

# GATHERING CLINICAL RESEARCH DATA IN OROFACIAL MYOLOGY

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## ABSTRACT

This document responds to questions from an orofacial myologist about how to collect data in orofacial myology for clinical research with orofacial myofunctional disorders (OMDs).

**KEY WORDS:** Cephalometric x-ray films (cephs); antegonial notching; hyoid bone; tonsils and adenoids; velar dimple; velar stretch; cranial base angle; oral diadochokinetics; freeway space; lip incompetence; swallowing; dental overbite, open bite; dental malocclusion.

**Questions from a clinician:** I have again been thinking about the clinical data that is needed to be collected by orofacial myologists for research purposes. What types of data do you feel will be most useful to collect? In addition, I wonder how we could collect data from multiple practitioners to compare results and to show the effects of therapy?

**Reply:** I will give a *partial* reply here.

The first process in data gathering involves a thorough assessment of the overall status of the patient and his/her history, which should include the medical and dental/orthodontic history. If the referral is from an orthodontist, and records were taken by the orthodontist, I recommend that orofacial myology therapists (OMTs) should request a summary of lateral cephalometric x-ray (ceph) findings from the orthodontist, especially to identify measurements that deviate from the norm. Of special interest (and I recommend that OMT's ask for and keep a record of these things) is information that would include selected questions that will be detailed below. A concern, however, is that some appropriate questions of interest to OMTs may not be familiar to some orthodontists whose training did not include consideration of some of the variables of interest discussed below. In that sense, OMTs may have to educate orthodontists to look at the questions posed below in future patient evaluations of ceph data.

## A MORPHOLOGIC DESCRIPTION OF THE PATIENT:

A logical starting point in a patient evaluation is to characterize the presenting structures of each patient. A morphological evaluation would include several observations:

- 1) Is the ramus of the mandible short, normal, or long? (Being short would encourage the tongue to protrude or thrust).
- 2) Is there an *antegonial notching* of the mandible (every orthodontist would know about this - it is the notching just in front of the gonial angle, or where the lower body of the mandible meets the posterior rim of the ramus; this is often present where there is a deviation of mandibular growth such as an open bite or even mandibular prognathism. This notching can be palpated, but better appreciated by viewing the lateral ceph).
- 3) The vertical position of the hyoid bone (at a horizontal level of which cervical vertebrae?) - the hyoid is an excellent marker as to how the tongue has adapted to the contents/size of the oral cavity). This observation should be from the lateral ceph, and the vertical level is described by recording whatever cervical vertebra is at this level.
- 4) The estimated size of the faucial tonsils on the ceph (small, medium, or large); recording a Mallampati score in the patient's record should always be done.
- 5) The estimated size of the adenoid mass (sparse, small, medium, or large). This observation is derived from the lateral ceph (see Figure 1 below). To determine adenoid size on the ceph, the method includes finding the posterior pharyngeal wall below the adenoid and continuing an imaginary line up and behind the adenoid, ending at the base of the skull (the body of the sphenoid bone). The amount of tissue filling the nasopharynx between this imaginary line and the posterior opening of the nose (the posterior choanae) provides the basis for estimating the size of the adenoid mass; that is, the estimation is made of how much of the nasopharyngeal space is filled in with adenoidal tissue.

**Estimating adenoid size:** As per the well-known evaluation method of Pruzansky and Mason (1965), a "sparse" adenoid fills less than 1/3 of the nasopharyngeal space; a "small" adenoid fills up to 1/2 of the diameter of the nasopharynx; a "moderate" adenoid consists of more

than  $\frac{1}{2}$ , up to  $\frac{3}{4}$  of the nasopharynx filled with adenoid; and a “large” adenoid involves more than  $\frac{3}{4}$  of the nasopharynx filled by adenoidal tissue (Figure 1).

**Important note:** the lateral ceph shows the *midline* of the adenoids, but clinicians know this and continue to use this view to assess adenoid size and the area of the nasopharynx since it is the midline adenoid mass that can obstruct the posterior choanae. Also, it is the midline adenoid that provides a contact site with the velum during velopharyngeal closure that is needed to maintain normal nasal voice quality. In some patients, such as those individuals with repaired clefts or submucous clefts, an adenoidectomy would result in severe hypernasality as the architecture of the pharynx is dramatically changed by adenoidectomy.

To verify any suspicions of a problem with speech if an adenoidectomy is done, an additional lateral ceph should be taken during a sustained production of a sound, such as /ah/ or /s/. This provides the opportunity to assess whether the velum is capable of contacting the posterior pharyngeal wall to achieve velopharyngeal closure. An illustration is included (Figure 2) that visually compares the nasopharyngeal spaces during velar elevation in an individual who has normal anatomy with an individual with a submucous cleft palate. In this illustration, although the velum elevates well in the patient with submucous clefts of hard and soft palate, the **velar dimple** is displaced farther forward during phonation and as well, a sparse adenoid mass combines with the short effective length of the velum to create hypernasality.

The **velar dimple**, a phenomenon seen only during phonation (or any contraction of the velar muscles), normally occurs at the 70-80% area of the length of the soft palate (from the posterior margin of the hard palate to the uvula). The dimple (Figures 2 and 3 below) reflects the location of the muscles that elevate/raise the velum; the levator muscles, or levator veli palatini. When there is a submucous cleft of both the hard and soft palates, (there can be a submucous cleft of soft palate only), the velar muscles course forward to find the aponeurosis of the hard palate onto which to attach, rather than meeting normally in the midline. This abnormal muscle coursing forward displaces the levator muscles, and as a result, the velar dimple appears closer to the hard palate rather than at 70-80% of the velar length. The area of the elevated velum from the end of the hard palate to the velar dimple is termed the **effective length of the velum**, (Figure 3) as compared with the overall length of the velum. It is the effective length that is used in velopharyngeal closure, while the tissue beyond the dimple hangs pendant and does not participate in velopharyngeal closure.

More about Figure 2: the individual on the left with normal velar anatomy shows the velar dimple to be located at 70-80% of overall velar length, while the individual on the right with anomalous velar findings shows the velar dimple to be displaced forward to 50% of overall velar length. Also, the individual on the left has a small adenoid, which is adequate to maintain velopharyngeal function, while the individual on the right has a sparse adenoid that already contributes to the lack of velopharyngeal closure and hypernasality that is present.

Over time, as the adenoids involute (regress/resorb), starting around age 9-12, and continuing normally up to around age 20, the velum normally is able to stretch during function as a way of maintaining normal nasal voice quality. This phenomenon is referred to as **palatal stretch**. For patients with a displaced velar dimple, or who have scar tissue in the velum following cleft surgery, their capacity to “stretch” the velum is either absent or greatly diminished.

A primary reason for adenoidectomy is to remove the adenoid tissue when it encroaches over the Eustachian tubes. Since the Eustachian tubes are located on the lateral walls of the nasopharynx, a *lateral adenoidectomy* (also referred to as a peritubal adenoidectomy) will resolve the adenoid tissue encroachment and accompanying middle ear fluid buildup, while preserving the midline adenoid for speech purposes.

The evaluation of the adenoid mass on a lateral ceph can identify individuals whose adenoids are needed for speech purposes (that is, for normal nasal voice quality and nasal resonance). Evaluating adenoid size, and the possible negative impact on speech (severe hypernasality) that may follow from a total adenoidectomy, provides a unique opportunity for orofacial myologists to prevent a speech problem before it occurs from adenoidal removal surgery.

6) The cranial base angle (nasion to sella to basion – see Figure 4) - a measurement obtained from a lateral ceph that many orthodontists may not appreciate, has great value in some patient with OMDs. The cranial base angle is an estimate of the horizontal bony width of the nasopharynx. When the cranial base angle is acute, the diameter of the nasopharynx follows by narrowing; that is, there is less room in the nasopharynx. This is seen especially in patients with a small or retruded maxilla (such as individuals with Down syndrome and in many midface retrusion syndromes); while an obtuse (or open) cranial base angle can contribute to widening the bony nasopharynx. This can explain part of the reason why hypernasality develops in some patients as the adenoids involute.

F.Y.I. A normal cranial base angle is  $130^{\circ} +$  or  $- 10^{\circ}$ , and an illustration (Figure 4) provides a visual for this important observation from lateral cephs.

**RATIONALE FOR CEPH OBSERVATIONS:** The measurements recommended above can serve to characterize the current morphologic status of an individual patient, and may shed light on whether a patient has a tongue thrust only, or a tongue thrust and a forward rest posture of the tongue. I have postulated for some time that there are likely morphological differences that would distinguish thrusters from those thrusters with a forward rest posture. I would expect hyoid position to differ between thrusting groups separated on the basis of anterior rest posture or not, and the groups may also differ on the basis of the *height of the mandibular ramus*, the *amount of tonsillar or adenoid tissue present*, and the *angle of the cranial base*. If each member had a record of such ceph findings, some impressive clinical research could be accomplished by grouping patients according to clinical rest and function differences. Also, if the highlighted morphologic characteristics and possible differences between thrusters and those thrusters with an anterior tongue rest posture are shared with referring orthodontists, such communications may facilitate multidisciplinary research efforts that utilize the cephalometric x-ray films that all orthodontists routinely include in patient workups.

#### **CLINICAL OBSERVATIONS OF THE PATIENT - ORAL DIADOCHOKINETIC TESTING:**

I am a believer in the value of oral diadochokinetic testing as a way of assessing the neuromotor developmental/maturational level of the patient and his/her ability to affect changes in oral postures and functions, including speech. The value of this testing is the observations made of the *pattern* of movements, the *range* of movements, any *randomized* patterns, and *substitutions* of horizontally-directed tongue movements in lieu of vertically-directed movements. Such observations document much more about the patient than fixating on a stop watch to count the number of repetitions over ten seconds and comparing them to Fletcher's norms for oral diadochokinesis. Observations can be recorded as answers to the following questions:

#### **THE LIPS:**

- 1) Are lip movements and lip closures accomplished in a consistent manner?
- 2) Are randomized, non-purposeful, uncontrolled movements of the lips observed during bilabial productions?
- 3) Does the patient display difficulty in rapidly producing bilabial sounds, rating the difficulty on a 1 to 5 scale?

#### **THE TONGUE:**

- 1) Does the patient exhibit any ability to elevate the tongue tip under control during testing? If so, under what conditions or tasks?
- 2) Is a **mandibular assist** present? (That is, is the tongue fixated on the lower anterior teeth while the mandible moves to accomplish the rapid repetitive task?). **Note:** if a mandibular assist is present, this is a normal expectation up until age 7 - (my own unpublished research). At or around age 7, the mandibular assist spontaneously ceases with age and oral maturation.
- 3) While repeating tasks during which you have eliminated a mandibular assist, is the tongue able to perform adequately in range, direction and speed? **Note:** to eliminate a mandibular assist, several strategies are available, such as a dental bite block placed between posterior teeth on one side to lock the mandible, or, more simply, making a pile out of two or three tongue blades and having the patient bite on them at the molar area on one side while you hold the tongue blades near the corner of the mouth. Locking the mandible by having the patient bite on the flat surface of the small tongue blade pile eliminates a mandibular assist.
- 4) Are there any randomized lateral movements of the tongue during production of rapid /t/ /d/, or /l/? (I recommend using all of these sounds in testing). If so, is there a lateral shift of the mandible involved? Randomized movements suggest a delay in neuromotor maturation for speech and other behaviors, and it is suggested that the presence or absence of lateralized movements during rapid productions be compared to the presence or absence of thrusting and a forward rest posture of the tongue; that is, do lateralized tongue movements correlate with other clinical observations? **Note:** the principle here is that there is merit in maximizing some oral behaviors as a means of revealing behaviors that may not be otherwise identified.
- 5) Upon stimulation (not unlike *stimulability* for speech sound learning), does the patient improve when you provide tactile cues about the location of the "spot" as a site for contacts during /t/, /d/, /l/ productions? A 5 point equal-interval stimulability scale can be used where the patient cannot elevate the tongue tip with control and limits rapid repetitions to the horizontal plane?

6) I recommend using /kuh/ and /guh/ productions to assess palatal activity, but I am not concerned when these repetitions are reduced in speed, nor do I worry about a problem with the soft palate if the repetitions are slow. Since the tongue blade is large and thick, with less sensory innervation, slower lingual repetitions are to be expected.

7) I do not recommend us of /puh-tuh-kuh/ or other combinations of repetitions, as these can be considered tongue-twisters and are not useful or revealing, in my view.

### **CLINICAL ASSESSMENT OF THE PATIENT:**

1) **Assessment of the freeway space.** The technique I reported in the IJOM, v 31, November, 2008, works better for adults than children, but some assessment of the resting freeway space should be made - with lips slightly parted. A millimeter number for the freeway space dimension, determined as the number difference between a closed bite and the normal open rest position, should be recorded at the initial evaluation and - at the least - at the end of treatment. Use of the freeway space measures can serve as a motivation for selected patients who have habitually closed down the freeway space to some varying extent in therapy. Changes in freeway space dimension numbers can serve as a useful self-monitoring tool.

2) **Assessment of lip competence or incompetence.** Where there is lip incompetence, measures should be recorded:

A. distance between the base of the nose and the vermillion of the lip at its upper dimension - made in initial evaluation and later on;

B. distance between resting upper and lower lips, from vermillion at the area where lip contacts would/should meet;

C. distance between the biting edge of the right central incisor (if present) and the vermillion of the upper lip;

D. amount of upper gingiva showing between the gingival margin over the upper right incisor and the upper lip at rest, with lips naturally parted.

Note: these dimensions should change with age and treatment. If there is vertical maxillary excess, the dimensions may worsen with age, while the dimensions may diminish with therapy. Also, lip incompetence (a lips-apart rest posture) is the expected norm up until age 12-13, when lip closure is then expected.

E. estimation should be made with a 1-5 equal-appearing interval scale as to the degree of muscle strain when the patient is asked to contact the lips lightly and maintain the contact. The observation of strain can either be made by assessing at the lips in contact, or at the mentalis muscle on the right side. A 1-5 scale can be helpful here.

3) **Assessment of the tongue.**

A. *Where does the tongue tip rest?* Determine this by observing the patient while in a normal rest position, whether lips are together or apart, and then ask the patient where the tongue tip is? The choices should include

(a) against the hard palate (spot),

(b) between the teeth,

(c) against the upper or lower teeth,

(d) or, resting on the floor of the mouth.

Note: we need such data! The report of patients can be useful, if they are questioned appropriately. Ask patients to lick their lips and then go to a rest position after closing the lips; then ask again where the tongue tip is resting. Using several tasks followed by inquiring about the rest position may be helpful in validating patients' responses.

B. *What happens during a swallow?* Patients' responses about where the tongue tip is during a swallow should also be recorded. For example, my tongue tip remains on the floor of my mouth just behind the lower incisors at rest and during swallowing -- never moving. This for me is apparently an economical use of the tongue -- allowing the mid-portion of the tongue blade to do the work.

It seems apparent to me that we don't utilize patient reporting as much as is useful. There are also other measures of the tongue that clinicians may add here (this is not intended to be an all-encompassing document). For other measures, I yield to the clinical experience and preferences of those of you providing the therapy. However, there is a great need for standards to be developed for reporting swallowing activity according to some scale, such as the historically used 1-5 equal appearing interval scale.

Some additional observations that should be recorded:

(a) Are any randomized lateral tongue movements seen during swallowing?

(b) What does the initiation of the swallow look like? Forward movement, downward movement of the tongue tip, vertical movement of the mandible, and if so, how much opening? (Observations made after food is chewed or liquid manipulated and ready for swallowing).

(c) Is there muscle strain present at the initiation of, middle of, or end of swallow? If so, where? Lips, neck, muscles of mastication? Rate the difficulty with the 1-5 scale.

#### 4) Assessment of the dentition:

A. I recommend recording the class of occlusion at the canines in children, as this is more important for OMT's than the situation at the molars -- and may differ from observations of molar occlusion. With an anterior open bite, evaluating occlusion at the canines would be impossible; however, evaluating at the canines is especially useful with young children and those in mixed dentition when it is difficult for the non-dentist to determine which posterior teeth are primary or adult molars.

B. Describe whether there is a normal curve around the front of the dental arch. If the incisors are upright, record this (upright incisors are normal in children but not adults). If the maxillary central incisors in an adult are upright and "flat" and the laterals are flared forward, describe this (this combination is often found with Class II malocclusions, especially Class II, division 2).

C. Measure the amount of anterior overjet and overbite in mm, or the amount of open bite from biting edges of right central incisors (if present). Remember that the term **overjet** expresses a *horizontal* relationship between the dental arches (also known as *horizontal overlap*), while **overbite** expresses a *vertical* relationship of the dental arches, also known as *vertical overlap*.

D. Since normally, in an adult, the lower lip should cover 2-3 mm of upper incisors at rest, measure and record the *amount of upper right incisor covered by the lower lip at rest*, by gently lifting the upper lip up and open from a rest position. In most children, this measurement may be difficult or impossible, but even with lip incompetence, the lower lip should cover a few mm of the upper incisors; however, this will not occur in some children - but should be noted that this is the case (as this relationship may normalize after orthodontic treatment, growth, or your treatment).

E. Describe and measure (not in all cases) *posterior transverse overjet*, or lack of. Where there is a posterior crossbite, or if the upper arch extends farther toward the cheeks than normal, or if there is a transverse difference from one side to the other and a horizontal millimeter measurement can be made, this measurement should be a part of the patient record. 1) In such cases, a mandibular shift may be present and should be assessed without manipulating the mandible but instead, by asking the patient to open and then close the bite several times as you observe the contacts at the canines. This will reveal whether a shift is present. If there are no canine contacts, it is more unlikely that a shift will be present.

F. Examine the lingual frenum and its relationship to the lower central incisors. Does the frenum tissue extend up to the embrasure between the incisors? Does it extend through and onto the facial surface of the gingiva between the lower incisors? Is there spacing at the lower incisors with the connective tissues of the frenum involved? The criteria offered by Irene Marchesan are useful here.

#### 5) Assessment of the palates:

A. the height/vault of the hard palate should be described, especially with regard to the relationship to the upper and lower posterior teeth.  
(1) Is there a narrow hard palatal vault and a posterior cross bite - unilateral or bilateral?

B. Is there a torus palatinus or a developing torus on the hard palate? (the developing torus will show no midline coloration but instead, a pale or blue oval manifestation that may be flat since the torus has not expressed its growth as yet. 1 in 7 individuals will show a palatal torus, which is an extra benign growth of bone over the area of the hard palate midline.

C. Any change in coloration should be noted. The palatal midline should appear pinkish-white and perhaps one to 2 in width. At the end of the hard palate, away from the midline, you should see the two holes indicating the openings of soft palate salivary glands. This is a convenient way to identify the end of the hard palate, which lies just behind these pin holes.

D. The soft palate should always be evaluated during function with the patient seated looking straight ahead; not with head tipped back (which distorts your view of the relationship of the velum to the posterior wall of the pharynx).

(1) The examiners eyes should be at the mouth level.

(2) The mouth should be opened as wide as possible, then closed down to 1/2 of full opening (this keeps the velum from being locked up).

(3) The tongue should NOT be protruded, since the palatoglossus contracts as the tongue is protruded thus inhibiting the full range of movement of the velum.

(4) During sustained phonation of "ah", the anterior and midportion of the velum should elevate to the horizontal level of the hard palate, or beyond. The posterior part of the velum should remain pendant, or draped.

(5) A midline dimple should be seen just above the uvula, denoting where the levator veli palatini muscle insertions elevate the velum. This should be at the 70%-80% mark of overall velar length. It is recommended to estimate the millimeter location of the velar dimple above where the uvula and end of the velum converge. A millimeter estimate of the velar dimple location is recommended to be recorded in patient charts.

(6) If the velar dimple appears to be located farther forward than a few mm above the uvula, such as 50% of overall length (see Figures 2 and 3), the clinician should be suspicious of a submucous cleft being involved. In such cases, the midline of the velum may appear to have a bluish tint to it because of a lack of muscle tissue across the midline. As well, if the tissue bows up as an inverted V and seems to extend into the hard palate, a submucous cleft of the hard palate should also be suspected.

E) Observing the oral structures at rest need not be done with the patient's head looking straight ahead. The head can be tilted back, and the mouth can be fully open to evaluate the anatomy, except for the soft palate. While you can evaluate the faucial tonsils as per guidelines to follow, and record the size of the oral isthmus, there is no way to observe the amount of adenoid tissue present by unaided visual inspection.

#### 6) Assessment of the faucial tonsils:

A. The faucial/palatine tonsils should be evaluated with regard to their participation in the dimensions of the oral isthmus. A Mallampati score (Figure 5) should be obtained and included in each patient chart at initial examination, and again at the end of treatment. Observations of the size of the tonsils and whether they are in contact ("kissing tonsils") should also be recorded. Whatever changes may occur may not have anything to do with the treatment provided, but can serve as a useful clinical research tool in the event that orthodontic or other treatment relapse occurs. It would be nice to have this information for possible use in evaluating various aspects of treatments provided.

**SUMMARY:** The observations and suggested measurements and clinical recordings of findings suggested above can be used by all OMTs, regardless of whether they have any instrumentation that can be used in evaluation. If instrumentation is available, such as the simple See-Scape, or the IOPI, or airflow equipment, EMG, or other tools of evaluation, those clinicians who have such equipment available have an added responsibility to develop evaluation protocols that can result in standardized data recording during patient evaluations.

The data and clinical suggestions included in this document are certainly open to additional observations, modifications, and perspectives. Hopefully this reply to questions about gathering data in orofacial myology will stimulate further discussion and eventually result in standardization of data collection and research reporting within the entire field of orofacial myology.

(ILLUSTRATIONS TO FOLLOW BELOW)

Figure 1. Adenoid size in normal population (sparse is misspelled in photo)



Figure 2. On left, child with normal velar anatomy, normal location of velar dimple (70-80% of overall velar length) and normal velopharyngeal function. On right, child with submucous clefts and forward displaced velar dimple, with less effective velar length and hypernasality.

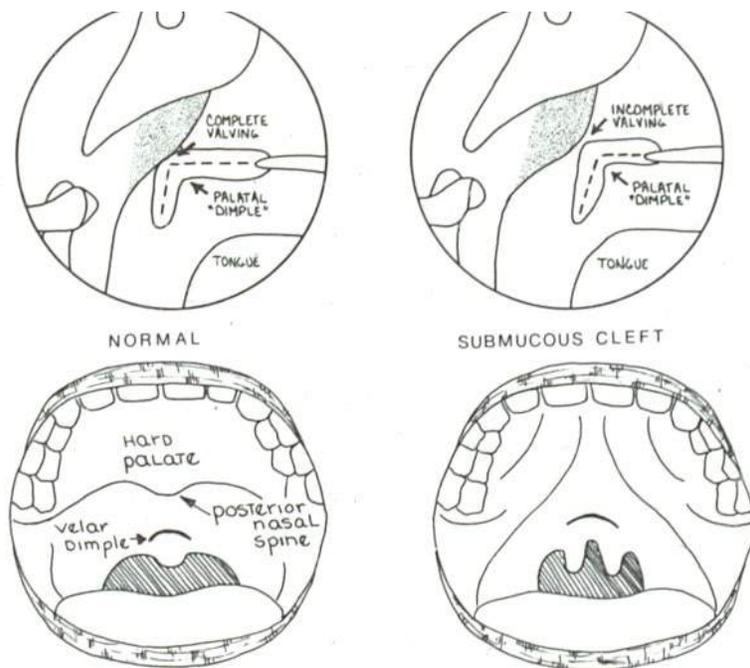


Figure 3. Comparing soft palate at rest (normal length) and during phonation, with reduced effective velar length and velar dimple displaced forward to @ 50%, rather than a normal location at 70-80% of overall velar length.

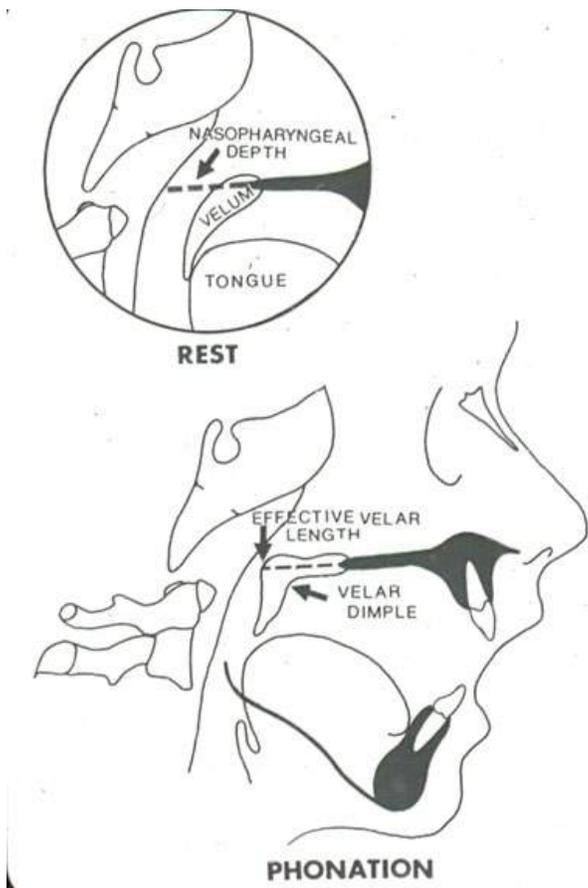


Figure 4. Cranial base angulation.

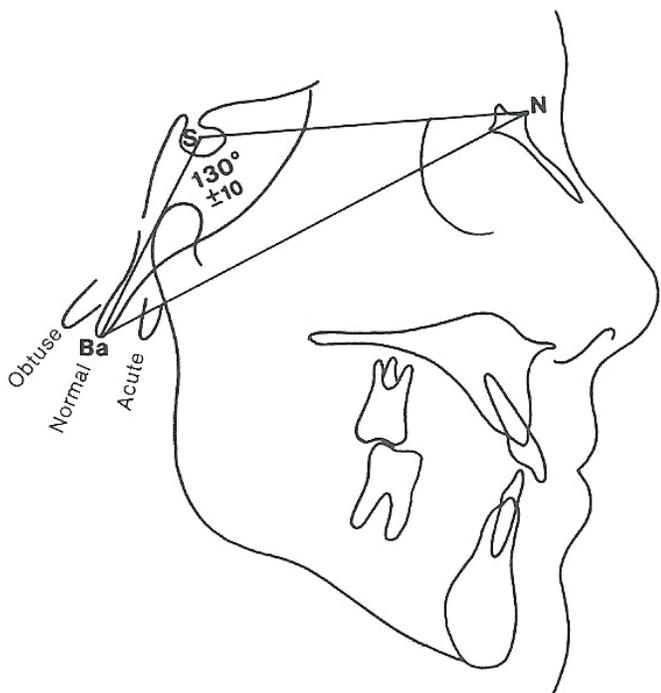


Figure 5. Mallampati scoring system to estimate oral isthmus size.

# Mallampati Score

## For visual examination:

**Class I = Full view of posterior pharyngeal wall, faucial arches and uvula**

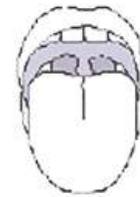
**Class II = Partial view of uvula (about 50% of its body) and post. pharyngeal walls**

**Class III = Partial view of the uvula, limited to its insertion on soft palate, no posterior pharyngeal wall, no faucial arches**

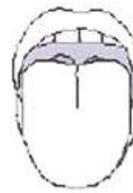
**Class IV = Completely obstructed view, with only portions of the soft palate visible**



Class I



Class II



Class III



Class IV

## SUGGESTED CLINICAL RESEARCH PROJECTS IN OROFACIAL MYOLOGY

- For patients with lip incompetence and tongue thrusting, can lip exercises obviate the need for tongue thrust therapy?
- Determine the value of oral diadochokinetic testing in diagnosis, for monitoring therapy progress, and documenting the results of therapy. Do the lingual movement patterns become consistent after myofunctional therapy?
- Document observations of patient tongue patterning during oral diadochokinetic testing. Do specific patterns reflect or suggest a level of difficulty in therapy, or a specific strategy for eliminating a tongue thrust swallow?
- Tongue thrust therapy is not often needed following elimination of a sucking habit. During the waiting period following habit cessation, what criteria are useful in determining which children will need tongue therapy?
- How and when to select a tongue tip up or a tongue tip down rest posture. (A tongue tip down rest position has been ignored, yet is a more physiologic posture than tongue tip up). What are the indications for each? (There are many untold/undocumented stories to tell about the benefits of a tongue down rest posture). I, for one, have a tongue tip down position for sibilant and affricate productions, and at rest. Others like me also have a tongue tip down rest posture. How often does this occur? In my practice, it approached 50% of patients.
- Not all short lingual frenae will need surgical correction. Criteria for determining who and when to refer are needed. Diagnostic therapy? Inability to sweep the vestibule?
- The direct observation of lingual movement patterns during oral diadochokinetic testing may influence how a swallowing pattern is taught. (I, for one, do not elevate my tongue tip at all during a swallow – the tip remains against the lower incisors, and yes, I am normal). It seems obvious that there are many swallowing patterns that are physiologic and acceptable other than the usual prescriptive pattern taught. Should not these alternate patterns be employed in some cases? If so, criteria are needed (swallowing with tongue tip down and at the lower incisors is easy for me, and is logical physiologically).
- Swallowing therapy should reflect the presenting oral morphology. Not all swallowing is alike, especially with huge faucial tonsils (the tongue base should drop), or a long soft palate (the tongue base will normally lift the velum during a swallow). Individual patient characteristics need to be identified and specific therapy procedures should be developed that reflect the presenting morphology.
- As Proffit reports from oral pressure-transducer studies, there are up to 10 transitional swallow stages that a child passes through on the road to an adult swallow. These patterns reflect orofacial growth and development and the need for swallows to adapt to presenting morphology, such as large tonsils, a long soft palate, or a short ramus of the mandible that positions the tongue higher in the oral cavity. Swallowing at various ages needs to be evaluated according to the morphology involved, and therapy to change

the swallow should also reflect morphological features. Such documentation, with clinical guidelines, is needed. The answer should not be to force an adult swallow on all children.

- Not all patients with a tongue thrust swallow should undergo therapy due to age or morphologic findings that can obligate a tongue thrust swallow. Criteria are needed for how to identify those patients with a tongue thrust swallow that should **not** receive therapy due to morphologic conditions involved.
- The therapy strategy of creating a normal freeway space by having a dentist make a niteguard-type appliance and then using it to habituate a normal vertical dimension should be implemented. Such an appliance need not cover the anterior teeth or the spot area so that normal speech can be maintained. The use of a soft (and inexpensive) niteguard-type appliance as a part of therapy to stabilize a normal vertical dimension presents an opportunity to work cooperatively with dental referral sources.
- Other strategies for stabilizing a normal vertical interocclusal dimension (that is, the freeway space) should be developed and documented, such as the use of the flat part of a tongueblade between teeth as the patient gently bites down. Other creative strategies need to be developed, documented, and shared.
- The current focus of tongue thrust therapy has been the functions and rest position of the anterior tongue. Strategies and conditions in which the tongue base would benefit from being habitually repositioned inferiorly should be identified and documented.
- As mentioned in the ***Gathering Clinical Research Data in Orofacial Myology*** article, evaluating tongue posture from lateral cephalometric x-ray films (lateral “cephs”) via tracing the tongue height relative to the palatal plane and also documenting the vertical and horizontal position of the hyoid bone according to presenting morphology (Class I, II and III skeletal and dental patterns) presents an opportunity for a landmark study that could be done collaboratively with an orthodontist, or a group of orthodontists. For any meaningful statistical analyses, 30 or more subjects would be needed for each group involved. (Such a study would be an excellent topic for a thesis by an orthodontic resident in a university-based orthodontic training program. You could become a part of this study by virtue of serving as a learning experience and the possible clinical applications to orofacial myofunctional therapy).
- There is a great need to educate dentists and orthodontists about the link between resting tongue posture and the position of teeth, and the lack of a link between tongue thrusting and dental malocclusions. An epidemiological study needs to be done of how many patients referred by dentists for tongue thrust therapy also have an anterior rest posture. Such information is needed to dispel the myth that tongue thrusting is the issue and link with developing malocclusions. It would be rare to find an orthodontist or dentist that includes an anterior rest posture of the tongue on their problem list. This is sad because of the link with malocclusions that has incorrectly been blamed on the tongue. Collecting data from orthodontic offices as to the presence or absence of an anterior tongue rest posture, along with a tongue thrust, will eventually dispel this myth. In any way possible, dentists need to be apprised of the importance of identifying a forward tongue rest posture in patients. Any study of the morphological differences between groups of tongue thrusters with and without a forward, interdental tongue rest posture should be revealing. Specific observations to be recorded from lateral cephs are detailed in the article ***Gathering Clinical Research Data in Orofacial Myology***.
- One topic that is in desperate need of clarification and documentation is the loose and incorrect use of the observation of “muscle tone”, or especially “low muscle tone” that represents a diagnosis made by simply looking at structures rather than measuring the level of muscle tone in some fashion. There is a great need to develop instrumental measures to measure muscle tone, or a lack of, or to describe muscle tone by using resistance measures to estimate the level of muscle tone in selected areas. Surface and needle EMG may possibly be applied appropriately to the evaluation and description of muscle tone. Hopefully, all would agree that a description of a patient having “low muscle tone” does not represent a documented observation, nor should a visual analysis of the tissues involved be accepted as an accurate description of a patient.

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