</tr>
<tr>
<td>On the floor of the mouth</td>
<td>(1)</td>
</tr>
<tr>
<td>Protrudes between the teeth</td>
<td>(2)</td>
</tr>
<tr>
<td>Laterally protrudes between teeth</td>
<td>(2)</td>
</tr>
</tbody>
</table>
**Tongue mobility (best result = 0 e worst result = 14). Final result =**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Successful</th>
<th>Partially successful</th>
<th>Unsuccessful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protrude and retract</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Touch the upper lip with the apex</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Touch the right commissura labiorum</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Touch the left commissura labiorum</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Touch U&amp;L molars</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Apex vibration</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Sucking against the palate</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>
Something very important about the tongue lateralization at right and left comissura labiorum.

In a research entitled “Other features that may help lingual frenulum assessment”, done with 107 children from a public school from 6.6 to 10.7 years old, we saw that subjects identified as altered frenula had greater percentage of asymmetrical lateralization when compared with the subjects considered as having normal lingual frenula. Thus, tongue and its lateralization may help dispel doubts about the normality of the lingual frenula during their assessment.

<table>
<thead>
<tr>
<th>Results</th>
<th>TONGUE LATERALIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Symmetric</td>
</tr>
<tr>
<td>Normal frenulum</td>
<td>52,4% (33)</td>
</tr>
<tr>
<td>58,9% (63)</td>
<td></td>
</tr>
<tr>
<td>Altered frenulum</td>
<td>31,8% (14)</td>
</tr>
<tr>
<td>41,1% (44)</td>
<td></td>
</tr>
</tbody>
</table>
Altered frenulum and asymmetric lateralization

Tongue position during rest (best result = 0 e worst result = 4). Final result =

<table>
<thead>
<tr>
<th>Position</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not visible</td>
<td>0</td>
</tr>
<tr>
<td>On the floor of the mouth</td>
<td>1</td>
</tr>
<tr>
<td>Protrudes between the teeth</td>
<td>2</td>
</tr>
<tr>
<td>Laterally protrudes between teeth</td>
<td>2</td>
</tr>
</tbody>
</table>

Irene Marchesan
II - FUNCTIONAL TESTS

Speech (best result = 0 e worst result =12) Final result =

Test 1 – Informal speech
E.g.: What is your name? How old are you? Do you study/work? Tell me about your school/work. Tell me about something interesting.
Test 2 – Ask to count from 1 to 20. Ask to say the days of the week. Ask to say the months of the year.
Test 3 – Ask to name the pictures from the picture table

<table>
<thead>
<tr>
<th>Speech tests</th>
<th>Omission</th>
<th>Substitution</th>
<th>Distortion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>(0)</td>
<td>(1)</td>
<td>(0)</td>
</tr>
<tr>
<td>2</td>
<td>(0)</td>
<td>(1)</td>
<td>(0)</td>
</tr>
<tr>
<td>3</td>
<td>(0)</td>
<td>(1)</td>
<td>(0)</td>
</tr>
</tbody>
</table>

Check for which sound there is omission or substitution or distortion

<table>
<thead>
<tr>
<th>p</th>
<th>t</th>
<th>k</th>
<th>b</th>
<th>d</th>
<th>g</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>η</td>
<td>f</td>
<td>s</td>
<td>x</td>
<td>v</td>
<td>z</td>
</tr>
<tr>
<td>j</td>
<td>l</td>
<td>χ</td>
<td>r</td>
<td>rr</td>
<td>{S}</td>
<td>{R}</td>
</tr>
<tr>
<td>pr</td>
<td>br</td>
<td>tr</td>
<td>dr</td>
<td>cr</td>
<td>gr</td>
<td>fr</td>
</tr>
</tbody>
</table>

If the alteration occurs in only one or two tests, identify in which test there was alteration.
<table>
<thead>
<tr>
<th>Clock</th>
<th>Pencil</th>
<th>Cat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dice</td>
<td>Bird</td>
<td>Couch</td>
</tr>
<tr>
<td>Scissors</td>
<td>House</td>
<td>Bicycle</td>
</tr>
<tr>
<td>Star</td>
<td>Truck</td>
<td>Eye</td>
</tr>
<tr>
<td>Key</td>
<td>Plane</td>
<td>Butterfly</td>
</tr>
<tr>
<td>Dog</td>
<td>Phone</td>
<td>Sunflower</td>
</tr>
<tr>
<td>Gift</td>
<td>Crocodile</td>
<td>Hammer</td>
</tr>
<tr>
<td>Cross</td>
<td>Wheat</td>
<td>Acrobat</td>
</tr>
</tbody>
</table>

**Picture Table for the speech evaluation**
<table>
<thead>
<tr>
<th>Picture</th>
<th>Patient production</th>
<th>Picture</th>
<th>Patient production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock</td>
<td></td>
<td>Cockroach</td>
<td></td>
</tr>
<tr>
<td>Pencil</td>
<td></td>
<td>Strawberry</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td></td>
<td>Giraffe</td>
<td></td>
</tr>
<tr>
<td>Dice</td>
<td></td>
<td>Door</td>
<td></td>
</tr>
<tr>
<td>Bird</td>
<td></td>
<td>Rabbit</td>
<td></td>
</tr>
<tr>
<td>Sofa</td>
<td></td>
<td>Lion</td>
<td></td>
</tr>
<tr>
<td>Scissors</td>
<td></td>
<td>Plate</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td></td>
<td>Train</td>
<td></td>
</tr>
<tr>
<td>Bike</td>
<td></td>
<td>Dragon</td>
<td></td>
</tr>
<tr>
<td>Star</td>
<td></td>
<td>Letter</td>
<td></td>
</tr>
<tr>
<td>Truck</td>
<td></td>
<td>License plate</td>
<td></td>
</tr>
<tr>
<td>Eye</td>
<td></td>
<td>Arrow</td>
<td></td>
</tr>
<tr>
<td>Key</td>
<td></td>
<td>Blouse</td>
<td></td>
</tr>
<tr>
<td>Airplane</td>
<td></td>
<td>Flute</td>
<td></td>
</tr>
<tr>
<td>Butterfly</td>
<td></td>
<td>Radio</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td></td>
<td>Car</td>
<td></td>
</tr>
<tr>
<td>Phone</td>
<td></td>
<td>Zebra</td>
<td></td>
</tr>
<tr>
<td>Flower</td>
<td></td>
<td>Blue wing</td>
<td></td>
</tr>
<tr>
<td>Gift</td>
<td></td>
<td>Umbrella</td>
<td></td>
</tr>
<tr>
<td>Alligator</td>
<td></td>
<td>Fish</td>
<td></td>
</tr>
<tr>
<td>Hammer</td>
<td></td>
<td>Horse</td>
<td></td>
</tr>
<tr>
<td>Cross</td>
<td></td>
<td>Ladybug</td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td></td>
<td>Chicken</td>
<td></td>
</tr>
<tr>
<td>Owl</td>
<td></td>
<td>Crown</td>
<td></td>
</tr>
<tr>
<td>Athlete</td>
<td></td>
<td>Globe</td>
<td></td>
</tr>
</tbody>
</table>
### II - FUNCTIONAL TESTS

Other aspects to be observed during speech (best result = 0 e worst result = 10) Final result =

<table>
<thead>
<tr>
<th></th>
<th>(0) adequate</th>
<th>(1) reduced</th>
<th>(1) open wide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth opening:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tongue position:</td>
<td>(0) adequate</td>
<td>(1) on the floor</td>
<td>(2) protruded</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2) visible sides</td>
</tr>
<tr>
<td>Mandible movements:</td>
<td>(0) no alteration</td>
<td>(1) right displacement</td>
<td>(1) left displacement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1) forth displacement</td>
<td></td>
</tr>
<tr>
<td>Speed:</td>
<td>(0) adequate</td>
<td>(1) increased</td>
<td>(1) reduced</td>
</tr>
<tr>
<td>Speech precision:</td>
<td>(0) adequate</td>
<td></td>
<td>(1) altered</td>
</tr>
<tr>
<td>Voice:</td>
<td>(0) no alteration</td>
<td></td>
<td>(1) altered</td>
</tr>
</tbody>
</table>

**Functional assessment total score:**

best result = 0 and worst result = 40
Lips and mandible movements during speech

Irene Marchesan
The tongue movements during speech
Functional assessment total score:
best result = 0 and worst result = 40

Tongue mobility (best result = 0 e worst result = 14).

Tongue position during rest (best result = 0 e worst result = 4).

Speech (best result = 0 e worst result = 12).

Other aspects to be observed during speech (best result = 0 e worst result = 10).

When the score of the functional assessment is equal or greater than 25, the frenulum may be considered altered.

Documentation:
Photography and video of tongue mobility and speech assessment

Irene Marchesan
Other speech assessment procedures

• When the frenulum is altered, the speech may or may not be altered
• In some patients we realize the speech alteration through auditory perception
• In other patients we have the feeling that “something” is different, but it is difficult to detect exactly what it is
• Because of that, we began to do electromyography and acoustic analysis in all the patients with frenulum alteration
Electromyography

- The electrodes are placed externally at the supra-hyoid muscle to evaluate the electric activity;
- The patient is requested to repeat 10 times each of these following syllables: [a], [la], [aR], and [ta];
- After the exam: the graph obtained is analyzed and the average electrical activity between the right and left sides supra-hyoid muscle is compared.
Patient with normal frenulum

10x [la]

10x [ra]

10x [ar]

10x [ta]

8.3µV

11.5µV

10.4µV

15.0µV

7.9µV

11.2µV

10.0µV

15.3µV
Patient with altered frenulum

10x [la]

12,0µV

19,3µV

10x [ra]

13,0µV

17,4µV

10x [ar]

14,0µV

18,1µV

10x [ta]

15,1µV

19,6µV
Results

In the exams, we have observed the following differences in people with altered frenulum:

1. more peaks on the graph, probably demonstrating more effort to produce the syllables.

2. the average electrical activity between the right and left sides supra-hyoid muscle is very different, probably demonstrating difference between the tongue sides.
Comparing the EMG in patient with normal and altered frenulum

Normal frenulum

10x [la]  
8,3µV
7,9µV

10x [ra]  
11,5µV
11,2µV

Altered frenulum

10x [la]  
12,0µV
19,3µV

10x [ra]  
13,0µV
17,4µV
Acoustic analysis of speech

A tool that allows to:

– evaluate compensatory strategies detected in speech signal;
– follow the evolution in therapy by means of non-invasive techniques of speech assessment,
– develop rehabilitation strategies by means of real time acoustic analysis technologies;
– establish correlation between speech production and perception.
Waveform and wide-band spectrograms of the production of the word “arara” in the pre-operative (I) and post-operative (II) stages in a case of lingual frenectomy.

No signs in the pre-operative, only in the post-operative
Waveform and wide-band spectrograms of the productions of the word “arara” in the pre-operative (I) and post-operative (II) stages in a case of lingual frenectomy

The patient had [ʃ] signs in pre-operative and this sign improved in the post-operative
References


My special thanks to Dr. Zuleica Camargo, CEFAC’s Chief of Acoustic Speech Lab

My special thanks to Dr. Adriana Rahal, CEFAC’s Chief of Electromyography Department
Part of CEFAC’s team

We are waiting for your visit to our Country and to CEFAC!
Thanks for the opportunity!

Irene Marchesan
Irene@cefac.br